

# Identification and Prioritization of Dimensions and Components Effective on Human Resources Valuation: A Case Study on National Iranian Oil Company and its Subsidiaries

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## ABSTRACT

The purpose of the current work, conducted in 2017 and 2018, is to identify and prioritize the qualitative and quantitative factors affecting human resources (HR) valuation at National Iranian Oil Company and its subsidiaries. Using a snowball sampling method, 28 experts were selected from the head of human resources, the head of finance, and some staff members of National Iranian Oil Company and its subsidiaries. In order to identify the dimensions and components affecting human resources valuation, a comprehensive literature review at international and national levels, interviews with experts, and three stages of distribution and collection of questionnaires using the Fuzzy Delphi method were performed. Then, two phases of the paired comparison questionnaire were developed and provided for the experts to explain and evaluate the cause-and-effect relationships between the dimensions and the components together. The specified components and dimensions were prioritized using the Fuzzy DEMATEL method. Using the Fuzzy Delphi method, 15 dimensions and 101 components influencing HR valuation were identified at National Iranian Oil Company and its affiliated companies. According to Pareto 20-80, 20 components were identified as the factors influencing human resources valuation at National Iranian Oil Company and its subsidiaries, and using the Fuzzy DEMATEL method, 15 dimensions and 20 specified components were prioritized. According to the results obtained, the most important dimension and component affecting human resources valuation at National Iranian Oil Company and its subsidiaries are job satisfaction, motivation, and perseverance in employees' assignments.

## 1. Introduction

In today's competitive world, human resources are one of the factors that can provide competitive advantage to organizations. The success or failure of any organization depends to a large extent on the people of that organization, and the organizations can survive, which can play a decisive role in adapting to the changes of the current world. In this context, it should be noted that the reason for the distinction between human resources and other organizational resources

is that the human resources of an organization have capabilities such as learning, changeability, innovation, and creativity, which can guarantee the long-term survival of organizations, if properly managed. The importance of creating a new accounting system, followed by the effective management of human resources, is due to the fact that an annual large share of the cost of each organization is composed of its operational costs, a significant part of which goes to manpower.

Contrary to the industrial age when organizations took into

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account their physical assets, today, based on the requirements of the environment and the emergence of a knowledge-based economy, human capital forms a significant part of the value of the organization; accordingly, human resources should be presented as an asset in the balance sheet so that appropriate decisions should be made and necessary measures should be taken by the management based on quantitative analyses. Human resources accounting has been focusing on human resources analysis since the middle of the last century and is still on the rise.

Accounting as one of the branches of social sciences seeks to report on the financial status and economic performance of individuals, both real and legal. As long as human beings are not considered as an element in reporting the financial situation and the outcome of the operation, human values are not at the right place (Talaneh et al., 1994). Promoting human capital and its impact on different aspects of an organization performance and, more broadly, on the economic and social development of a society is not overlooked by anyone. Using human resources accounting, people can be considered as a long-term capital, not as short-term expenditures which must be minimized (Wadi Zadeh et al., 2009).

In fact, human resources accounting is the transformation of the qualitative and subjective meaning of human resources value in a quantitative and objective way using accounting knowledge and deals with three major components of human resources, including their quantity identification and quality analysis, the evaluation and measurement of their economic value, and their appropriate financial reporting (Tabarsa et al., 2007).

Over the past 100 years, the oil industry has been a major player in Iran's economy and has actually been at the heart of the country's progress and development in all areas. Hence, the growth and development of the country depends on the growth and development of this industry. Since human resources are considered as one of the important factors in the development of the oil industry, the significance of human resources in this industry is also increasing. In recent decades, due to insufficient attention to the training of expert human resources, the abnormal withdrawal of qualitative forces, and the quantitative and qualitative inadequacy of successors, the pyramid of the human resources of Iran oil industry is disrupted, so in the near future, Iran oil industry will face a serious shortage of experts and top managers at top levels of organizations. It is worth mentioning that the average age of the managers of Iranian oil industry highlights the lack of appropriate training of human resources in various management categories (Gol-Shirazi, 2014).

Today, the managers of the oil industry have a wide range of material, physical, and equipment resources, but managers' information is limited in the evaluation of human resources.

Also, if managers want more efficiency and effectiveness in their tasks and missions, it is imperative to acquire the ability to evaluate and measure the importance of the human resources needed to manage their capabilities. With the help of human resources accounting, information about the value of an organization's human resources which should be used in the supervision and decision-making of managers is recorded and reported (Hassan Ghorban, 2000).

At present, oil and gas companies are facing serious shortages of trained and skilled personnel due to the increasing growth of oil projects around the world. Consequently, competitive conditions have been created to attract skilled and experienced manpower among active companies in these industries globally, especially in the Middle East. The losers of this competition are the companies offering the least attractiveness of maintaining human resources. In this regard, the migration of experts from these companies to competing companies is the evidence of this claim.

The weakness of the oil industry services compensation system in the international competitive environment and in comparison with the leading domestic companies has reduced the attractiveness of the oil industry for attracting and retaining specialized forces and changing the pattern of human resources competency (Gol-Shirazi, 2014).

The main purpose of human resources accounting is to attract the attention of managers who are indifferent about keeping the manpower and the managers who do not pay attention to job satisfaction and positive motivation of their employees and do not create job security, hope, and sense of loyalty; in fact, they do not think of creating opportunities for improving and/or eliminating human resources problems, and they result in the expulsion or resignation of employees (Abtahi, 1996).

