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Evaluation of the Influential Factors in Human Resource Development in State-Owned Enterprises Using a Mixed Method

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Abstract

Given the increased competition and turbulence in business environments, the proper management of human resources and employee growth is a significant challenge faced by organizations to achieve competitive advantage. The present study aimed to analyze the influential factors in Human Resource Development (HRD) in State-Owned Enterprises (SOEs). This was an applied research in terms of objective and a mixed (qualitative-quantitative), exploratory study in terms of design. In the qualitative-quantitative section of the study, content analysis and descriptive-exploratory techniques were applied. Data were collected via semi-structured interviews and by using questionnaires in the qualitative and quantitative sections, respectively. The research population included human resource experts, managers, and experts in the field of human resource planning and SOE management. In total, 22 individuals were selected via purposeful sampling. In the qualitative section, data analysis was carried out using open, axial, and selective coding for the classification of the identified factors into four categories of organizational, occupational, behavioral, and empowerment factors. In addition, screening was performed using the Fuzzy Delphi method, and the correlations between the identified factors and sub-factors were determined using the Fuzzy DEMATEL method. According to the results, empowerment factors were the most significant determinants of HRD, which could be improved by considering the associated influential factors and prioritization of organizational factors. On the other hand, the factor weighting findings based on the Fuzzy Analytic Network Process (FANP) indicated that among the identified factors and sub-factors of knowledge management, empowerment factors had the most significant impact on HRD.

Keywords: Human resource development, Industrial companies, Fuzzy DEMATEL, Fuzzy analytic network process.

1 | Introduction

Today, fundamental changes have been made in the world economy due to excessive competition. Researchers believe that competition changes rapidly within a short period, and such environmental changes are rather difficult to predict for companies. Human resource quality plays a pivotal role in achieving competition mainly because human resources could improve competitiveness through their capabilities and skills [1]. Human resources are the capital for the growth and development of a country. Skilled manpower increases productivity and directly contributes to economic growth. On a national scale, human resource policies and educational programs are considered essential to the workforce productivity growth within a country [2], [3]. Human development methods are classified as the organizational activities that could lay the foundation for the comprehensive enhancement and



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education of all employees, which result in the improvement of their knowledge and skill-seeking behaviors [4].

Human development is a key issue in the field of organizational human resources as the empowerment of human resources to guarantee an organization's survival is a major challenge in various companies [5]. Human Resource Development (HRD) plays a pivotal role in the development of human expertise and implementation of systematic changes in organizations. Through organizational and educational development and enhancing the main areas of HRD, HRD strategies and methods could increasingly contribute to long-term human development and organizational performance [6]. Today, several high-tech companies have heavily invested in employee development [4]. However, it is crucial to plan human resources in order to eliminate irregularities and lay the foundation for the operational planning of an organization [7].

According to the literature, the higher quality of human resources is associated with the higher competitiveness of the workforce [1]. HRD supports the efficacy and long-term stability of an organization [6]. As such, organized and efficient HRD programs encompassing the necessary support infrastructures largely contribute to retaining experienced and skilled staff [9]. Human resources and skills development are major organizational challenges in every country, especially developing countries [8]. Therefore, continuous changes in the cultural, economic, and technological environment of organizations may give rise to challenges concerning proper human resource management and the improvement of their performance [10], which highlights the importance of long-term HRD programs [8]. By creating a beneficial work environment, HRD could increase employees' knowledge, honesty, trust, and involvement in performance improvement programs [11]. Performance improvement at an organizational level requires the establishment of a culture revolving around continuous staff training within an organization [12].

The State-Owned Enterprise (SOE) system is one of the foundations of the country's economic development since it could provide the economic cycle of the society and generate jobs. Since SOEs are the engines of the national economic production sector, they are expected to excel in HRD. Given the constant development of the world's industrial sector and the key role of SOEs in this area, SOEs must have a better understanding of the correlation between HRD and production quality. Therefore, HRD has become a necessity in such organizations. In the city of Mashhad, there are 24 SOE that face several issues of development in the field of human resources that must be addressed in order for state-owned industrial companies to expand their presence domestically and internationally.

