

Discussing Performance Index of Human Resource Valuation with AHP-occupational Safety Section in T Company in Taiwan as the Case Study

¹Yung-Fu Huang, ²Kuang-Hua Hsu, ¹Po-Shun Chen and ³Shih-Hao Dong

¹Department of Marketing and Logistics Management,
Chaoyang University of Technology, Taichung, Taiwan

²Department of Finance, Chaoyang University of Technology, Taichung, Taiwan

³Department of Business Administration, Chaoyang University of Technology, Taichung, Taiwan

Abstract: Human resource has become more important in businesses that a lot of supervisors have perceived the establishment of performance evaluation standard. It is a wisdom that the situation has become even more apparently in the case company. From previous valuations, T company still needs improvement on the systems, like human resource in practice. For this reason, the study aims to (1) develop a suitable valuation model for the Occupational Safety Section in T company, select an appropriate human resource valuation index and classify the index with the characters, (2) propose various weights and sequences for T company with Analytic Hierarchy Process (AHP) and (3) apply the model with motivational pattern to promote the work motivations and desires to remain of employees. The findings show (1) to provide the valuation index of the Occupational Safety Section in T company with an appropriate weight, (2) that, with the valuation, the performance evaluation is the product of original performance and performance index, showing that the results are flexible and objective and (3) the model collocating Weighted in Points can provide T company with methods to encourage employees with better performance and increase work incentives.

Key words: AHP, performance evaluation, performance index, human resource management, occupational safety

INTRODUCTION

Background and motivation: With the progress of technology, the change of economic environment in international societies and the impact of exodus, production technologies and operational environments in various organizations have yielded enormous change in Taiwan. In such rapidly changeable environments and competitions, competent people have become the key to success for corporate administration. In this case, how to appeal or retain the competent people will depend on the combination of integrated performance evaluation system and reward system to achieve the target.

Traditional performance evaluations were often preceded in curtailed environments of decision-making so that the data, including the assessment items in performance evaluation index or the settings of weight proportion in indexes, were measurable and unchangeable. Nonetheless, the environment of decision-making in actually evaluating the performance of an organization or an individual is subjective, immeasurable, group decisive and uncertain.

In response to the previous environments of decision-making, Analytic Hierarchy Process (AHP) is

suitable for describing measure results, under the conditions of uncertain decision-making evaluations and various decision-making risks. Besides, it can be effectively applied to decision-making domain, particularly to the applications on multiple objective decision-making.

Comprehensively viewing various industries, including state-owned enterprises or private organizations, a lot of resources have been invested in employee performance evaluations. From the aspects of performance evaluations, personal performance is firstly calculated and the performance of various sections is followed, so that the overall operational performance of the organization can be observed. In this case, the sections with more complicated work will become more difficult to calculate the performance of the section and individuals, as the criterion of evaluations or the indexes of references are so many that errors are easily resulted. Besides, when the evaluation tools are not sorted or ranked with importance sequence, it will become more inconvenient. The annual study on the human resource valuation in T company has encountered the problem, particularly in the sections with wider contents of work, like the Occupational Safety Section. More efforts, therefore, have to be made for this section.

Table 1: Models of human resource valuation

Scholar	Contribution	Contents
Tyler (1942)	The first and the most influential valuation model	<ol style="list-style-type: none"> 1. Established extensive targets 2. Systematically classified targets 3. Defined objectives or targets with concrete behaviors 4. Found out the context of the most achievable target 5. Developed or selected the technology or tool for measures 6. Collected the data in present situation 7. Compared the data in present situation and defined present target difference s
Scriven (1973)	Allowed evaluators to figure out the targets	Since evaluators needed to maintain the objectiveness and uniqueness, it was not necessary to advise the target in the process of valuation, but let the evaluators figure it out
Stufflebeam (1983)	Focused on the process of decision-making that valuations were designed for gathering the advantages and shortcomings of the decision-making so that it would become fair in specific standards	<ol style="list-style-type: none"> 1. Context evaluation 2. Input evaluation 3. Process evaluation 4. Product evaluation

Source: Guskey (2000)

Different from other sections, the valuation of the Occupational Safety Section focuses on the prevention of disasters that is an intangible performance for the company. Consequently, a correspondent index for the measure needs to be discovered that is more difficult than the measure with the link of financial performance and operational performance in other sections. Moreover, there were few studies on the classifications and comparisons of the Occupational Safety Section indexes. For this reason, this study, aiming at classifying the valuation indexes for the Occupational Safety Section, sorts the order of weights and, according to the present shortcomings received in this study, expects to provide the relevant sections with suggestions.

