



Designing a model for selecting human resource through multi criterion decision making method: evidence from Iran

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ABSTRACT

Human resources are regarded as the most important competitive factor of today organizations. Therefore, the valuable role of staff in organizations and their desirable management are emphasized. In this regard, Purposeful and precise selection of human resource is a key factor in the success of an organization. This research has been carried out in three oil and gas industry-related organizations. Research community includes seven managers in each organization. So total of 21 persons were participated in this research. The purpose of this research is to identify a set of most important and most influential factor affecting human resource selection. The next step is to use multi-criterion techniques, as well as referring to experts, for evaluation and prioritization of these factors. Finally, the finding of research shows that "Professional and personal skills" is the most important factor in human selection and "Personal characteristics" is in the last. Therefore Professional and personal skills is more important for human resource selection.

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INTRODUCTION

In today's global economy, human recourses are considered as a vital factor in economic competitiveness of any organization (Nagadora, 2008). Attraction, retention, and development of talented, competent, and high-performing personnel is one of the key goals of human resource management (Chien, 2008), which starts with selection and hiring of appropriate employees and leads to the success of the organization (Risavy, 2011).

In today's competitive business world, organizations cannot afford the expenses associated with the inappropriate human resource selection due to the increasing global competition, integration of organizations, and reconstruction of industry (Golec, 2007). The reason is that hiring, training, and replacement of inappropriate employees are often costly and identification of low-performing and incompetent personnel is a time-consuming process (Golec, 2007).

Unqualified personnel with their costly mistakes necessitate careful monitoring and require frequent training sessions, which of course impose exorbitant costs on the organization (Golec, 2007).

Hence, among the other tasks of the human resource management unit, careful and objective

personnel selection is one of the key factors for the success of the organization (Lin, 2010) and influences competitiveness and future performance of the organization.

Personnel selection is the process of selecting employees who best meet the predefined requirements of a given position. This process determines the quality of recruited personnel and plays a key role in human resource management (Dursun, 2010).

Therefore the study of the factors impacting on the human resource selection process is essential and developing models and tools that can provide a good understanding of each factor and predict their impact can be helpful in improving the selection process (Nagadora, 2008).

One of the essential steps of personnel selection, which is a complicated issue faced by the human resources unit of an organization, is defining the requirements and specifications of the desirable candidate, selecting the most appropriate criteria, and prioritizing them according to their significance (Jessop, 2004).

A candidate can have an acceptable level of education, good technical experience, and well-developed communication skills. However, this person can fail when it comes to task organization and control of the situation. Another candidate

could, despite acceptable technical knowledge and expertise, lack responsibility and necessary personal traits (Moradi, 2004). Sometimes, selection techniques can discover desirable characteristics of a potential employee. If hiring approaches are in line with business approaches of an organization, they will have a great positive impact on the organization performance. Hiring policies should be coordinated with the culture and strategic planning of the organization (Golec, 2007). In fact, one of the reasons of organization failures is disregarding the important factor of hiring appropriate human resources (Dahelgard et al., 2007). Human resource management can significantly alter organization progress and performance (Milton, 2010).

Basically, the most important factors in employee hiring and evaluation are determined based on the characteristic of high-performing current employees. Without compiling a list of such important characteristics, staff selection will not be successful. On the other hand, if the list of such characteristics is too long, it would be impossible to find any appropriate candidate (Golec, 2007).

Hence, there are various factors that are used for staff selection, which begs the question among this wealth of factors and required characteristics, which ones must be chosen and what are the necessary tools to identify such factors? On the other hand, the variety of existing occupations makes it necessary to have an appropriate list for each type of occupation to ensure a successful hiring process and best performance of the organization (Moradi 2014).

Using appropriate human resources can lead to achieving the specified goals of the organization (Moradi, 2014).

Therefore, well-developed model based on organization needs, which determines the most proper list of factors based on the type of occupation, equips organization management with a powerful tool to overcome hiring mistakes originated from bad judgement and limited information and time (Simon, 1991).

