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Using AI and the Fuzzy Delphi Method for Dispatching Executives to Overseas Banks

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Keywords *— **Fuzzy Delphi Method (FDM), Artificial Intelligence (AI), Wilcoxon Rank Sum Test, Traits of Ability, Dispatching Executives***

Abstract *— With the openness of Taiwan's government's financial policy, the banks here are becoming more liberalized and internationalized. Taiwan is becoming a competitive financial market since more new commercial banks have been set up in Taiwan. So, it is important for a bank to dispatch good executives to overseas branches. In this paper, we analyze what kinds of characteristics and traits a bank's manager in an overseas branch should have by using the fuzzy Delphi method (FDM). The purposes of the research are: Firstly, to analyze what kinds of characteristics and traits a bank's manager in an overseas branch should have. Secondly, to compare the differences between managers in overseas branches in Japan and Hong Kong by using the Wilcoxon rank sum test. Thirdly, establish the dispatch criteria with Artificial Intelligence (AI) and FDM methods. Through the examination of FDM, a fuzzy referent model framework for the bank's dispatch in the overseas branch is built. It is anticipated that the fuzzy framework will provide a more objective means for the dispatch of appropriate personnel for overseas branches.*

I. INTRODUCTION

Since the US Senate and House passed an epoch-making financial reform law in November 1999, the "Financial Services Modernization Act", dismantling barriers erected by the "Glass-Steagall Act" and the "Banking Holding Company Act" for limiting the business scope of banks and allowing banks, security companies, and insurance companies to do cross-industry business and establish relationships of business affiliation. This transformation has prompted the merger of already-large banks in the US and the establishment of branches all over the world to offer their customers complete financial

products and services.

A bank is a part of the service industry that offers its customers financial services. In order to conform to the liberalization and internationalization trends of the time, banks established their overseas branches widely. In a competitive environment, banks heavily rely on the dispatch of capable staff to overseas branches to maintain their competitiveness in markets. If any organization wants to achieve its targets, "the right person" is one of the most primary and basic factors. It is certainly safe to say "human resources" is the most important resource in any organization. The success or failure of a business depends largely on whether chief officers know their subordinates well enough to assign them jobs commensurate with their abilities. Therefore, to gain competitive advantages, a bank should strengthen education and training for their staff, and it is very important for the selection of executives for overseas branches.

In recent years, fuzzy theory has been widely applied to various research projects. So has the fuzzy Delphi method (FDM). Scholars like Ishikawa et al. (1993), Chang et al. (1995), and Chang et al. (2000) have developed many different FDMs that have been applied to solve matters with large uncertainties. Thus, the research adopted FDM to screen indexes of capabilities that executives who are dispatched to branches in Japan and Hong Kong should have and conducted empirical research on these dispatches. It is hoped that the results of the research could help banks find the right people to serve at overseas branches to enhance their competitiveness.

II. LITERATURE REVIEW

Based on an earlier policy-capturing study of general mental ability and the Big Five personality traits, Jane & Kim (2004) explore and analyze the hiring preferences of Hong Kong employers across five important personal attributes. They think that among knowledge, abilities, skills, and personality, the personality of a candidate has a relatively greater impact on the hiring decision.

Dakin et al. (1994) think that despite widespread evidence of low construct validity and productivity, personality testing is increasingly being used for the selection of managers. Based on available research, it is argued that personality is likely to play an important role as a determinant of managerial performance.

Chang et al. (2000) developed a new FDM used in managerial talent assessment for a company located in Taiwan. This new method employs the fuzzy statistics and technique of the conjugate gradient search to fit membership functions. Membership functions may be derived from fuzzy forecasts.

Ana and Fintan (2020) refer to the AI shown by machines made by humans. Generally, AI refers to technology that presents human intelligence through ordinary computer programs. Viswanathan et al. (2020) think that the term also refers to the study of whether and how such intelligent systems can be realized. At the same time, through advances in medicine, neuroscience, robotics, statistics, etc., normal predictions believe that many human occupations will gradually be replaced by them.

III. RESEARCH METHOD

1. The construction and induction of selection factors for banks to dispatch executives of overseas branches

In order to construct and induct abilities that executives of overseas bank branches should have, after a broad literature study and communicating and discussing with other experts, we inducted and constructed the selection factors shown in Table 1. The factors covered include 1) traits of ability; 2) diversified intelligence; 3) academic ability; and 4) graduating college.