SOEs deal with various issues regarding HRD, which must be resolved in order to increase the presence of SOEs at national and international levels. Notably, HRD in these companies is so important that weaknesses in HRD and staff knowledge improvement have become a critical issue in the management of different challenges such as work-related problem-solving incapability, diminished value of the knowledge of experiences, poor competence, and inadequate knowledge of staff, which could weaken human resource performance, diminish the overall efficiency of the organization, and intensify issues in the future. One of the main goals of private companies is to reduce costs, earn profits and increase productivity, while state-owned companies have not been successful in reducing costs, increasing profits and productivity hence, what distinguishes this study from other studies is that this study was conducted on SOEs in which there are no previous studies. Given the importance of HRD in SOEs, the following questions have been addressed in the present study:

- *What are the factors, sub-factors, and indicators affecting the HRD of SOEs?*
- *What are the correlations between the factors and sub-factors affecting the HRD of SOEs?*
- *What is the relative importance of the factors and sub-factors affecting the HRD of SOEs?*

2 | Theoretical Framework

The industrial revolution is recognized as a driving force in the evolution of HRD. By the mid-1930s, the formal concept of Organizational Development (OD) had emerged. The theories of OD development have created an opportunity for the education and development of flourishing staff [13]. On the other hand, neglecting HRD and its impact on organizational success may have detrimental effects on organizational performance [14]. HRD establishes purposeful measures that guide staff toward certain behaviors and physical/mental inclinations [15]. According to Burma's theory, HRD mainly focuses on learning with the aim of achieving individual and organizational goals. In this respect, development occurs over time and through emphasizing learning, education, and development opportunities to improve the individual, a team, and organizational performance [7]. Sablok et al. [16] define HRD as the integrated use of education, development, organizational enhancement, and career advancement to improve the individual, a group, and organizational efficiency. In general, HRD is defined from two perspectives; first, HRD is defined as a learning model, which is recognized as learning and performance outcome enhancement based on Chalofsky's theory. The other model has been presented by Ju [17], who emphasized that HRD could improve performance through learning. HRD is an interdisciplinary profession, which is focused on systematic training and development, professional development, and OD to improve organizational processes and enhance the learning and performance of individuals, organizations, and communities [18]. Researchers have evaluated HRD based on individual development, training/development, career advancement, team development, and OD [19]. OD and strategic HRD are often employed to improve individuals, a team, and organizational performance [17]. In a research conducted by Dixit and Sinha [9], education and development were reported to be the main components of HRD [9]. According to Ju [17], the most important components of HRD include the individual, a team, and OD.

In numerous countries, terms such as productivity, professional education, equity/diversity, and health/safety are considered the inherent elements of HRD [11]. Moreover, the production and improvement of competitive advantage occur through workforce productivity and innovation [3]. While long-term sustainable HRD programs are of paramount importance, they cannot be designed without a solid basis, and adequate preparation for efficient human resource management is essential to expertise development. To retain workforce, workforce planning should: 1) assess the current workforce and the extent to which it is used to exploit industries, 2) establish a regular structure for evaluating various types of HRD plans and improvements, 3) identify the competency gaps between the current and future manpower, 4) develop long-term competency-based recruitment strategies, and 5) ensure careers, incentives, and reward packages [8]. On the same note, Shin et al. [20] confirmed that the coordination among the three factors of industry, HRD, and research is essential to economic development.

Employment could be strengthened in agencies through improving skills and promoting innovation by taking effective HRD measures, such as job training, on-the-job learning, and specialized training development [21]. In this regard, Otoo and Mishra [40] claimed that HRD measures are the plans that strategically contribute to the organizational process of HRD, thereby leading to the overall success of the organization. HRD measures should be designed and implemented by organizations to enable the staff to work efficiently through enhancing their individual competencies and meeting performance expectations. In addition, HRD measures should enhance employees' abilities in terms of their occupation, efficiency, and productivity and increase the quality of products and services [40].