In fact, this research, by examining the literature of research and the opinion of certified experts, seeks to identify all the aspects and components of human resources valuation at National Iranian Oil Company and its subsidiaries.

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## 2. Theoretical Foundations and Research Background

The process of accounting developments involves four stages of "invoicing accounting," "financial accounting," "management accounting," and "socio-economic accounting,"; the accounting has more or less gone through the first three stages; the future challenge of accountants is the implementation of the fourth stage of accounting, which is the "human resources accounting" of this category.

The development of human resources accounting can be described in six periods as follows:

First period: the derivation of the basic concepts of human resources accounting from the corpus of relevant theories (1960-1967);

Second period: academic fundamental research into the development of measuring models (1971-1967);

Third period: the rapid growth of inclinations to human resources accounting in the academic society (1976-1971);

Fourth period: the recession of the academic society's desire to human resources accounting (1976-1980);

Fifth period: reviving universal inclination to human resources accounting in theory and practice (1980-99);

Sixth period: the origins of intellectual capital (1995- present) (Karami and Hasani Azar, 2006).

Today, the lack of measurement, evaluation, and reporting of human resources value is the main reason for the adoption of non-optimal decisions by the managers of organizations. Due to the lack of the measurement of the economic value of human resources, the effects of directors' decisions on the value of human resources are not investigated. In their decisions, directors pay attention only to quantitative variables but do not take into account qualitative variables. Therefore, managers' decisions may seem to be useful, but it can be detrimental to the organization in practice and can unknowingly lead to the destruction and weakening of its human resources. For example, decisions made by managers in order to reduce costs and the effects of such decisions on employees' orientations, motivation, and satisfaction are not taken into account, which may lead to the loss of employees' motivation and satisfaction and may weaken human resources. Therefore, it can be emphasized that HR valuation is one of the most crucial issues of any organization (Pazhoohi, 2016). The advantages of human resources accounting can be noted as follows:

- \* Human resources accounting shows the impact of human resources on company performance.

- \* Human resources accounting should assist managers in evaluating different strategies of the company.

- \* Human resources accounting can develop a capital budgeting system and correct the quality of the investment return.

- \* Human resources accounting enables managers to better use human resources scarcity (Mutmani et al., 2012).

- \* Human resources accounting information can be viewed through two methods:

1. Human Resources Costing: a human resources accounting system first requires identifying costs related to human resources which must be separated from other business unit costs. The methods and practices used should distinguish between the capital and current sectors. Human resources costing consists of two parts:

- 1.1 Primary Costs: all the funds required for supplying human resources, including selection and recruitment of manpower, placement and in-service training, retraining and practical

training for the acquisition of skills.

- 1.2 Replacement Costs: the cost of replacing employees who are currently in the organization, including:

- (a) post or occupational replacement costs, including maintenance, education, or retirement expenses.

- (b) Other personnel costs, including rewards (cash and non-cash), facilities (tools, furniture, and equipment necessary for the welfare of employees), health and hygiene, consultancy and negotiation expenses, payroll, and other payments such as insurance.

2. Human Resources Valuation: human resources accounting needs more value than costing. The concept of the value of human resources is based on the theory of value in the general economy. Given that human beings are able to create potential future benefits, one can value human like other resources as the current value of a set of services that a person is expected to create during the period of his service in an organization. A group has rejected this theory and believes that human resources are beyond evaluation, and in fact, irrecoverable. According to the theory of researchers, there are two basic steps to measure human resources. This means that one must first define the concept of human resources in non-monetary or qualitative terms and then describe it in monetary terms so as to be represented in the organization's balance sheet. Some HR practices are economic value (current), replacement value, value coefficient, Flamholtz model, Marco model, auction theory, and historical cost (Tabarsa et al., 2008).

Some researchers believe that a person is not owned and therefore should not be considered as an asset and should not be depreciated; by contrast, the advocates of human resources accounting believe that what is considered in the human resources accounting system for asset management is the imaginary, expected, and future prosperity service source of human resources. Some believe that there is a lot of uncertainty about identifying people's services, so identifying people as assets is not correct according to the conservatism principles; however, supporters believe that the fundamental objective of reporting (matching revenue with period expenses) should not be sacrificed for conservatism. Some other also admit that there is ambiguity about the timing of determining the future benefits of investing in manpower, so taking into account the cost of manpower costs could create the possibility of distorting profit; nevertheless, the proponents support that there is potential for the distortion of profit and loss through the absence of investment in human resources (Hassan Qorban, 1996).

Soraya et al. (2006) addressed "prioritizing the indicators of human resources assessment under a fuzzy environment" in a study and developed a methodology based on the fuzzy hierarchy process analysis to weight the indicators of human resources assessment. Their model includes five main criteria



of intelligence and talent; leadership; perseverance and seriousness in work; initiative; and creativity, flexibility, and relevant sub-criteria and 20 indicators. Their results showed that the level of the application of individual knowledge to creating optimal results, staff skill level, the transfer of information, and the success rate in educational programs are the most significant indicators of human resources assessment.

In another study entitled “prioritizing human resources performance evaluation indicators using hierarchical analyses under fuzzy environment,” Bozbura et al. (2007) described a methodology for prioritizing the indicators of human resources assessment in fuzzy environments in Turkey. Their results confirmed that the rate of knowledge utilization in obtaining outcomes, staff skills, information reporting, and the success rate of educational programs are the most significant indicators of human capital estimation in Turkey.