2. The design of the FDM

In order to compare factors for selecting dispatched executives of branches in Japan with those of branches in Hong Kong, the research uses a questionnaire design.

3. Data collection

Data were collected in a survey of the professors and professional members in Taiwan's banks. A total of 61 first questionnaires were distributed, and 32 usable questionnaires were used in the decision analysis, representing a valid response rate of 52.46%. The second questionnaire investigation was carried out aiming at those who had sent back the first questionnaire, and 29 copies were returned. After consistency and stabilization checks, 24 copies were valid questionnaires; the valid response rate is 82.76%.

3. The steps of FDM

The FDM of Kaufmann and Gupta (1988) is based on a triangular fuzzy number.

$$u_A(x)=\begin{cases}0 & , \quad x<a\\ \dfrac{x-a}{b-a} & , \quad a\le x\le b\\ \dfrac{c-x}{c-b} & , \quad b\le x\le c\\ 0 & , \quad x>c\end{cases} \tag{1}$$

And measure convergence of each cycle with dissemblance index in Formula (2).

$$\delta(A,B)=\int_{\alpha=0}^{1}\delta(A_\alpha,B_\alpha)d\alpha$$

$$=\frac{1}{2}(\beta_2-\beta_1)\int_{\alpha=0}^{1}(\left|a_L^{(\alpha)}-b_L^{(\alpha)}\right|)+(\left|a_U^{(\alpha)}-b_U^{(\alpha)}\right|)d\alpha \tag{2}$$

In Formula (2), α interval of confidence of triangular fuzzy number A or B is defined as

$$A_\alpha=\left[a_L^{(\alpha)},a_U^{(\alpha)}\right]=[(b-a)\alpha+a,(b-c)\alpha+c],\alpha\in[0,1]$$

β1and β2 are offered as any two convenience value to conduct prediction of Fuzzy. The steps are as follows:

Step 1: Ask experts for their predictions (a,b,c). A represents the most pessimistic value, c represents the most optimistic value, and b represents the most suitable value in the interval between a and c.

Step 2: Average opinions of all experts (a, b, c) obtain (am, bm, cm) average, minus opinions of individual experts (a, b, c) from the average separately, and obtain (am-a, bm-b, cm-c). Distribute those opinions to experts for reference when they are given questionnaires to fill out.

Step 3: According to the average opinions in Step 2 (am, bm, cm), calculate with Formula (2) the degree of differentiation of triangular fuzzy numbers between fuzzy opinions and average opinions for every expert in the cycle. If all differentiations are falling within a certain tolerable scope, then we could consider that they have reached convergence. The average opinion in the cycle is the final prediction, so go ahead and implement Step 4. If not, return to Step 1.

Step 4: Defuzzication is to transform a fuzzy number into a definite value that acts as a tool used in the process of fuzzy making. The research adopted the OM method, which was introduced by Chang & Lee (1995). The higher the OM value, the more important the factor will be in Formula (3).

$$OM(A_i)=\int_0^1\{\tfrac{1}{2}w[a_m+w(b_m-a_m)]+(1-\tfrac{1}{2}w)[c_m$$

(3)

IV. RESULTS

1. Selection factors for banks to dispatch executives of overseas branches

FDM, provided by Kaufmann and Gupta, is a repeated procedure; the results of the first and second questionnaires are shown in Table 1. Besides, the result includes the first and second OM values of dispatched executives of overseas branches that are calculated with Formula (3). Based on these OM values, calculate the degree of stability of fuzzy opinions between two

questionnaires. The calculating method for degree of stability is 2nd OM minus 1st OM, then picking absolute values.

Table 1 The OM value and stability value of executives who are dispatched to branches in Japan and Hong Kong