As mentioned earlier, HRD measures are absolutely essential, and researchers have previously proposed some of these measures. According to the literature, career development efforts could enhance employee competencies [40]. Career development encompasses organized, official, and planned efforts to strike a balance between the occupational needs of an individual and the workforce needs of an organization, which increases the motivation of employees and enhances the company's performance [40]. Evidence suggests that organizations use education and development to improve the work-related knowledge and technical skills of their employees [16]. Education and development are attained through training,

occupational learning, coaching, and other nurturing approaches [22]. Educational quality has a significant impact on the economic development of Asian countries [3].

Researchers have widely discussed performance assessment and its role in HRD. The evaluation of individual performance could increase efficiency. Meanwhile, performance management strategies play a key role in the commitment and attitudes of the workforce [40]. On the other hand, it has been proposed that using technology in HRD methods could improve learning, occupational performance, and organizational decision-making, thereby providing a great opportunity for increasing the efficiency of HRD measures [23]. Technology saves time, money, and human resources in HRD techniques over time [24]. Moreover, strategic human resource management affects HRD. In fact, strategic human resource management explicitly links human resource management measures with the organization's strategic management processes, emphasizing the coordination of various human resource management measures, including education and development. Therefore, strategic human resource management could influence HRD activities [16], while the lack of strategic plans regarding the knowledge of management in an organization leads to the failure of human resources in innovation and strategic performance [25].

Several studies have discussed the role of leadership development in HRD [19]. Leadership is an operational tool for the effective change of HRD and helping the staff to have a better performance [26]. A leader must be able to teach and foster a suitable culture to prevent misunderstandings, errors/failures in a project, and personal/professional dissatisfaction [27]. In the theoretical literature, researchers have proposed various HRD measures with economic, cultural, and psychological viewpoints (*Table 1*).

Table 1. HRD measures extracted from the theoretical literature.

HRD Measures	Reference
Strategic planning	[16]
Management development	[16]
Occupational planning	[16], [22], [40]
Technology	[41], [42]
Budget	[41]
Management support	[42]
Organizational structure	[42], [43]
Organizational structure	[22], [43], [44]
Human resource management	[43]
State policies	[43], [45]
Knowledge management	[28]
Performance evaluation	[40]
Information technology	[46]
Leadership	[19]

3 | Literature Review

In this section, we have presented a summary of previous domestic and foreign findings regarding HRD models and measures in various areas. In a research, Hajilo et al. [28] evaluated an HRD ethical model in government organizations, focusing on three dimensions of empowerment, talent management, and knowledge management, in order to achieve an optimal combination. Fallah [30] stated that knowledge management plays a pivotal role in the empowerment of employees through increasing the synergy of cultural and capacity-building factors. Furthermore, Pakdel et al. [31] assessed a national HRD model using a dynamic system approach, reporting that the national HRD system had the key infrastructures for the training of human resources and their introduction to the market.

In another study, Masoudi Alavi [5] identified and ranked the influential factors in HRD in educational organizations. In the mentioned study, the main HRD dimensions were determined to be individual, organizational, and environmental. According to the obtained results, the individual dimension had the most significant effect in this regard. Askari Masouleh [32] proposed an integrated HRD model in the organizations of the Islamic Republic of Iran based on the Islamic-Iranian model of progress. In the

mentioned study, the key factors of the development model were managerial, national/extra-organizational, individual, service compensation, performance appraisal system, employee commitment, career advancement path, employee planning/guidance, employees' independence in performing tasks, hardware/software conditions of the work environment, training/knowledge management in the organization, employee empowerment, culture/values/organizational behavior, religious orientation, organizational justice, perfectionism, and content/indigenous factors. In another study, Namee [29] presented an HRD model based on the knowledge management process and knowledge transfer model. According to the findings, the knowledge transfer model, knowledge management process, and organizational factors directly affected HRD. On the same note, Ahmadvand and Yavari Bafghi [33] designed an HRD model in the Islamic Republic of Iran Police (NAJA). According to the obtained results, the evaluation and level of human resources, ordering education, continuous education, job rotation, and individual opinion most significantly affected the HRD of NAJA, respectively.