Abeysekera (2008) examined the issue of “determinant factors in the disclosure of human capital information on the financial statements of companies accepted by the Colombo Stock Exchange (Sri Lanka Stock Exchange).” Therein, senior HR managers of 30 companies were interviewed, and the results showed that the disclosure of HR information in financial reports was solely to reduce the concern of the company stakeholders about the company capital growth. According to the results of this work, companies have provided information on human resources only to add qualitative information to the financial statement appendixes and reported information such as staff assessment, personnel training, and staff welfare; on the other hand, the health indicators of personnel, personnel skills, and the creativity of personnel are less considered in these reports.

Michael Oyewo Babajide (2013) addressed “the comparative analysis of human resources accounting disclosure practices in Nigeria's financial and production services companies.” 30 variables disclosing human resources accounting including total human resources value, number of employees, added value of employees in the form of value-added, composition of the board, manager's rights, retirement benefits, performance identification, employment of disabled people, health, safety, and environment at work, the range of salaries received by employees without a pension, the scope of salaries received by managers, the disclosure of diverse and non-discriminatory practices in employment, the number of employees employed by each department, the disclosure of the method for determining the salary of individuals, etc. were identified and placed on the checklist. The study stated that although HR disclosure index of banks is higher than that of manufacturing firms, the difference is not statistically significant. There is also a strong positive correlation between the disclosure of human resources accounting and firm size. Companies may consider valuation and combination

of human assets in their financial statements to increase the credibility of financial statements. The relevant authorities should set up specific financial reporting standards for human resources activities to resolve the issues of arbitrary disclosure of human resources accounting.

Soltani et al. (2014) investigated “prioritization of human resources accounting indicators based on the valuation approaches in the industrial machinery and equipment industry.” The purpose of this study was to identify the value of human capital assets and prioritize them based on the human resources accounting approach and using Flam Holtz model. Their findings indicated that managers approved the following as the criteria for determining the value of human assets in an organization:

- \* Ability index: the dimensions of creativity, innovation, adaptive ability, and teamwork capabilities;
- \* Performance index: the dimensions of duty, participation, obedience, and work conscience
- \* Potential index: the dimensions of age, health, talent, and experience;
- \* Attitude index: dimensions of succession, optimism, honesty, kindness, and sacrifice .

The dimensions of skill, duty, talent, and success are of the highest priority in the four indicators.

Abdi et al. (2016) conducted a research entitled “determining the role of factors affecting the valuation of players (human capital) of the Iranian football league”. Based on the results of the coefficients of the regression model, the findings indicated that factors such as age, number of national matches, player goals, previous player level, and constant participation in the previous season have a significant effect on player prices as the human capital of the club; however, other factors such as game post, individual and team prizes and honors, leg position, height, goal ratio, and the minutes of the game did not remarkably influence determining the price of players.

Omole et al. (2017) examined “the impact of human capital accounting on the market value of oil and gas companies in Nigeria.” They collected second-hand information from 2005 to 2014 from annual reports, accounts of oil and gas companies, as well as books published by the stock exchanges of Nigeria. Their results indicate that human capital has a positive and significant relationship with stock prices. The findings suggest that capitalizing corporate investment in human resources should increase the market value of oil and gas companies and should also be able to create a favorable image of Nigeria's oil and gas companies. Therefore, this study recommends that a standard for the disclosure and measurement of human resources information be developed to enhance human capital valuation and insure uniformity in the disclosure, interpretation, and more reliable comparison of

financial statements.

Fazel et al. (2017) studied “identify the dimensions and components that affect the utilization of university human resources with an emphasis on third and fourth generation universities using the fuzzy Delphi approach: providing a conceptual model.” The survey was carried out in four stages in 2016, and the results of each stage were refined using the formulas of the fuzzy Delphi method. A model of empowering human resources in Iran universities, emphasizing entrepreneurship and value creation universities in three dimensions and including 22 components for faculty members and 23 components for higher education system staff was proposed.

Naghshbandi et al. (2017) investigated “measuring factors adoption of HR valuation: manager’s perception.” They highlighted the factors affecting the adoption of human resources accounting and predicted organization performance. For this purpose, the data on 100 managers were gathered from 15 companies operated in India and abroad. The companies were selected for the purpose of this study on the basis of the invested capital. The data analysis methods were Chi-square tests and multiple regression method for identifying that weather respondents have a positive perception about the use of HRA. Since the perception of managers was treated as evidence for wealth creation, it was proposed that managers of Indian and global companies should adopt human resources accounting.

Khodabandeh et al. (2018) worked on “designing a human resources agility model based on grounded theory approach (case study: social security organization), and indicated that the agility of human resources as an axial phenomenon is due to a set of individual-organizational, individual-personal, organizational, and occupational characteristics. The effects of this phenomenon were categorized into two groups: individual and organizational. Moreover, in this model, the underlying factors (power sharing practices, human resources management practices, organizational coordination, communication and information technology, and organizational process) and interventional conditions (organizational culture, leadership style, self-development, and environmental factors) impact on the ruling relations.

Khorshidi et al. (2018) addressed “identification and explanation of dimensions, components, and indices of human resources development in Sama organization.” The data obtained from the qualitative part were examined through content analysis, and the collected data in the quantitative part, according to the research questions, were analyzed through descriptive (mean, standard deviation, tables, etc.) and inferential statistics (structural equation modeling, exploratory factor analysis, and one-sample T-test) using SPSS and Lisrel software. The results proved that empowerment, job

performance, and improvement are the elements of human resources development in Sama organization. Furthermore, given the proposed mechanisms, facilitators, and barriers, a well-fitted model was designed.

