Using Fuzzy Analytical Network Process Approach to Develop Job Search Success Model of Engineering Graduates

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Abstract: *Recent decades have seen significant breakthroughs and profound changes in the scale, structure, categories, and models of training in higher education systems around the world. Following the trend of diversification, Vietnamese universities have shifted from serving a narrow elite niche to universalization of higher education. This shift can be seen in the thriving surge of new universities and enrollments. Meanwhile, paradoxically, the reality also entails a shortage of high-quality human resources against the idleness of highly educated job-seekers. This will entail a huge waste of social resources and immensely sap the opportunity for Vietnamese youngsters to promote their potential in the modern context of deep and wide-ranging integration. In light of this context, this article introduces a successful job search model for engineering graduates. Policies on unemployment rate reduction, job opportunity improvement and job hunting pressure release for training institutions are also proposed.*

Index Terms: *Analytical Network, Fuzzy Logic, Job Success Model, Decision Analysis, Human Resource*

I. INTRODUCTION

Vietnam as a whole and Ho Chi Minh City, in particular, have recently experienced ground-breaking advancements in economy, culture, and society [1]. Ho Chi Minh City is emerging as a national economic leader that has made important progress. Nonetheless, the city is facing many significant challenges posed by a modest educational level, the shortcomings of education and training against rising social needs, and the high unemployment rate (especially for new graduates) compared to the nation's level. According to the Ministry of Education and Training of Vietnam, in the 2016-2017 school year, there were roughly 235 universities and academies around the country, providing tertiary education to 1,767,879 students. Hayden [2] shows a sharp increase of unemployed graduates from 72,000 in 2013 to 115,400 in 2016. Statistics of the Ministry of Labor, Invalids and Social Affairs, on the other hand, show that more than 200,000 students were unemployed by the end of 2017, while 125,000 students were engaged in low-skilled jobs not commensurate with their training level. A question to be

raised is thus how novice job seekers can overcome their unemployment. In an attempt to answer this question, this article reviews the literature and develops a successful job search model for university graduates in Vietnam. Solutions are thereby proposed for training institutions (i.e., universities) and learners to improve the chances of job attainment and sources of earning for university graduates.

II. LITERATURE REVIEW

The term "success" comes from the Latin word "succedere", meaning "to come close after" [3, 4]. This definition has both positive and negative connotations. The word "success" later came to be used in a more positive sense to mean getting something one wants [5]. In other words, success means achieving the best results using the available resources. The measurement of success varies from person to person. Some relate success to attaining a huge fortune, high status or fame, while others find success in a few intimate friendships. Some people seek to accomplish lofty deeds for the community or humanity as a whole, while others focus on things as simple as a happy and harmonious family.

According to the Labor Code of Vietnam, employment is an income-generating activity that is not prohibited by law. For a worker, career success is defined as positive psychological outcomes or working achievements a person gains from their work experience [6, 7]. Success in job search involves a series of activities related to collecting information about job opportunities and evaluating and selecting such opportunities in order to achieve the desired outcomes, such as an interview and appointment to the applied position. Framed by this definition, Saks [8] emphasized the costs of job search success. Past research on job search success indicates a high time cost of job search for academicians, which serves as a barometer of the job search cost. Brasher and Chen [9] discussed how long it takes for graduates to find employment, assuming that all students will succeed equally in job hunting if they can find a job in a predetermined limit of time. Subjective factors such as pressure and difficulty in finding a job should also be taken into account [10]. Thus, a comprehensive definition of job search success should include the following criteria: (i) job search cost, (ii) job quality, and (iii) job seeking convenience.

With regard to the job

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search cost, in addition to job search time, Franzen and Hangartner [10] has added such indicators as the number of job applications delivered by job seekers and the number of invitations to interviews. It is common practice for researchers to bear in mind salary as one of the key indicators for measurement of job quality [11]. However, salary may be determined by timing, the labor market, industries, occupations, and so on, rather than the success of the job search. It is also notable that respondents tend to keep their salaries private. Therefore, some studies have probed the satisfaction of workers regarding their remuneration instead of the actual salary amount [12]. Satisfaction with work, chance of promotion, relevance of the job to one's speciality, and skill development are also used for measuring the job quality.

Other researchers see the job seeking convenience as a worth-considering index of job search success. In a study on the job search success of graduates from medium-scale universities in the Mid-West region of the United States, "search stress" is used to represent search convenience. Similarly, Franzen and Hangartner [10] study examined the respondents' perception of difficulties in finding jobs.

III. RESEARCH METHODOLOGY

The following Analytic Hierarchical Process (AHP), a modern structural analysis technique based on psychology and mathematics and developed by Professor Saaty in 1980, is used to identify the criteria weights [13-15]. The method uses a combination of both qualitative (hierarchical model construction) and quantitative (pairwise comparison matrices) data in a logical hierarchy [16-18]. Analytical Network Process (ANP) is an advanced form of AHP. The Fuzzy-ANP method has been proposed by many researchers such as Chang, et al. [19], [20-22]. This approach is flexible, visual, and helpful in criteria conflict-solving and on complex multi-criteria issues [22-25]. As a result, subjective and prejudiced attitudes toward decision making are alleviated. These advantages explain the popularity of Fuzzy-ANP in disciplinary research in fields including economics, social and management sciences and technology.