As for foreign studies, Mahmood et al. [11] confirmed the effect of emotional intelligence on HRD. Nguyen and Hadikusumo [19] investigated the impact of HRD on the success of engineering projects, reporting the main HRD components to be individual, education and development, occupational development, teaching development, and OD. In another study, Ensour et al. [34] evaluated the effects of different factors on the HRD strategic position in the universities in Jordan, observing that all the identified factors (i.e., performance, organizational, and individual factors) played a key role in the prediction of the dependent variable. Sparkman [35] evaluated the national HRD conditions and influential factors in Brazil, stating that political, economic, social, and educational factors had the most significant impact of HRD.

Kazakovs [36] analyzed the influential factors in finding a solution for HRD. In the mentioned study, 12 influential factors were identified, including the need for development, efficiency of developmental solutions, time, development methods, identification style, and place of residence, price, travel costs, indirect costs, situation development priorities, and skill development priorities. Furthermore, Kumpikaite and Sakalas [37] proposed an HRD system assessment model encompassing variables such as the organizational approach to HRD, career organization, training, professional development, adaptation, and evaluation, developmental needs, and rewards.

4 | Research Methodology

The present study aimed to evaluate the influential factors in the HRD of SOEs. This was an applied research in terms of objective since it developed applicable knowledge in the field of HRD in SOEs. In addition, it was a mixed research (qualitative-quantitative) in terms of the type of data. In terms of design and methodology, this was an exploratory study. Data were collected using the library method, and field data collection was performed via interviews and by using questionnaires. The study was carried out in two qualitative and quantitative sections. The study population includes experts, managers and employees of SOEs in the city of Mashhad. *Table 2* shows the statistical population and sample size.

The qualitative section involved a directed content analysis, using the theoretical background proposed by experts, and interviewing these experts. The research population included experts, managers, and specialists in the field of human resources management and SOE planning in Mashhad, Iran. The inclusion criteria of the study were a high academic level, minimum work experience of 15 years in the related fields, a previous human resource management position in SOEs, thorough knowledge of the research subject and sufficient motivation. The participants were selected via purposeful sampling, and a total of 22 individuals completed the questionnaires. The researcher attempted to select the participants who had an adequate knowledge of the research subjects.

Table 2. SOEs in the city of Mashhad and sample size.

Company Name	Activity	Number of Staff	Sample Size
Foolad Yar Novin Factory Industrial Complex	Nonmetallic mineral	128	18
Lahour Ahan-e Shargh	Basic metals	113	16
Production of Khorasan Gas Power Plants	Power generation	65	9
Part navard-e lahour	Basic metals	79	11
Gas Refining of Shahid Hasheminejad	Oil, gas and petrochemicals	68	10
East Asian Cavian Steel	Basic metals	256	36
Khorasan Steel	Basic metals	385	54
Arna Petro Gas	Oil, gas and petrochemicals	79	11
State Mining Company	Basic metals	202	29
Production of minerals in East Khorasan Steel	Basic metals	257	36
Iran Khodro Khorasan Company Shir	Car	318	45
Pegah Khorasan Company Mashhad	nutritive	112	16
Cement Company	Nonmetallic mineral	253	36
Mashhad Packaging Industries	Nonmetallic mineral	45	6
Carton of Mashhad	Nonmetallic mineral	62	9
Mashhad ring making	Car	82	12
Shargh Electric Car Company	Car	108	15
Tavanir Company	Power generation	126	18
Total		2738	360