In this research work, based on a comprehensive literature survey, first different important factors in hiring new employers are identified and classified. Then, based on expert opinion, group decision making, and the process of hierarchical analysis, we prioritize and assign weighting parameters to each factor. Ultimately, a comprehensive human resource selection model is developed based on the previously described steps.

Literature Review

There is a vast body of literature on the problem of human resource selection based on various techniques. The literature survey concludes that the utilized criteria and factors are numerous and

various. However, certain criteria are common between different studies. Criteria such as gender, age, educational background, marital status, and work experience (Konger, 2009), personality, emotional stability, self-confidence, social responsibility, effective use of time (Golec, 2007) or skills such as auditory, written, ability to convince others (Golec, 2007) are used. Moreover, in certain studies planning skills, organizing skills, control, risk management, and strategy development skills are used (Golec, 2007). In other studies, leadership capabilities, adaptability, marketing skills, and learning abilities are considered (Golec, 2007). Furthermore, criteria such as technical knowledge, professional efficiency, and the ability to use modern technologies are taken into account (Golec, 2007). These studies then rank-order the aforementioned criteria for staff selection.

These studies have also drawn the following conclusions:

Various skills such as creativity and intelligence of candidates help them in making good deals (Baron 2007). Interpersonal relationships are very important for organizations that pursue offering high quality products (Walter, 2002).

Positive relationships enable exchange of opinions and ideas; however, weak relationships would lead to unconstructive communication and paranoia within an organization (Haber and Richer, 2007). Behavioral and management skills will results in satisfied customers that will come back in the future (Mitas, 2007), because customer retention will obviate the needs for and eliminates the cost of attracting new customers (Chee-Chee Biaram, 2009).

As an example, quick and comprehensive customer service is of utmost importance in customer satisfaction (Yon, 2010). The ability to complete tasks is identified as one of the important characteristics of the personnel (Eskolin, 2011). The ability and competency in fulfilling tasks is a characteristic with a high significance for organization success (Green, 2008).

Phillips and Ropper believe that high skilled individuals, are those with a high degree of commitment that can influence the customer (Phillips, 2009). According to another study, considering individuals' potential will lead to understanding key opportunities to pursue competitive deals (Collins, 2009). In another study, it is demonstrated that leadership approach of the management has a direct relationship with job satisfaction and team work (Brown, 2013). Also, it has been shown that personal traits and intelligence have a significant influence on employer efficiency (Kavaztti, 2013).

Since the important aspect of human resource selection is its fuzziness, multiobjective decision

making techniques based on fuzzy systems is widely used by experts (Kleinse, 2010).

For instance, using the theory of fuzzy sets and criteria related to professional, managerial, and personal skills, Capaldo has developed a method for staff evaluation and hiring (Capaldo, 2001). In order to select a marketing manager, Royce developed a method that took into account factors such as age, work experience, educational background, leadership capabilities, adaptability, and competence for team work, and employed the Fuzzy TOPSIS technique to rank all candidates and select the most appropriate one (Royce, 2013). Golec used a fuzzy hierarchical analysis for employer hiring and evaluation and utilized criteria such as communication skills, interpersonal skills, knowledge and technical skill, managerial capabilities, job development and decision making abilities for his approach (Golec, 2007). Various techniques using artificial intelligence have been developed that utilize data mining and decision making rules to support the hiring process. By combining network analysis process and data analysis (Lin, 2010), Lin has developed an employee selection techniques based on criteria such as

professional knowledge and skills, educational and work background, and personality and hidden potentials.

In summary, the number and volume of studies that are conducted and published signify the importance of human resource selection. In this paper, by classifying key criteria for hiring, it is attempted to present a functional, useful, and comprehensive framework for hiring and personnel evaluation.

METHODOLOGY

This work is an applied research that fulfils all the requirements in three steps. General schematic of the research process is presented in figure 1.

In the first phase, based on the conducted literature survey, criteria and factors of human resource selection are identified and using the existing publications, personnel selection criteria are classified into seven main categories as shown in table 1.