Patrick Olajide et al. (2018) conducted an “empirical study of human resources accounting disclosure on financial performance of selected listed firms in Nigeria.” The collected data were analyzed using descriptive statistics, correlation, and regression. The study revealed that there is a positive co-efficient value of 0.565 between the independent and dependent variables. Based on these findings, the study therefore recommends that the listed firms should imbibe the culture of capitalizing on their reports and disclose all the expenditure on human resources so as to improve the productivity of the firms. Moreover, the regulatory body should set a minimum standard of reporting human resources accounting in the financial statement of the listed firms in other to enhance stakeholders’ valuation in the statement of financial position and note to the accounts.

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### 3. Research Methodology

The purpose of this study is to apply applied research and to collect data from an analytical-type survey conducted in 2017 and 2018. The statistical population consisted of all the experts in the field of human resources valuation who have been involved in determining the importance of dimensions and components, including human resources, finance chiefs, and some experts of National Iranian Oil Company and its subsidiaries. In the present work, 28 experts were selected using snowball sampling method.

First, with a comprehensive literature review on human resources assessment and interviews with experts, with the three stages of the distribution of the questionnaire, and with the use of the fuzzy Delphi method, the dimensions and components that affect the human resources valuation at National Iranian Oil Company and its subsidiaries were identified. Then, two phases of the fuzzy DEMATEL comparison questionnaire were developed for the purpose of explaining and evaluating the cause-and-effect relationships between the dimensions and the components together and were presented to the experts. The specified components and dimensions were prioritized using the fuzzy DEMATEL method. Microsoft Excel software was utilized to analyze the fuzzy Delphi and the fuzzy DEMATEL questionnaires.

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### 4. Data Analysis Method

In this study, in order to identify and determine the dimensions and components that affect the human resources

valuation using the fuzzy Delphi method and then the fuzzy DEMATEL method and to achieve a more accurate analysis, we used effective and influential relationships between the dimensions and the components determined.

After the initial design of the questionnaire, some of the experts were asked to do the initial test on the questionnaire. The results showed that the experts had a common understanding of the subject and of the questions of the questionnaire, which indicates the validity of the questionnaire structure. Moreover, when designing the questionnaire, we tried to study the

research literature and related articles to identify effective and relevant dimensions in the field of human resources valuation. Then, according to the experts' opinions, their initial screening was dealt with, and then the questions were designed based on the dimensions and components approved by the experts (supervisors, consultants, and a number of the heads of the organization). Therefore, the questions were approved by the experts, which affirms the validity of the content of the questionnaire. To assess the reliability of the questionnaire, both the Cronbach's alpha and the test-retest were used between the first, the second, and the third rounds. According to the amount of elongation and sloping data, the data were analyzed to separate the normal or non-normal data.

The implementation phases of the fuzzy Delphi method are in fact a combination of the implementation of the Delphi method and the analyses of information using the definitions of the fuzzy sets theory. The algorithm for implementing the fuzzy Delphi method is shown in Figure 1 (Habibzadeh et al., 2016).

In the fuzzy DEMATEL method, the experts were asked about the relative importance of each component with respect to the other components and each dimension compared to the other dimensions. In other words, all the components and dimensions were compared two by two. After collecting experts' opinions, the components and dimensions were prioritized using the relationships specified in the fuzzy method. The advantages of the fuzzy DEMATEL method are the acceptance of relationships compared to other decision-making methods based on paired comparisons. That is, in the hierarchical structure of each element, it can affect all the elements at a higher or lower level, and elements can interact with each other individually; also, structuring complex factors in the form of causal groups is one of the advantages of the fuzzy DEMATEL method, and given the complexity of human resources valuation at National Iranian Oil Company and its subsidiaries, this method can be of great help to us. The algorithm of implementing the fuzzy DEMATEL method is displayed in Figure 2 (Habibzadeh et al., 2016).