Consider K experts in a group P_k (k = 1, 2,..., K) that assess n elements E_i (i = 1, 2,..., n). From preference scales, expert P_k evaluates the importance between two criteria (E_i, E_j) (i, j = 1,2,.., n). He or she will give a ratio judgment a_{ijk} which expresses the relative importance of the criteria E_i over E_j. In other words, the judgment specifies how much E_i is preferred or not preferred over E_j. Assume that each decision maker provides a set of m interval fuzzy comparison judgments:

$$A^k = \left\{ \tilde{a}_{ijk} \right\} \tag{1}$$

where k = 1, 2,…, K; i = 1, 2, 3…, n-1; and j = 2, 3, …, n; $j \succ i$, and $m \le \dfrac{n(n-1)}{2}$.

These judgments are represented as the TFN $\tilde{a}_{ijk} = \left(l_{ijk}, m_{ijk}, u_{ijk} \right)$, where m_{ijk}, l_{ijk}, and u_{ijk} are the mode, the lower bound, and the upper bound, respectively.

$A^k = \left\{ \tilde{a}_{ijk} \right\}$ can be applied to form a fuzzy pairwise comparison judgment matrix:

$$A^k = \begin{bmatrix} (1,1,1) & (l_{12k}, m_{12k}, u_{12k}) & \cdots & (l_{1jk}, m_{1jk}, u_{1jk}) \\ (l_{21k}, m_{21k}, u_{21k}) & (1,1,1) & \cdots & (l_{2jk}, m_{2jk}, u_{2jk}) \\ \cdots & \cdots & \cdots & \cdots \\ (l_{i1k}, m_{i1k}, u_{i1k}) & (l_{i2k}, m_{i2k}, u_{i2k}) & \cdots & (1,1,1) \end{bmatrix} \tag{2}$$

This model derives a crisp ranking vector such that priority ratios $\dfrac{w_i}{w_j}$ are approximately within the scope of the initial fuzzy comparison judgment a_{ijk} as

$$l_{ijk} \, \tilde{\le} \, \frac{w_i^k}{w_j^k} \, \tilde{\le} \, u_{ijk} \tag{3}$$

where $\tilde{\le}$ denotes "approximately less or equal to" and the ratio $\dfrac{w_i}{w_j}$ can also represent the satisfaction of experts.

This ratio explains the similarity of the crisp solutions to the initial comparison opinions from the experts. By considering the decision makers' role, their importance weights I_k are taken into account. As a result, the F-ANP problem can be represented in nonlinear programming by using the goal programming technique as:

The objective function:
Max
$$Z = \sum_{k=1}^{K} I_k \lambda_k$$
subject to:
$$(u_{ijk} - m_{ijk})\lambda_k w_j + w_i - u_{ijk} w_j \le 0$$
$$(m_{ijk} - l_{ijk})\lambda_k w_j - w_i + l_{ijk} w_j \le 0 \tag{4}$$
$$\sum_{i=1}^{n} w_i = 1, \; w_i \succ 0$$

where λ_k is the main variable measuring the degree of the experts' judgment with the final ranking vector w_i, and I_k presents the importance weighted of the expert P_k.

IV. RESULTS AND DISCUSSION

It is found that job search convenience is the most important factor of the model, with a weight equal to 0.4839. Smith and Gerhart [26] indeed shows that the earlier a labourer takes a job, the more likely it is that he or she will achieve success. To succeed requires one to build and

nurture social trust. High social trust lays the foundation for forming a positive attitude, which contributes to the success of individuals [27]. Therefore, proper career orientation should be provided to enable students to develop a positive attitude, career passion, and abilities. It is a fact that universities call for enrollment based on their capacity and emphasize quantity rather than quality, not to mention a clear orientation for their training outcomes. This fact is underscored by the absence of a complete forecast for the workforce demand of employers, the low practicability of training programs and the poorly implemented employment advising and support for students.

It is also noted that engineering students during their university years should acquire various experience and be equipped with self-employment skills. Practical experiences help bolstering soft skills and readiness for career opportunities upon graduation. For this to become true, the engineering students' effort is not enough, as for the part of training environments, universities need to take their newbies on field visits to enterprises, where engineering students can have an eye and a hand on the job they choose. A more concrete direction and rigid platform of knowledge and skills can be formed thereby as a backpack for future job searchers. Furthermore, universities should look for a connection with businesses, as this enables engineering students' exposure to the industrial settings while slaking the thirsty for human resources of enterprises. Partnership with those businesses relevent to the taught majors is a strategy that assures a stable and sustainable output for the universities and prevents the waste of trained workforce.

Research results reveal that the cost of job search weighs as important as search convenience. Indeed, 2013 and 2015 surveys by the General Statistics Office and International Labour Organization pointed out that those leaving universities spent on average 7.3 months searching for the first job that they deemed stable and satisfactory. In particular, more than 26% of young workers have education levels higher than required for their jobs. This problem may be solved by the linkage between universities and local employers. In addition, training institutions should establish alumni contact points in departments and faculties to connect and support enterprises in recruitment. On the other hand, employers and society should clearly define their human resource needs, so as to provide recruitment information and order a workforce from universities by signing recruitment agreements.

V. CONCLUSION

Job search is among the most challenging global social issues. It drives the attention of people in most countries, especially developing nations like Vietnam. The Communist Party and the state have placed the promotion of employment for all people toward improved income generation and better quality of life at the top of socio-economic policies. In this context, this article proposes a successful job search model for engineering graduates of universities in Ho Chi Minh City. Research findings are expected to help reduce the unemployment rate and offer solutions for engineering

students and training institutions, so as to boost the chance of employment for newly graduated engineering students in the labor market.

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