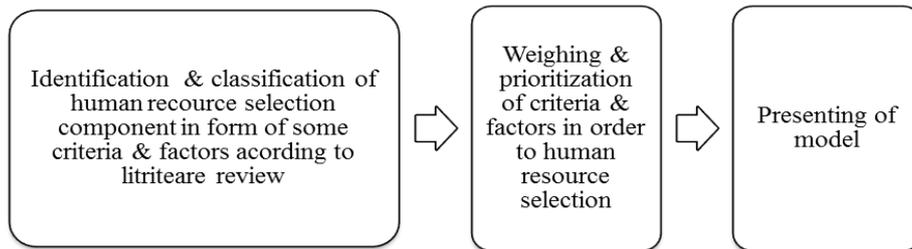


Figure 1. Research process

Table 1. Classification of criteria and components for selecting employees

Criteria	Factor
Personal characteristics	Age, Gender, Marital Status, Educational and Job background
Personality traits	Potential, Emotional stability, Self-discipline, Self-confidence, Social responsibility, Effective use of time
Communication skills	Listening, Writing, Ability to convince others
Decision Making Skills	Analysis, Risk taking, Innovation, Organizational sensitivity
Capacities and capabilities	Planning, Organizing, Controlling, Delegation of authority
Professional and personal skills	Leadership capacity, Adaptability, Ability to perform teamwork, Independence, Risk management, Learning
	Technical knowledge, Professional efficiency, Use of new technologies

In the next phase, to rank-order criteria and factors, a pair comparison questionnaire is

distributed among statistical samples. In this work, four significant and high-profile companies involving in oil and natural gas related activities in Iran are studied. 7 managers from each organization are identified to complete the developed questionnaire, with a total of 21 survey takers. The position and demographic information of these 21 representatives are provided in table 2.

To conduct pair comparisons between factors and sub factors (subsets of criteria) and then their prioritization, different questionnaires for pair comparisons are developed for each area. Considering a main group of criteria and seven categories of factors for each criterion, overall eight questionnaires of pair comparison are developed and were distributed among respondents. To have a consistent understanding between all respondents, all criteria and how to complete the questionnaires by the participating managers are fully described and the developed questionnaires are completed in person after interviewing the participant.

After collecting all responses and conducting a pre-processing on them and crosschecking them for

consistency, AHP algorithm is employed to prioritize them.

Table 2. Position and demographic information of Sample statistics

Samples	N	Gender		Work Experience	
		Male	Female	Less than 10 years	More than 10 years
Human recourses manager	3	2	1	1	2
Commercial manager	3	3	0	0	3
Engineering manager	3	3	0	0	3
Finance manager	3	3	0	0	3
Legal & contact manager	3	2	1	1	2
Logistic manager	3	3	0	1	2
System & method manager	3	2	1	1	2
Total	21	18	3	4	17
Percentage	100%	85.71%	14.29%	19.05%	80.95%

Fuzzy AHP Approach

AHP is one the widely used approaches of studying human resources (Cho et al., 2012). This method is widely used in the industry to make selections (Scott, 2002). AHP is also one the most powerful methods of decision making for multi criteria problems (Ganger, 2009). Prioritizing criteria and factors is one the approaches in which decision making with multiple criteria and constraints prevails and is defined as a multi-objective decision making problem This method was first introduced by Saati in 1980 and is a powerful decision making approaches that by transforming complicated decision making processes into simpler sets and then conducting simple comparisons and then combining and compiling the results, converts the critical aspects of the complicated problem into hierarchical structures (Soccolli, 2012).

This approach has the following advantages: simplicity and easy implementation, possibility of consistency of judgements, hierarchical structures, and the possibility of considering qualitative and quantitative criteria. Since ambiguity and uncertainty exist in the judgement of decision makers and their pair comparisons, the combination of AHP method and fuzzy logic makes it a powerful tool (Zakki, 2005). Typically, decision makers tend to use relative quantities to express their opinion rather than absolute quantities. Hence, triangular fuzzy numbers sets are used to prefer one criterion over another. Then, the development analysis first introduced by Chung in 1996 is used for pair comparisons. This procedure is described below.