In the quantitative section, data were collected via semi-structured, in-depth interviews, and data analysis was performed by coding. This section of the research was descriptive-exploratory, and the sample population included experts such as human resources managers. In total, 22 individuals were selected for model development and screening the factors using the Fuzzy Delphi method and fuzzy DEMATEL method to determine the correlations between the identified factors, and data were collected using a questionnaire. For screening by the Fuzzy Delphi method, the items of the questionnaire were scored based on a five-point Likert scale, and the questionnaire of fuzzy DEMATEL method was also applied for paired comparisons. Data analysis was carried out using the Fuzzy Delphi method to screen the identified factors and the fuzzy DEMATEL method to determine their correlations. In addition, the significance of the identified factors was determined through the Fuzzy Analytic Network Process (FANP).

Content validity was evaluated based on the opinions of the experts in the field. In the present study, we applied measurement tools and Lawshe method to assess the research variables. To this end, a questionnaire was provided to the experts to determine the appropriateness of each item related to each variable by selecting one of the options of 'necessary', 'Beneficial but not necessary', and 'Unnecessary'. In the next stage, the Lawshe coefficient of 22 experts was calculated and compared to the Lawshe table for the minimum values of the content validity ratio. In this respect, the Lawshe coefficient of 0.40 was estimated for 22 experts as an acceptable value.

The fuzzy DEMATEL-based FANP was used for data analysis in the quantitative section of the present study. DEMATEL is an approved method for the assessment of complex structures and the correlations between the identified influential factors in HRD. Moreover, this approach shows the visual structural model as a cause-and-effect graph. In addition to examining the correlations between the levels of various criteria, cause-and-effects are also classified and displayed in a diagram in this method [47]. The FANP also weighs factors and is more accurate for the factors that are correlated [38]. To implement the fuzzy DEMATEL-based FANP:

- I. We asked a panel of experts to determine the effect of each factor on the other factors based on the information provided in *Table 2* using a paired comparison questionnaire. Afterwards, a fuzzy direct relation matrix was prepared by calculating the arithmetic mean.

Table 3. Linguistic scales for pairwise comparison.

Linguistic Words for Pairwise Comparisons	Fuzzy Numbers
Extremely high effect	$\tilde{4}$ (0.75, 1, 1)
High effect	$\tilde{3}$ (0.5, 0.75, 1)
Low effect	$\tilde{2}$ (0.25, 0.5, 0.75)
Extremely low effect	$\tilde{1}$ (0, 0.25, 0.5)
No effect	0 (0, 0, 0.25)

II. After forming the fuzzy direct relation matrix, the matrix was normalized using Eqs. (1) and (2).

$$X = K \cdot \tilde{A}. \quad (1)$$

$$k = \min \left[\frac{1}{\max_{1 \leq i \leq n} \sum_{j=1}^n \tilde{A}_{ij}}, \frac{1}{\max_{1 \leq i \leq n} \sum_{i=1}^n \tilde{A}_{ij}} \right], \quad i, j = 1, 2, \dots, n. \quad (2)$$

In these equations, K is the least value obtained by dividing 1 by the sum of the values of the rows and columns. Afterwards, the fuzzy direct relation matrix was multiplied into K value and normalized matrix was obtained.

In Stage 3, the general relationship matrix was obtained through Eq. (3).

$$T = [X(I - X)]^{-1}. \quad (3)$$

In these equations, K is the lowest value obtained by dividing one by the sum of the values of the rows and columns. At the next stage, the fuzzy direct relation matrix was multiplied into the K value, and a normalized matrix was obtained.

III. In Stage 3, general relation matrix was obtained using Eq. (3).

$$T = X(I - X)^{-1}. \quad (4)$$

In the equation above, \tilde{T} shows the general relation matrix, and X is the normalized matrix. To calculate the T matrix, the normalized matrix was subtracted from the identity matrix and reversed. Ultimately, the obtained value was multiplied into the normalized matrix, and the general relation matrix was obtained.