Research objective: Based on the previous research motivations, this study will discuss the human resource valuation model in T company with AHP as well as design a set of flexible system, which can respond to the present situation of T company and be followed in the future. The research objectives for this study are listed as below.

- To develop a set of appropriate valuation models for the Occupational Safety Section in T company, to select an adaptive human resource valuation index and to classify it with the characters
- With AHP, to provide the Occupational Safety Section in T company with weights and sequence of various indexes so as to solve the inequality of fresh and worn-out in implementing valuations
- To promote the work motivations and desires to remain of employees, with the collocation of the model and motivational pattern

For the research objective, many related studies and discussions are reviewed as below:

Significance of valuations: Worthen and Sander (1987) defined a valuation as a systematic and valuable inspection to determine the values. The process of a valuation is referred to (1) determining the targets, (2) determining the correlation and importance of targets, (3) collecting relevant information and (4) establishing values with standards.

Models of valuations: Each valuation is generated from abstruse philosophy and concept and strategic thinking as well as reinforces the meaning and functions in the process of valuation. Each model also presents special advantages and significant limits. This study applies valuation models of Tyler (1942) and Scriven (1973) as well as CIPP valuation of Stuffleam. The contents are summarized in Table 1.

Significance of performance evaluations: Regarding performance measures, Venkatraman and Ramanujam (1986) proposed that the structure of performance conceptualization should contain financial performance, business performance and organization effectiveness.

- **Financial performance:** The most common conceptualization in traditional strategy studies, presented the economic target of a business, such as growth of sales, yield rate and earnings per share
- **Business performance:** Contained nonfinancial indexes, such as market share, new product introduction, quality of products and marketing efficacy
- **Organization effectiveness:** Contained to achieve the target of various conflicts in the organization and to meet the satisfying objectives of various related parties internally and externally

Table 2: Comparison of the approaches for performance evaluations

Approach	Characteristics of evaluation indexes				
	Strategic consistency	Reliability	Validity	Interpretability	Concreteness
Trait approach	Lower in general, also requiring links in evaluations	Lower in general, but can be improved by clear definition	Lower in general, but can be improved with careful design on trait dimension	Lower in general, unless with actual evaluations	Very low
Behavioral approach	Can be highly linked.	Generally higher	Higher in general, but need to pay attention to insufficient range of evaluations and the problem of pollution	Generally higher	Very high
Results approach	Very high	High	Higher in general, but might occur insufficient range of evaluations and the problem of pollution.	Very high in general	High goal specificity, but not clear how to achieve.

Source: Noe *et al.* (2003)

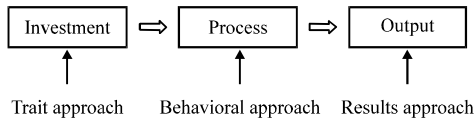


Fig. 1: Approaches for performance valuations. Source: Huang *et al.* (2007)

Approaches for performance evaluation: Three approaches for performance evaluation are classified, as trait approach, behavioral approach and results approach. From the aspect of the system in response to systematic procedure, trait approach emphasizes on the evaluations on the traits and the competent of employees, behavioral approach aims at the evaluation of behavioral performance in the work process and results approach focuses on the overall comparisons of the work results, Fig. 1.

The comparisons among the three approaches for performance evaluations are listed in Table 2.

According to the above analysis, this study applies the formula, results approach = section performance (strategic target) multiple individual performance, with the advantages as:

- Confirming the predicted target and activities in the company
- Defining the weight index of the target activities
- Establishing the corresponding relationship between indexes and performance
- Developing the weighing system to provide accurate calculations and overall valuation results

Contents and purpose of AHP: Analytic Hierarchy Process (AHP) was a multiple objective decision-making method, proposed by Satty, a professor in University of

Pittsburgh, in 1971. From the viewpoints of various scholars, AHP was considered a hierarchical structure building a mutual influence relation with the utilization of organizational structure. With pair comparisons between two factors, AHP could reduce the load of decision makers so that the intentions of the decision makers could be clearly reacted. Furthermore, the feature of collective decision-making allowed individual opinions to be meta-analyzed with the hierarchic system to enhance the effectiveness and reliability of the evaluation. The analysis results could be presented with numerical units which made the sequence of relative importance between factors more understandable as well as significantly established a weighing system for resource allocation, investment portfolio and prediction. Having been applied, revised and verified constantly, the entire theory of AHP became more complete after 1980.