Step 1: Each fuzzy number is calculated based on the i^{th} criterion using Equation (1), where i is the row index and j is the column index:

$$S_i = \sum_{j=1}^m M_{gi}^j \left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} \quad (1)$$

In this equation, $\sum_{j=1}^m M_{gi}^j$ is calculated using (2) & (3):

$$\sum_{j=1}^m M_{gi}^j = \left(\sum_{j=1}^m l_{ij}, \sum_{j=1}^m m_{ij}, \sum_{j=1}^m u_{ij} \right), \quad i = 1, 2, \dots, n \quad (2)$$

$$\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j = \left(\sum_{i=1}^n \sum_{j=1}^m l_{ij}, \sum_{i=1}^n \sum_{j=1}^m m_{ij}, \sum_{i=1}^n \sum_{j=1}^m u_{ij} \right) \quad (3)$$

The inverse of Equation (1) is calculated as follows (equation 4):

$$\left[\sum_{i=1}^n \sum_{j=1}^m M_{gi}^j \right]^{-1} = \left(\frac{1}{\sum_{i=1}^n \sum_{j=1}^m l_{ij}}, \frac{1}{\sum_{i=1}^n \sum_{j=1}^m m_{ij}}, \frac{1}{\sum_{i=1}^n \sum_{j=1}^m u_{ij}} \right) \quad (4)$$

Step 2: In this step, the magnitude of M_2 and M_1 are compared using equation (5) & (6):

$$V(M_2 \geq M_1) = \sup_{y \geq x} [\min(\mu_{m_1}(x), \mu_{m_2}(y))] \quad (5)$$

$$V(M_2 \geq M_1) = hgt(M_2 \cap M_1) = \mu_{m_2}(a) = \begin{cases} 1 & ,if \ m_2 \geq m_1 \\ 0 & ,if \ l_1 \geq u_2 \\ \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}, & otherwise \end{cases} \quad (6)$$

On the other hand, the magnitude of a fuzzy number is calculated using Equation (7):

$$(M \geq M_1, M_2, M_3, \dots, M_k) = \min V(M \geq M_i), \quad i = 1, 2, 3, \dots, k \quad (7)$$

Step 3: The vector of weights is calculated using equation (8):

$$d' = \min (s_{i \geq k} - s_{k \geq i}) \quad k = 1, 2, \dots, n; k \neq i \quad (8)$$

$$W' = (d'(A_1), d'(A_2), d'(A_3), d'(A_4), \dots, d'(A_n))^T, \quad i=1, 2, \dots, n$$

And normalized weights are obtained using equation (9):

$$W = \frac{W'_i}{\sum W'_i} \quad (9)$$

Since it is impossible to use linguistic values in mathematical calculations, these values should be converted to fuzzy numbers. In the fuzzy AHP literature, different scales exist. Therefore, in this paper the scale provided in Table 3 (triangular fuzzy numbers) is used:

Table 3. linguistic values for triangular fuzzy numbers

Linguistic values	Triangular fuzzy numbers
Equal importance	(1, 1, 1)
Slightly equal importance	(0.5, 1, 1.5)
Slightly more important	(1, 1.5, 2)
More important	(1.5, 2, 2.5)
Much more important	(2, 2.5, 3)
Extremely more important	(2.5, 3, 3.5)

After confirming the consistency of outputs and verifying that they are all smaller than 0.1, geometric mean is calculated using MS-Excel and collected data are compiled.

■ RESULTS AND DISCUSSION

In table 4, the weights of factors and criteria and consistency ratio in each subgroup of criteria are listed. The consistency parameter between different criteria is 0.056.

Table 4. Criteria and factors and final weights.