IV. Based on the general fuzzy relation matrix, (\tilde{D}) effectiveness values were obtained from the sum of the columns of the general relation matrix, and (\tilde{R}) effectiveness values were calculated from the sum of the rows of the general relation matrix. These relations are presented in Eqs. (5)-(7).

$$T = [t_{ij}]_{n \times n}, \quad i, j = 1, 2, \dots, n. \quad (5)$$

$$\tilde{D} = \left[\sum_{j=1}^n t_{ij} \right] = [t_i]_{n \times 1}. \quad (6)$$

$$R = \left[\sum_{i=1}^n t_{ij} \right] = [t_j]_{1 \times n}. \quad (7)$$

V. At the final stage, the status of each factor was determined by calculating the sum of the effective and impressionable values $(\tilde{D} + R)$ and subtracting the respective values from the effective values $(\tilde{D} - R)$.

Correspondingly, the cursor and state of a factor were plotted on the axis of the coordinates, and the map of the relations of effects was obtained, which demonstrated the interactions of cause

(effectiveness) and effect (impressibility). Various hypotheses were used to determine the correlation among the identified factors, which have been discussed below:

- I. The factor is considered impressionable if it is below zero $(\tilde{D}-R)<0$ and $(\tilde{D}+R)=\alpha$.
- II. The factor is considered effective if it is above zero $(\tilde{D}-R)>0$ and $(\tilde{D}+R)=\alpha$.

At the next stage, the fuzzy DEMATEL general relation matrix was exploited to solve the FANP. Notably, the accuracy of the method has been previously confirmed [38]. Initially, we normalized the fuzzy DEMATEL general relation matrix using Eq. (7) to achieve a balanced matrix for solving the FANP.

$$T_C^{\text{norm}} = \begin{bmatrix} t_{C_{11}}^{11}/d_1^{11} & \dots & t_{C_{1j}}^{11}/d_1^{11} & \dots & t_{C_{1m_1}}^{11}/d_1^{11} \\ t_{C_{i1}}^{11}/d_i^{11} & \dots & t_{C_{ij}}^{11}/d_i^{11} & \dots & t_{C_{im_i}}^{11}/d_i^{11} \\ t_{C_{m_11}}^{11}/d_{m_1}^{11} & \dots & t_{C_{m_1j}}^{11}/d_{m_1}^{11} & \dots & t_{C_{m_1m_1}}^{11}/d_{m_1}^{11} \end{bmatrix}. \quad (8)$$

The exponentiation of the obtained balanced supermatrix was performed until all the elements were integrated based on $\lim_{h \rightarrow \infty} (W^w)^h$ equation and the weight of each element was calculated.

5 | Empirical Results

In the qualitative section, data analysis was carried out in three main steps. The first step involved presenting the qualitative data and coding, the second step was extracting concepts from the qualitative data through axial coding, and the third step was extracting the categories of the related concepts through selective coding. To this end, the main concepts obtained from the interviews were initially shown in a free coding form, and the overview of the research was presented to the readers. In addition, the key points in the interviews were converted into open codes, and the codes were converted into concepts related to the research subjects.

In the second step of axial coding, the codes that were distinguished in the previous step were combined based on their correlation with the other codes, which resulted in the formation of the related concepts. In the final stage (i.e., selective coding), the related concepts were classified based on their correlation with similar subjects, thereby forming categories with a high conceptual power since they were able to accumulate concepts on the axis. The categories were labeled by the researcher based on a research literature and attempted to have the highest communication and harmony with their representative data. Table 4 shows the concepts extracted from the open codes and their conversion into different categories.

Table 4. Open codes, concepts and extracted categories.