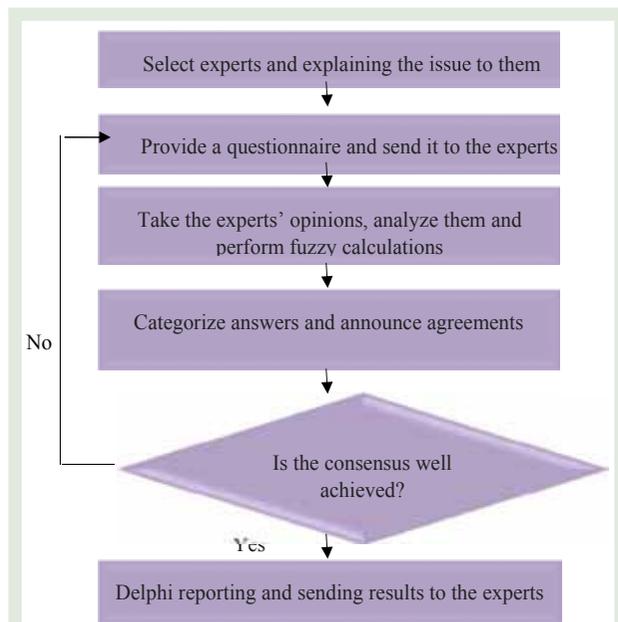


Figure 1: Fuzzy Delphi algorithm

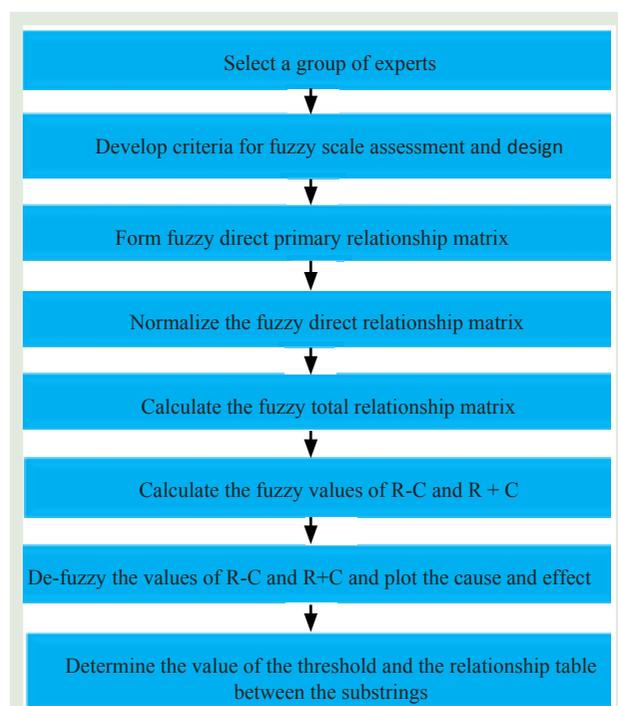


Figure 2: DEMATEL fuzzy implementation algorithm

## 5. Research Findings

In the fuzzy Delphi method, the questionnaires were distributed among the experts, and their views were examined. After identifying the components of the research based on the literature review and the background of the research and interviewing the experts, the first-round questionnaire was designed with 98 questions and one open question. After collecting questionnaires in the first-round and reviewing them, it became clear that five new components, including avoiding political gambling and paying attention to expertise

and commitment, complying with HSE, managing skills of the staff, updating the knowledge of doing work, identifying the opportunities of the organization, were added to the previous components. In order to evaluate the questionnaire, the first step should be to determine a de-fuzzy of the responses given

**Table 1- Main dimensions which are effective on human resources valuation**

Main Dimensions	
C1: Tacit knowledge	C9: Job satisfaction
C2: Joining	C10: Individual loyalty to the organization
C3: Talent	C11: Obedience and conscience
C4: Creativity	C12: Coaching
C5: Skill	C13: Succession
C6: Kindness and dedication	C14: Teamwork ability
C7: Duty	C15: Quantitative variables
C8: Leader	

**Table 2- Components which are effective on human resources valuation**

Components	Rating	Components	Rating
C1: Employee experience	18	C11: The spirit of readiness to help around people	10
C2: Staff technical information	16	C12: Belief in doing the right thing	1
C3: Participation of staff in providing suggestions	14	C13: Honesty and truthfulness	3
C4: Individual staffing abilities and talents	8	C14: Having an accountability feature for employees	15
C5: The mental health of the staff	2	C15: Create added value on the job	6
C6: Energetic staff	19	C16: Having a bias feature and defending the organization	7
C7: Thinking before action	11	C17: Staff performance	4
C8: Having a location feature	9	C18: The reliability of the staff	13
C9: A quick understanding of employees' work issues	5	C19: Flexibility of staff	12
C10: Having the spirit of helping people with high workload	17	C20: Motivation and persistence in staffing assignments	20

**Table 3- The fuzzy spectrum of the verbal expression**

Verbal phrase	Fuzzy value
No impact	(0,0,0.25)
Small impact	(0,0.25,0.5)
Medium impact	(0.25,0.5,0.75)
Great impact	(0.5,0.75,1)
Enormous impact	(0.75,1,1)

to each question and then compare them with the average of the range or threshold indicator (which is always equal to 3 for the 5-point Likert scale). The amount of the de-fuzzy response of all the questionnaire questions was higher than the target threshold, so all the questions were confirmed at this stage. The Cronbach's alpha of the first-round of the questionnaire was 0.801 (which is more than 0.7), confirming the reliability of the first-round questionnaire. The amount of the statistics of the index of sloping and elongation ranges from -2 to +2. In general, if elongation and skidding are in the range of -2 to +2, we can consider that the distribution is normal (Habibpour Gatabi, 2016). Therefore, according to the results, the normalization of the data related to each question can be accepted.

Then, in the second-round, by distributing the new questionnaire, the general results obtained from the first questionnaire were provided to the experts, and their opinions were evaluated. In the second questionnaire, considering that all the questions of the questionnaire were important in the first-round of the questionnaire and that five new questions were developed for five components introduced by the experts and added to the previous questionnaire, 103 questions were designed generally. At least 70% of the experts should have the same answers to each question to check the condition of consensus or the agreement of the experts (Hsu and Stanford, 2007). Since there was still no accumulation of experts' opinions, and there were insignificant questions in the questionnaire, the stop level was not achieved. The answers to the two questions have a de-fuzzy value less than the average value of the spectrum, i.e. 3 that is the basis of the evaluation, so these questions (components) were considered to be negligible questions and were eliminated.

According to the results of the second-round questionnaire, a third-round questionnaire was designed and distributed. After collecting the third-party questionnaires, most of the questions reached a consensus level. Therefore, the condition of the research agreement was provided. Due to the condition for stopping, 15 points and 101 components were identified.