Criteria (Weight)	Factor (Weight)	Consistency Ratio
Personal characteristics (0.033)	Age (0.157)	0.06
	Gender (0.243)	
	Marital Status (0.083)	
	Educational and Job background (0.516)	
Personality traits (0.052)	Potential (0.04)	0.04
	Emotional stability (0.069)	
	Self-discipline (0.277)	
	Self-confidence (0.102)	
	Social responsibility (0.368)	
Communication skills (0.078)	Effective use of time (0.146)	0.002
	Listening (0.36)	
	Writing (0.162)	
Decision Making Skills (0.146)	Ability to convince others (0.478)	0.07
	Analysis (0.506)	
	Risk taking (0.102)	
	Innovation (0.222)	
Management skills (0.117)	Organizational sensitivity (0.17)	0.08
	Planning (0.362)	
	Organizing (0.173)	
	Controlling (0.237)	
Capacities and capabilities (0.252)	Delegation of authority (0.098)	0.02
	Leadership capacity (0.089)	
	Adaptability (0.233)	
	Ability to perform teamwork (0.364)	
	Independence (0.062)	
Professional and personal skills (0.322)	Risk management (0.056)	0.07
	Learning (0.197)	
	Technical knowledge (0.56)	
	Professional efficiency (0.227)	
	Use of new technologies (0.213)	

Modeling

In this part of research, due to the prioritization, the designed model is as follow:

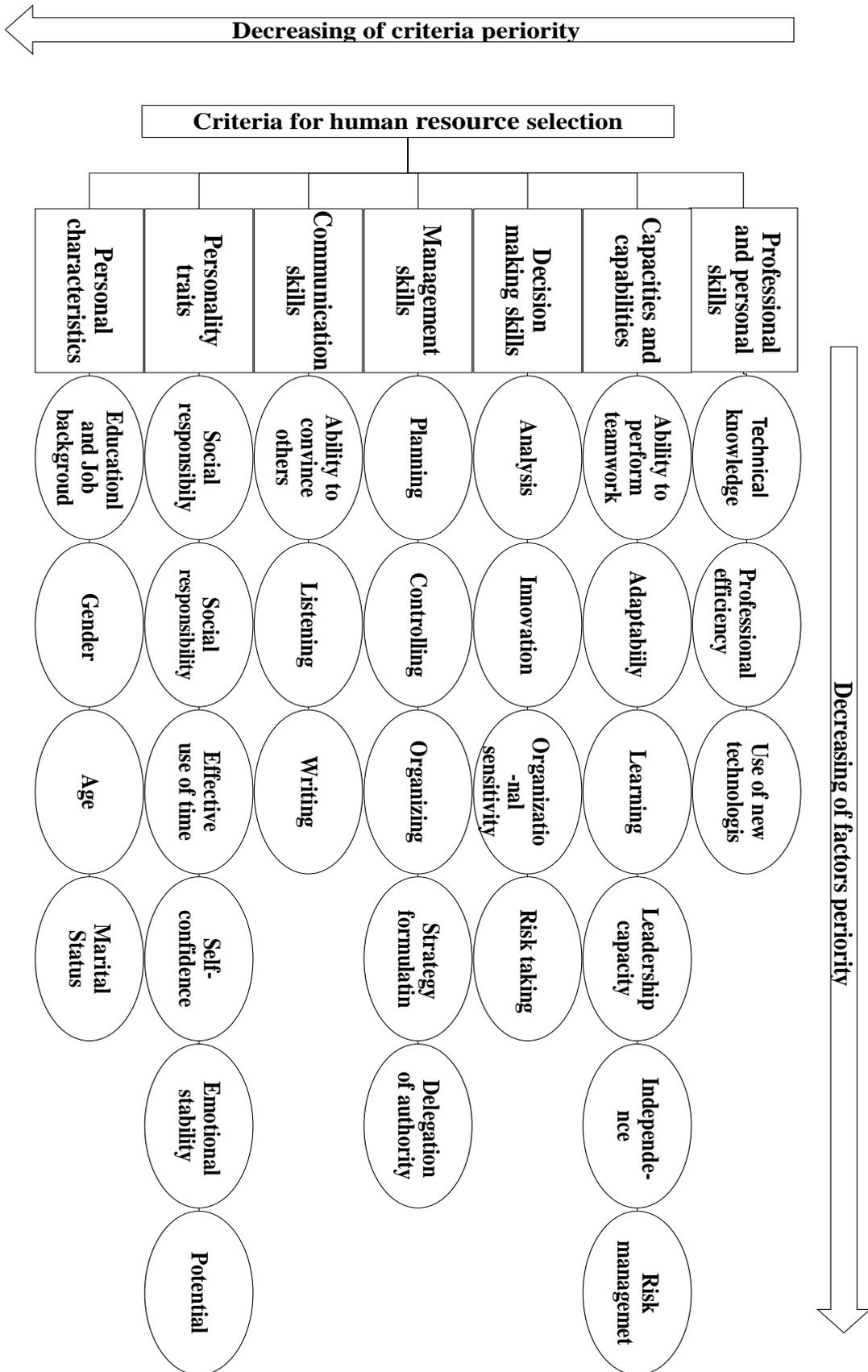


Figure 2. Desired model according to prioritization of criteria and factor.

This research seeks to study the criteria and factors in human resource selection. After identifying and

categorizing the important criteria and factors (subcriteria) for selecting the staff from the literature review, these criteria and factors has been categorized into 7 categories.

Then, by using multi criteria decision making technique and interviewing with active managers in the oil and gas industry, the prioritization has been done and the model is developed.

As indicated by the model, the prioritization of criteria is the following: Professional and personal skills, capacities and capabilities, Decision Making Skills, Management skills, Communication skills, Communication skills and Personal characteristics. In each criterion, there are several factors that must be considered.

For example in case of professional and personal skills, the most important factor is technical knowledge and the least one is the ability of using new technologies.

For human resource selection, an organization can use this model. Obviously, different organizations have different criteria with different significance levels based on what they do.

Overall, human resources is one the most important resources of each organization and appropriate hiring and evaluation techniques should be employed to guarantee the maximum efficiency for the organization.

■ DECLARATIONS

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Authors' Contributions

All authors contributed equally to this work.

Competing interests

The authors declare that they have no competing interests.