In addition, it was found the AHP method was widely used by performance evaluation. Wu *et al.* (2010a) evaluated business performance of Wealth Management (WM) banks in Taiwan by applying AHP and Grey Relational Analysis (GRA). Importantly, the proposed model could benefit the banking sectors in assessing the business performance of WM banks. Wen *et al.* (2010) developed business performance evaluation model for the electronic industry in Taiwan based on factor analysis and AHP Method. The result of business performance evaluation was presented and some suggestions were given to middle or top managers or conducting businesses. Wu *et al.* (2010b) evaluated the criteria of employment service outreach program personnel. The results generated by AHP could be further used for outreach personnel to improve the performance in a short period of time.

Sampling survey and description of samples: The research objects in this study are the supervisors in the Occupational Safety Section in T company. The questionnaire is established with AHP to receive the weight of evaluation indexes. Total fifteen questionnaires were distributed and ten copies were retrieved, with the response rate of 66.67%. With initial survey, the C.I value is less than 0.1 so that the response rate of effective questionnaires is 66.67%.

RESEARCH RESULTS

Reliability and validity of questionnaires:

- **Consistency test:** This study applies Expert Choice 2000 software to examine the consistency in the hierarchy structure of performance evaluation in the Occupational Safety Section. Saaty (1980) suggested the acceptable value of consistency ratio (C.R.) ≤ 0.1 . The findings show that the consistency ratio of the

performance evaluation in the Occupational Safety Section is less than 0.1, so that the consistency of the value is acceptable

- **Validity of contents:** With the literature reviews and interviews with experts, the factors of performance evaluation in the Occupational Safety Section are revised into AHP format and further become the contents of the questionnaire, so that the contents of the questionnaire presents high validity

Results analysis: From the calculations of expert choice 2000, the weight distribution of the overall performance index factors in the Occupational Safety Section is established as Table 4, as well as the weight of performance evaluation hierarchy structure in the Occupational Safety Section is presented as Fig. 3.

Remark: L, Local Priority, presents the factor belonging to the weight code in a small area of the previous level. G, global priority, is the weight code of all samples in the same level.

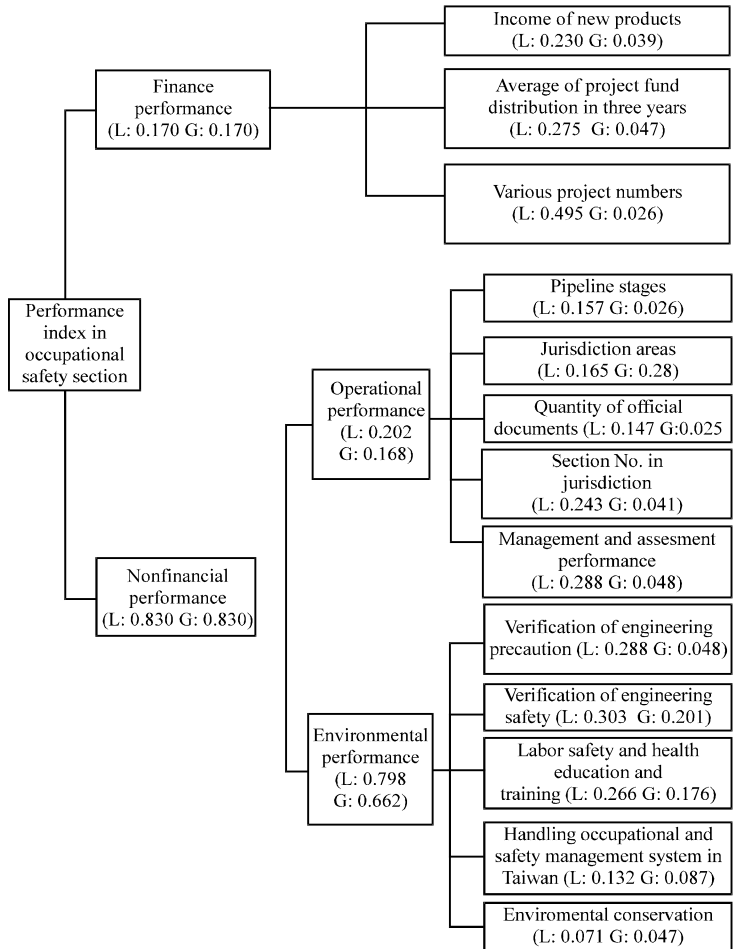


Fig. 3: Weight of performance evaluation hierarchy structure in the Occupational Safety Section