In accordance with Pareto 20-80,<sup>1</sup> (Pareto's Principle or Law 20-80 states that 20% of factors create 80% of the issues), 20 qualitative components were determined as the factors affecting human resources valuation at National Iranian Oil Company and its subsidiaries. None of the following components, including quantitative variables such as age, physical health, organizational occupation level, educational level, experience, the rights and benefits of the individual, etc. was among the first 20 factors affecting human resources valuation in National Iranian Oil Company and its subsidiaries.

Using the fuzzy DEMATEL method, 20 components and 15 specified dimensions were prioritized. The first step of the

<sup>1</sup>The history of the 80/20 rule goes back to 1906 when Pareto proved through mathematics that the distribution of wealth in his country was completely unequal. Indeed, he once came to the mathematical formula proving that 20% of the Italians had more than 80% of the country's wealth; interestingly, after discovering his idea, many other scholars and experts also discovered similar phenomena in their field of activity and in other countries, and it turned out that such a hypothesis became a universal law.

fuzzy DEMATEL method is to compare the components and dimensions separately using the experts based on the degree of priority on the 5-point Likert scale. The verbal comments of the individual respondents (the experts) on the components and dimensions affecting human resources valuation at National Iranian Oil Company and its subsidiary companies were collected. Then, using the Chang fuzzy method, the verbal expressions became fuzzy numbers (Table 3).

In the second step, the matrix of the aggregation of experts' opinions was extracted. Using the arithmetic mean, the collected comments were aggregated into a matrix. This matrix is calculated based the average of the experts' opinions and triangular fuzzy numbers.

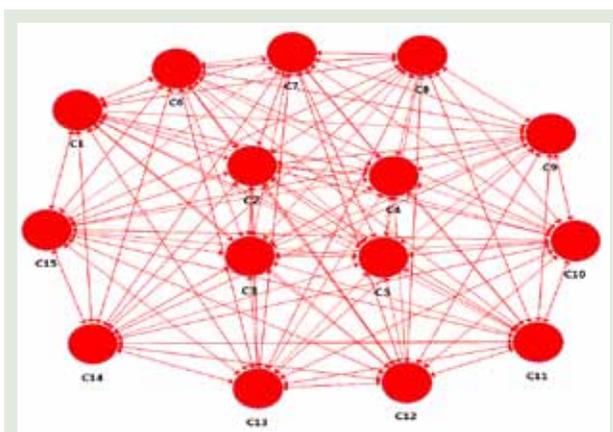


Figure 3: Dimensional cause-and-effect relationships

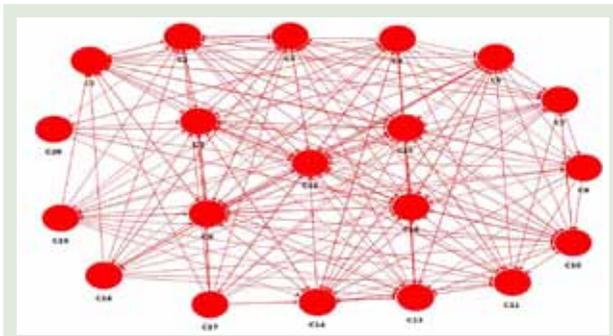


Figure 4: The causal relationships between the components

The third step involves normalizing the extracted matrix. To this end, we first calculated all the lower bound of the experts' opinions; then, the maximum was selected from the sum of the bottom boundary numbers, and all the numbers were divided by the maximum number.

In the fourth step, the lower bound (HL) of the normalized matrix was calculated using the experts' opinion. To do so, the lower bound of the normalized matrix just entered the matrix.

Then, in the fifth step, the matrix I-HL was calculated. The unique matrix (I) is a matrix in which all the matrix elements on the original diameter are equal to one, and the rest of the elements are zero; in this step, all the lower boundary elements (HL) are subtracted from all the unique matrix elements.

The sixth step involves calculating the inverse of the I-HL matrix.

In the seventh step, the matrix of  $(HL \times (I-HL))^{-1}$  was calculated. The bottom bound matrix was multiplied by the matrix obtained from the previous step.

The eighth step involves calculating the median boundary (HM) of the normalized matrix of experts' opinions. To this end, only the middle bound of the normalized matrix was inserted into the matrix.

The ninth step involves calculating the matrix of I-HM. The unique matrix (I) is a matrix in which all the matrix elements on the original diameter are equal to one and the rest of the elements are zero; in this step, all the median boundary elements (HM) are subtracted from all the unique matrix elements.

The tenth step involves calculating the inverse of I-HM matrix.

The eleventh step calculates the matrix of  $(HM \times (I-HM))^{-1}$ . The matrix of the intermediate boundary was multiplied by the matrix obtained from the previous step.

In the twelfth step, the upper bound (HU) was the normalized matrix of the experts' opinions, so only the upper bound of the normalized matrix entered the matrix.

The thirteenth step calculates the matrix of I-HU. The unique matrix (I) is a matrix in which all the matrix elements

Table 4- Calculate the importance of the dimensions and their relationships

Relations Matrix	C8	C7	C6	C5	C4	C3	C2	C1
R+C	4.033	2.333	5.692	7.170	3.287	6.257	7.970	2.931
R-C	2.106	1.899	-15.332	-0.539	1.337	2.823	-3.525	2.082

Relations Matrix	C9	C10	C11	C12	C13	C14	C15
R+C	6.743	5.834	6.981	7.449	7.091	10.138	3.014
R-C	4.012	2.473	0.526	-1.751	0.189	1.066	1.053

on the original diameter are equal to one and the rest of the matrix elements are zero; in this step, all the upper boundary elements (HU) are subtracted from all the unique matrix elements.