■ REFERENCES

- Baron, R. (2007). Opportunity Recognition as Pattern Recognition: How Entrepreneurs Connect the Dots to Identify New Opportunities. *Academy of Management Perspectives*, February, 104 -119.
- Braun S., Peus, C., Weisweiler, S., & Frey, D. (2013). Transformational Leadership, Job Satisfaction, and Team Performance: A Multilevel Mediation Model of Trust. *The Leadership Quarterly*, 24, 270-283.
- Capaldo, G., & Zollo, G., (2001). Applying fuzzy Logic to Personnel Assessment: A Case Study, *Omega*, 29, 585–597.
- Cavazotte, F., Moreno, V., & Hickmann, M. (2013). Effects of Leader Intelligence, Personality and Emotional Intelligence on Transformational Leadership and Managerial Performance. *The Leadership Quarterly*, 23, 443-455.
- Chi, C. G., & Gursoy, D. (2009). Employee Satisfaction, Customer Satisfaction, and Financial Performance: An Empirical Examination. *Journal of Hospitality Management*, 28, 245 - 253.
- Chien, C., & Chen, L. F., (2008). Data Mining to Improve Personnel Selection and Enhance Human Capital: A Case Study in High-Technology Industry. *Expert Systems with Applications*, 34, 280–290.
- Collings, D. & Mellahi, K. (2009). Strategic Talent Management: A Review and Research Agenda. *Human Resource Management Review*, 19, 304-313.
- Dahlgaard, P., & Dahlgaard, J. (2007). Excellence . 25 Years Evolution. *Journal of Management History*. 13, 371-393.
- Dursun, M., & Karsak, E. (2010). A Fuzzy MCDM Approach for Personnel Selection, *Expert Systems with Applications* 37, 4324–4330.
- Gleiber, F., Rogerio, C., & Golber, R. (2003); Applicants' Selection Applying a Fuzzy Multicriteria CBR Methodology, *Journal of Intelligent & Fuzzy Systems*, 14, 167–180.
- Golec, A & Kahya, E. (2007). A Fuzzy Model for Competency-Based Employee Evaluation and Selection, *Computers & Industrial Engineering* 52, 143–161.
- Green, N. (2008). Managing the Talent Management Pipeline: Towards a Greater Understanding of Senior Managers' Perspectives in the Hospitality and Tourism Sector. *International Journal of Contemporary Hospitality Management*, 7, 807 - 819.
- Gungor, Z., Serhadlioglu, G., & Erhan, K. (2009). A Fuzzy AHP Approach to Personnel Selection Problem. *Applied Soft Computing*. 9, 641–646.
- Haber, S., Reichel, A. (2007). The Cumulative Nature of the Entrepreneurial Process: The Contribution of Human Capital, Planning and Environment Resources to Small Venture Performance. *Journal of Business Venturing*, 22, 119 -145.
- Jessop, A. (2004). Minimally Biased Weight Determination in Personnel Selection, *European Journal of Operational Research*, 153, 433–444.
- Kickul, J., Walters, J. (2002). Recognizing New Opportunities and Innovation *International Journal of Entrepreneurial Behavior and Research*, 8, 292 -308.
- Kelemenis, A., & Askounis, D. (2010). A New TOPSIS-Based Multi-Criteria Approach to Personnel Selection, *Expert Systems with Applications* 37, 4999–5008.
- Lin, H. (2010). Personnel Selection Using Analytic Network Process and Fuzzy Data Envelopment Analysis Approaches, *Computers & Industrial Engineering*, 59,937–944.

- Milton, S. (2010). The Factors Driving HR Online at Ford. E-HR Cuts Cost. Reduces Management. Digest, 9, 12-14.
- Mithas, S., & Whitaker, J. (2007). Is the World Flat or Spiky? Information Intensity, Skills and Global Service Disaggregation. Information Systems Research.
- Moradi, M., & Zanjani, M. (2014). Designing a Threefold Skills Model for Selecting Managers through Multi-Criterion Decision-making Approach. Journal of Research in Human Resource Management, 5, 1-30.
- Nagadevara, V., Srinivasan, V., & Valk, R. (2008). Establishing a link Between Employee Turnover and Withdrawal Behaviours: Application of Data Mining Techniques, Research and Practice in Human Resource Management, 16.
- Phillips, D. R. & Roper, K. O. (2009). A Framework for Talent Management in Real Estate. Journal of Corporate Real Estate, 1, 7 - 16.
- Risavy, D., & Hausdorf, A. (2011). Personality Testing in Personnel Selection: Adverse Impact and Differential Hiring Rates. International Journal of Selection and Assessment 19, 18-30.
- Saaty, T. L. (2008). Decision making with the Analytic Hierarchy Process, International journal of Services Sciences, 1, 83-98.
- Scullion, H., & Collings, D. G. (2011). Global Talent Management. Journal of World Business, 6, 105-108.
- Sevкли, M., Oztekin, A., & Uysal, O., (2012). Development of a Fuzzy ANP Based SWOT Analysis for the Airline Industry in Turkey. Expert Systems with Applications, 39, 14–24.
- Simon, H. (1991). Bounded Rationality and Organization Learning, Organization Science, 2. 125-134.
- Yoon, C. (2010). Antecedents of Customer Satisfaction with Online Banking in China: The Effects of Experience. Journal Homepage. Dept of Business Administration, Mokpo National University, Republic of Korea.
- Zhang, S., & Liu, S., (2011). A GRA-Based Intuitionistic Fuzzy Multi-Criteria Group Decision Making Method for Personnel Selection, Expert Systems with Applications. 38, 11401–11405.