Table 4: Overall performance index factors in the Occupational Safety Section

	L1	L2	L3	Hierarchic weight	Overall weight	Sequence	
Performance indexes in the Occupational Safety Section	Financial performance 0.170	Income of new products Average of project fund distribution in three years Various project no.		0.230	0.039	10	
				0.275	0.047	7	
				0.495	0.084	5	
	Nonfinancial performance 0.830	Operational performance 0.202	Pipeline stages	0.157	0.026	12	
			Jurisdiction areas	0.165	0.028	11	
			Quantity of official documents	0.147	0.025	13	
			Section no. in jurisdiction	0.243	0.041	9	
			Management and assessment performance	0.288	0.048	6	
			Environmental performance 0.798	Verification of engineering precaution	0.228	0.151	3
			Verification of engineering safety	0.304	0.201	1	
			Labor safety and health education and training	0.266	0.176	2	
			Handling occupational	0.132	0.087	4	
			Environmental conservation	0.071	0.047	7	

CONCLUSIONS AND SUGGESTIONS

Conclusions:

The establishment of valuation model and evaluation index: Aiming at the human resource allocation and application in T company, this study selects a suitable results evaluation, refers to relevant literatures and interviews the experts of academia and practice as well as the consumers to induce the two factors of financial performance and nonfinancial performance and to further construct hierarchical evaluation structure with the thirteen evaluation indexes in the two dimensions of operational performance and environmental performance in nonfinancial performance.

The establishment of evaluation index weight: From the findings of performance evaluation index weights, the Occupational Safety Section emphasizes the environmental performance in nonfinancial performance the most, where the most emphases are sequenced as verification of engineering safety, labor safety and health education and training, verification of engineering precaution, handling occupational health and safety management system in Taiwan and environmental conservation. Regarding financial performance, various project numbers, the average of project fund distribution in three years and the income of new products are sequenced and management and assessment performance, section numbers in jurisdiction, jurisdiction areas, pipeline stages and quantity of official documents in operational performance are sequenced.

Selection of motivational pattern: Having selected the weight of performance evaluation index, this study, based

on literature reviews and practical applications in industries, suggests to apply Weighted in Points to evaluate employee positions with compensable factors. In other words, the job characteristics focused by the organization can promote performance or value-added skills and the reward can be decided with the following procedure.

From the findings analyses, the supervisors in the Occupational Safety Section in T company emphasize the indexes of verification of engineering safety, labor safety and health education and training and verification of engineering precaution in environmental performance as the primary elements of verifying the performance valuation in the Occupational Safety Section, while financial performance is the next. It proves the opinion of Kaplan and Atkinson (1998) that the balance development of financial and nonfinancial performances will become the key to success for businesses. In this case, sections should adjust the weights of evaluation indexes based on the type of work, instead of the traditional performance evaluations focusing on the measure of financial performance.

Implication of management: Comparing the performance evaluation index weights with the effects of previous valuation procedure, two dimensions are further discussed.

Organizational culture: The supervisors in various sections can master the individual performance of the employees and further pursuit the maximization of the section performance and integrate the work performance of the employees in the section. The performance comparisons among Sections can be implemented among

sections with same attribute but in different regions, after the distribution of section performance valuation index weights. Furthermore, the benchmark section in the organization can be elected to enhance the internal benign competition and build an organizational climate with high efficacy. For instance, the Section in the Occupational Safety Section in T company is elected with the valuation and the best Section in overall performance is further elected from fifteen regional branches.

Having clearly understood the weight distribution of various work, each employee will more actively develop the work performance. The purpose of valuation does not expect employees to follow rules, but to stimulate and encourage them being willing to execute heavier or time-consuming work and proving the work they manage parallel to the directions the organization focuses, with the promotion of organizational citizenship behavior. For instance, the employees in the Occupational Safety Section would be more willing to execute the verification of engineering safety work, which takes more time and energy.