In the fourteenth step, the inverse of I-HU matrix was calculated.

In the fifteenth step, the matrix  $(HU \times (I-HU))^{-1}$  was calculated. The upper bound matrix was multiplied by the matrix obtained from the previous step.

The sixteenth step involves the construction of a matrix of the total fuzzy relations (T). To construct this matrix, all the elements of the matrix  $(HL \times (I-HL))^{-1}$ ,  $(HM \times (I-HM))^{-1}$ , and  $(HU \times (I-HU))^{-1}$  entered the matrix.

The seventeenth step calculates the de-fuzzy matrix. To calculate the elements of the de-fuzzy matrix, the boundary of the bottom with a high bound and the double of the middle boundary of the matrix were summed up and then divided into four. The sum of each of the rows (R) and each of the columns (C) of the de-fuzzy matrix was calculated, and the threshold value was then determined using the mean total of the de-fuzzy matrix elements.

In the eighteenth step, the cause-and-effect matrix was created. To construct this matrix, all the elements with threshold values were compared one by one. If the value of each of elements is greater than or equal to the value of the threshold, 1 was placed in the cause and effect matrix, otherwise it was set to zero.

In the nineteenth step, the causal relationships and the relationship between the variables were plotted as depicted in Figure 3 and 4.

In the 20th step, the significance of the dimensions and relationships between them and the importance of the components and their corresponding relationships were calculated (Tables 4 and 5). To obtain the importance of the dimensions and components, the rows and the columns were added, and the columns were subtracted from the de-fuzzy matrix rows.

Based on the results obtained from the dimensions, the

dimension of teamwork capability is the highest (R); therefore, it is considered to be the most influential factor. Also, the dimension of altruism and sacrifice is the highest (C), so it is the most impressive factor. Then, job satisfaction with the highest (R-C) value is considered to be the most influential factor affecting human resources valuation at National Iranian Oil Company and its subsidiaries. Moreover, teamwork capability has the highest (R+C) value, which means it is strongly related to the other factors.

According to the data on the components, the thinking component before the action has the highest (R) value; thus, it is the most influential factor. Furthermore, the component of creating value-added work has the highest (C) value and is the most impressive factor. It should be noted that the sum of row elements (R) of each factor indicates the extent of its influence on other system factors; in other words, the effect of the variables is illustrated. On the other hand, the sum of column elements (C) of each factor indicates the extent of its impact on other system factors; in other words, the degree of impact variables is demonstrated. Therefore, the horizontal vector (R+C) shows the amount of impact and effect of a desired agent in the system. In other words, a higher (R+C) factor means a stronger interaction with other system factors. The vertical vector (R-C) shows the impress of each factor. In general, if (R-C) is positive, the variable is a causal variable, but if it is negative, it is considered to be an effect. Hence, on the basis of the above discussion, it can be stated that the component of motivation and perseverance of staffing assignments with the highest (R-C) is the most influential factor in human resources valuation at National Iranian Oil Company and its subsidiaries. In addition, the component of bias and defense of the organization has the highest (R+C) value, which means that this factor has the strongest relationship with other factors.

Dimensions and components affecting human resources valuation at National Iranian Oil Company and its subsidiaries are listed in the order of priority in Tables 6 and 7.

Table 5- Compute the importance of the components and their relationships										
Relations Matrix	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
R+C	-3.975	-6.310	-5.023	-3.415	-5.217	-4.387	-3.424	-6.344	-2.688	-4.130
R-C	-1.521	-1.300	-3.439	-1.572	1.442	1.600	0.777	1.560	-1.302	-1.883
Relations Matrix	C11	C12	C13	C14	C15	C16	C17	C18	C19	C20
R+C	-5.512	-3.091	-4.114	-3.712	-3.008	-2.196	-12.311	-6.760	-6.783	-13.771
R-C	-.084	-2.986	-1.443	-0.089	-4.259	-1.732	4.905	4.014	3.992	6.334

## 6. Discussion and Conclusion

The promotion of human capital and its impact on various aspects of the organization's performance and, more broadly, on the economic and social development of the early society is not a secret. The promotion of this capital involves a set of competencies for using knowledge and skills in order to achieve the results of the programs. Competencies include features such as creativity, flexibility, leadership ability, problem-solving ability, constructive communication with others, entrepreneurship, and complex skills such as how to learn. An effort to measure activities related to the formation of human capital requires the use of relevant and reliable tools and equipment. Reducing investment in human resources may increase short-term profits, but it threatens the long-term profitability of the organization. At least the advantage of using human resources accounting is the availability of such information to investors.

By specializing in occupations, the role of powerful manpower as an asset is undeniable. But, so far, accounting has not been able to properly assess this primary and costly asset and reflect it in the financial statements to help stakeholders decide, and it has always been a challenge. On the other hand, human resources accounting can be beneficial for investors, because human resources accounting can show if the human resources of an organization are preserved, degraded, or developed. Therefore, it can affect the investors' decision.

The main purpose of human resources accounting is to attract the attention of managers who are indifferent to the maintenance of human resources, who fail to create job satisfaction and positive incentives for employees and do not think about job security, creating hope and loyalty, creating opportunities for improvement, and solving human resources problems, and who lead to the expulsion or resignation of employees (Wadi Zadeh et al., 2009).