Factor		Japan (OM Value)			Hong Kong (OM Value)		
		A. 1st	B. 2nd	|B-A|	C. 1st	D. 2nd	|C-D|
Traits of Ability	Intelligence Quotient	7.355	7.3775	0.02	7.125	7.08	0.045
	Language Ability –English	2.7025	2.7825	0.08	6.5625	6.615	0.0525
	Language Ability –Japanese	7.9175	7.94	0.02	4.605	4.675	0.07
	Creation Ability	7.6825	7.605	0.08	6.995	6.9125	0.0825
	Organization Ability	8.235	8.2575	0.02	6.955	6.98	0.025
	Planning Ability	7.885	7.7875	0.1	7.015	7.0075	0.0075
	Learning Ability	7.6625	7.69	0.03	7.495	7.4575	0.0375
	Logic and Analyzing Ability	7.99	7.98	0.01	6.7675	6.7925	0.025
	Marketing Ability	7.25	7.32	0.07	7.1725	7.2325	0.06
	Frustration Tolerating Ability	7.685	7.755	0.07	7.13	7.08	0.05
	PR and Social Ability	7.6675	7.7375	0.07	7.1325	7.065	0.0675
	Management Ability	8.415	8.335	0.08	7.0125	7.1	0.0875
Diversified Intelligence	Decisiveness	7.1725	7.0925	0.08	7.3575	7.305	0.0525
	Responsibility Feeling	7.06	7.055	0.01	7.935	7.9975	0.0625
	Affinity	7.0675	7.0875	0.02	8.01	7.9375	0.0725
	Enthusiasm	6.815	6.735	0.08	7.6625	7.76	0.0975
	Patience	7.0175	7.0275	0.01	7.965	7.9375	0.0275
	Good at Understanding Other People's Viewpoint	7.125	7.145	0.02	7.3	7.3775	0.0775
	Expression	6.5125	6.5825	0.07	7.535	7.445	0.09
	Loyalty	4.805	4.8225	0.02	7.5675	7.5675	0
	Moral Character	7.095	7.0125	0.08	8	8.0175	0.0175
Academic Ability	Accounting	7.155	7.1625	0.01	7.0225	6.96	0.0625
	Economics	7.05	7.0225	0.03	6.985	6.9225	0.0625
	Computer	7.74	7.785	0.04	6.8675	6.8775	0.01
	Financial Management	7.0675	7.0825	0.01	6.885	6.9575	0.0725
	Investment	7.6225	7.5875	0.04	6.7575	6.6625	0.095
	Bank Operation and Management	7.0575	7.1475	0.09	6.875	6.91	0.035
Graduated College	College of Liberal Arts	4.88	4.82	0.06	2.7475	2.8275	0.08
	Law School	3.4025	3.4175	0.02	5.8225	5.8425	0.02
	Business and Management College	3.3525	3.3425	0.01	7.0225	7.0225	0
	College of Science and Engineering	3.4025	3.415	0.01	5.3625	5.3625	0

2. We can use the Wilcoxon rank sum test (Robert, 1988) to test whether the weighted values of the 2nd OM in dispatching executives to Japan and Hong Kong are the same (Table 2). We explored them in four parts: traits of ability, diversified intelligence, academic ability, and graduating college. The results found that the values of the 2nd OM were different in ability and traits, diversified intelligence, and academic ability between the Japan branch and the Hong Kong branch (Table 2). That means banks in Taiwan usually select and dispatch executives to their Japan branches and Hong Kong branches according to different traits of ability, diversified intelligence, and academic ability, which they attach more importance to. From the ranks, we know that they would pay more attention to the diversified intelligence of executive candidates for Hong Kong branches, while from the ranks we understand they would pay more attention to the academic ability of executive candidates for Japan branches. In the category of graduated college, we could learn that the difference in the weighted value of the 2nd OM between Japan branches and Hong Kong branches is not significant. That means that graduating college is not an important factor for them to consider executive candidates for branches in Japan and Hong Kong.

Table 2 The Wilcoxon rank sum test result of traits of ability

H0: The two 2-nd OM weights locations are the same H1: H0 is false					
		Japan (Population 1)		Hong Kong (Population 2)	
Factor		2nd OM	Rank	2nd OM	Rank
Traits of Ability	Intelligence Quotient	7.3775	14	7.08	9.5
	Language Ability –English	2.7825	1	6.615	3
	:	:	:	:	:
	:	:	:	:	:
	Management Ability	8.335	24	7.1	11
Sum of Ranks		T1=208		T2=92	
Sample Size		n1=12		n2=12	
p-value=0.0008, Reject the null hypothesis					

V. CONCLUSION

1. The research adopted FDM to find the weight of evaluation factors for overseas branch manager dispatch. The higher the value of OM, the more attention is paid to the factor during their process of selecting overseas branch executives.
2. The research took advantage of the Wilcoxon rank sum test to compare the weighted value of the 2nd OM of evaluation factors for dispatching executives to branches in Japan and Hong Kong. The results showed that there was no significant differentiation in the colleges the candidates graduated from. That means that the banks in Taiwan hardly consider which college or departments the candidates graduated from when they select executives for their branches in Japan and Hong Kong.

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