Implementation of valuation: For sections to evaluate themselves: With the weight distribution of performance, the calculation with basic hour-pay can multiply various work weights to obtain a standard hour-pay. As a result, the ratio of work contents and work hours of each employee can be clarified to achieve the performance distribution in the organization. In this case, the valuation results will present the gap of manpower requirement in each section.

For index feedback: Periodically applying AHP allows the organization to revise the index with the opinions of the supervisor in each Section, to adjust the work load of key indexes according to the analysis results, to delete irrelevant or unimportant indexes with the work and to enhance the accuracy of performance evaluation.

For the connection of work orientation and performance: Regarding original work load, without clear definition of performance weights, employees are likely to choose the work with more quantity but with fewer loads. With the distribution of performance evaluation indexes, employees will gradually transform the quantity of work into the quality. In this case, the thoughts of measuring work load with work hours and working hours equal to work performance can be corrected after the valuation and the work target of employees can be consistent with it of the organization.

For the connection of performance orientation and reward: The performance of employees will be adjusted

with the contribution to the organization so that employees are no longer satisfied with the achievement of basic work requirements, but combine the work target with personal demands, based on target theory. To make a firm and high-difficulty target will help employees reach effective performance. Besides, through the identity of other employees, employees can be led to the direction, strength and persistence of efforts as well as make a higher target.

Suggestions:

Applying different type of sections: Aiming at the performance indexes in the Occupational Safety Section, this study has obtained the evaluation weights of various indexes. Nonetheless, the decision-making of supervisors in various sections will present great influence. For this reason, different sections can be chosen for future studies to observe the evaluation index of the section supervisor.

Applying various analysis: AHP is applied in this study to examine the weight analysis of performance evaluation index in the Occupational Safety Section. Nevertheless, the judgment of performance evaluation index presents subjectivity and ambiguity among section supervisors. Consequently, it is suggested that AHP, Delphi Hierarchy Process (DHP), Data Envelopment Analysis (DEA), or other analysis methods can be applied in following research.

ACKNOWLEDGMENT

The authors would like to thank the NSC in Taiwan and CYUT partially finance this research and the project No. is NSC 98-2622-E-324 -004-CC3.

REFERENCES

- Guskey, T.R., 2000. Evaluating Professional Development. Corwin Press, London.
- Huang, L.C., C.C. Huang, C.F. Wen, W.C. Liao and C.H. Han, 2007. Human Resource Management: Theory and Practice. Theory and Practice, Taipei.
- Kaplan, R.S. and A.A. Atkinson, 1998. Advanced Management Accounting. Prentice-Hall, Inc, New Jersey.
- Noe, R.A., J.R. Hollenbeck, B. Gerhart and P.M. Wright, 2003. Human Resource Management: Gaining a Competitive Advantage. McGraw-Hill, New York, pp: 330-331.
- Saaty, T.L., 1980. The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation. McGraw Hill, New York.

- Scriven, M.S., 1973. Goal-Free Evaluation. In: School Evaluation, House, E.R. (Ed.). McCutchan Publishing Corporation, California, pp: 319-328.
- Stufflebeam, D.L., 1983. The Cipp Model for Program Evaluation. In: Evaluation Model: Viewpoints on Educational and Human Services Evaluation, Madaus, G.F., M.S. Scriven and D.L. Stufflebeam (Eds.). Kluwer-Nijhoff, Boston, pp: 117-141.
- Tyler, R.W., 1942. General statement on evaluation. *J. Educ. Res.*, 35: 492-501.
- Venkatraman, N. and V. Ramanujam, 1986. Measurement of business performance in Strategy research: A comparison of approaches. *Acad. Manage. Review*, 11: 801-814.
- Wen, W., 2010. Business performance evaluation model for the taiwan electronic industry based on factor analysis and AHP method. *Lect. Notes Eng. Comput. Sci.*, 2185: 2076-2081.
- Worthen, B.R. and J.R. Sanders, 1987. Educational Evaluation: Alternative Approaches and Practical Guidelines. Longman Pub. Group, New York, ISBN-10: 0582285518, pp: 60-61.
- Wu, C.R., C.T. Lin and P.H. Tsai, 2010a. Evaluating business performance of wealth management banks. *Eur. J. Operat. Res.*, 207: 971-979.
- Wu, H.H., J.I. Shieh, Y. Li and H.K. Chen, 2010b. A combination of AHP and DEMATEL in evaluating the criteria of employment service outreach program personnel. *Inform. Technol. J.*, 9: 569-575.