In most developed countries, especially in countries lacking rich natural resources such as fossil fuels etc., the economy has been based on the preservation and development of human resources, and human resources productivity is the most significant issue. However, in countries rich in natural resources, especially those with vast oil and gas resources, the main source of funding depends on the sale of fossil fuels, and less attention is paid to manpower; thus, the phenomenon of elite migration and the escape of efficient human resources is a serious challenge in these countries. Unfortunately, Iran is also among these countries.

From the viewpoint of human capital management, due to the lack of attention to the principle of competence and professionalism in recruitment, promotion, and appointment of manpower, the oil industry faces the challenge of the

inconsistency of the combination of manpower to match expertise and skills needed by businesses. This topic, rather than coherence, led to the disruption of the integrated integrity of the intellectual, behavioral, and functional manpower in individual, group, and organizational dimensions. There are several barriers to the synergy of human resources activities in the oil industry.

Planning weakness in creating the necessary structures to motivate and reinforce the employees' interest and increase the possibility of influencing them through the creation of a workplace environment coupled with role-playing and the effective and proper evaluation of the performance of individuals, which prevents the disturbance and disengagement of the workforce from an organizational system, is one of the challenges of human resources in the oil industry (Gol-Shirazi, 2014).

Table 6- Main dimensions effective on human resources valuation

Components	Rating	Components	Rating
Job satisfaction	1	Quantitative variables	9
Individual loyalty to the organization	2	Obedience and conscience	10
Talent	3	Succession	11
Leader	4	Skill	12
Tacit knowledge	5	Coaching	13
Duty	6	Joining	14
Creativity	7	Kindness and dedication	15
Teamwork ability	8		

Table 7- Components effective on human resources valuation

Components	Rating	Components	Rating
Motivation and persistence in staffing assignments	1	Staff technical information	11
Staff performance	2	A quick understanding of employee work issues	12
The reliability of the staff	3	Honesty and truthfulness	13
Flexibility of staff	4	Employee's experience	14
Energetic staff	5	Individual staffing abilities and talents	15
Having a location feature	6	Having a bias feature and defending the organization	16
The mental health of the staff	7	Having the spirit of helping people with high workload	17
Thinking before action	8	Belief in doing the right thing	18
The spirit of readiness to help around people	9	Participation of staff in providing suggestions	19
Having an accountability feature for employees	10	Create added value in the job	20

This study was conducted to identify and prioritize all the dimensions and components which affect the valuation of the human resources of National Iranian Oil Company and its subsidiaries by reviewing the literature and experienced experts' opinions.

Of the 15 dimensions, job satisfaction is the most important influential dimension factor in human resources valuation at National Iranian Oil Company and its subsidiaries. Job satisfaction is a continuation of the individual and organization's cooperation, which increases individual productivity, insures the physical and mental health of the individuals, improves individual's mood, and helps them learn new skills quickly. Prioritizing dimensions and components to attract the attention of the managers and the heads of National Iranian Oil Company and its subsidiaries will help invest in human resources based on their importance and work harder to improve and enhance more important dimensions and components.

Dimensions in the order of importance included job satisfaction, individual loyalty to organization, talent, leader, tacit knowledge, conscientiousness, creativity, teamwork ability, quantitative variables, obedience and conscientiousness, success, skill, coaching, participation, and type friendship and sacrifice.

According to the results, motivation and perseverance of staffing assignments are the most significant influential components of human resources valuation at National Iranian Oil Company and its subsidiaries. These components reflect the extent of staffing efforts in carrying out affairs. If employees are highly motivated in each organization and hope to meet expectations, both the organization and the staff will achieve their goals in this regard.

The components in the order of importance are motivation for and perseverance in the performance of staff assignments, employees' performance, staff reliability, employee flexibility, energetic staff, having a positioning feature, employees' mental health, pre-action thinking, moral readiness to help around, having a staff accountability feature, employees' technical information, quick understanding of staffing issues, honesty and truthfulness, employees' experience, individual capabilities and talent, organization bias and defense, having the spirit of helping people with high workload, belief in doing the right thing, participation of staff in providing suggestions, and creating added value in the work.

With regard to the priority given to the components and dimensions, National Iranian Oil Company and its subsidiaries can plan and invest in high-priority cases, which will lead to the promotion and improvement of human resources and promotion of industry.

Determining and prioritizing the dimensions and components is a part of the research conducted in my

doctoral dissertation titled "human resources valuation model and its reporting at National Iranian Oil Company and its subsidiaries", which designs a human resources valuation model and reports it to National Iranian Oil Company and its subsidiaries.

This study identified the dimensions and components of human resources evaluation in line with the work of Fazel et al. (2017) and prioritized the components of human resources valuation in accordance with the researches of Bozbura et al. (2007) and Soltani et al. (2014).

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## 7. Suggestions for Future Research

1. According to the data obtained on components using the method of fuzzy DEMATEL, motivation for and persistence in performing the assignments of employees is the most significant factor affecting human resources valuation at National Iranian Oil Company and its subsidiaries. Managers and corporate executives can motivate employees to carry out assignments by methods such as informing the individuals about the status of an organization, paying rewards for timely assignments, and training and justification classes should be designed to familiarize the staff with the organization's policies and compliance requirements.

2. It is suggested that in researches similar to the present study methods other than Pareto principle should be used to select the components for a paired comparison.

3. In future research, we can examine the interaction between the components and dimensions.

4. This research should be carried out at subsidiary staff and operating companies of National Iranian Oil Company and the results should be compared with this work.

5. It is suggested that similar research be carried out in relation to other business units, and their results should be compared with the results of this study.

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