Main Category	Concepts	Open Codes
Organizational factors	Strategic planning	Human Resource Strategic Planning - futurism and a clear vision- policy and developing programs - strategic coordination of programs.
	Budgeting	All codes were eliminated by the Lawshe coefficient.
	Organizational structure	Flexibility- decentralized control - horizontal structure.
	Information technology	All codes were eliminated by the Lawshe coefficient.
	Communications	Participation and cooperation with other units - communication and cooperation between people - communication facilities.
Occupational factors	Human resource management	Retention of specialists - design and analysis of occupations – performance-based compensation - health and safety - timely salaries and facilities.
	Job rotation	Skill diversity – identification of potential skills.
	Job enrichment	Emphasizing knowledge and expertise in decision making - job identity - increased employee authority and decision making - career feedback.

Table 4. Continued.

Main Category	Concepts	Open Codes
Empowerment factors	Career path planning	All codes were eliminated by the Lawshe coefficient.
	Career advancement path management	Designing career development paths - recognizing employees' career goals and aspirations -career policy and goals.
	Education	Staff training planning - continuity in training - applied and specialized training - training needs assessment – coaching.
	Knowledge management	Information sharing - establishment of knowledge management system based on culture and structure - training and culture of knowledge promotion - knowledge development.
Behavioral factors	Talent management	All codes were eliminated by the Lawshe coefficient.
	Performance assessment	Designing a performance evaluation system based on the appropriate method - performance evaluation and monitoring.
	Management and leadership	Senior manager support - incentive and motivational systems – proper leadership style - employee identification.
	Arousal	Individual motivation - sense of belonging - employee satisfaction.
	Organizational culture	Valueism - participatory culture - performance improvement culture - work culture formation - change management culture.
	Creativity and innovation	Attention to creativity and innovation - attention to employees' opinions - individual innovation.

Initially, the key points and concepts (sub-factors) were extracted from the interviews with the experts. Following that, the concepts were collected in larger categories of the main concepts (factors) based on the theoretical literature in this regard. According to the obtained results, the four main HRD categories included organizational, occupational, empowerment, and behavioral factors.

At the next stage, the Lawshe coefficient was applied to assess the indices, followed by the fuzzy Delphi method, to evaluate the sub-factors. In addition, the Lawshe coefficient of each questionnaire item was calculated based on the opinions of 22 experts. The Lawshe coefficient of all the items was compared to the coefficient value of 0.40, and the validity of the items was assessed. Following that, the fuzzy Delphi method was exploited to determine and select the sub-factors. To this end, the opinions of 22 experts about the significance of 21 sub-factors were obtained for solving the fuzzy Delphi in three stages based on a five-point Likert scale. To terminate the fuzzy Delphi, the experts considered the threshold of the difference of opinions to be 0.2 based on the Pareto front (80-20 rule). The sub-factors for which a lack of consensus was less than 0.2 in various stages and the mean fuzzy points were above eight were selected as the final sub-factors.

Table 5. Fuzzy Delphi results based on experts' opinions.

Factors	Column	Linguistic Value	Extremely High	High	Moderate	Low	Extremely Low	Non-Fuzzy Mean of Expert Opinion	Differences in Questionnaire Means	Results
		Numerical value	9	7	5	3	2			
		Sub-factors – fuzzy value	(10, 9, 7)	(9, 7, 5)	(7, 5, 3)	(5, 3, 1)	(3, 1, 0)			
Organizational factors	1	communications	14	6	2	0	0	8.78	0.10	Confirmation of the second stage
	1	Organizational structure	14	5	2	0	0	8.43	0.15	Confirmation of the second stage
	3	Budgeting	0	10	9	3	0	6.20	0.01	Rejected
	4	Information technology	0	5	9	7	1	5.11	0.01	Rejected
	5	Strategic planning	17	3	2	0	0	9.06	0.09	Confirmation of the second stage
Occupational factors	6	Job rotation	10	9	2	0	0	8.07	0.15	Confirmation of the third stage
	7	Career path planning	1	8	5	8	0	5.69	0.18	Rejected
	8	Human resource management	15	7	0	0	0	9.08	0.10	Confirmation of the third stage
	9	Job enrichment	14	4	3	1	0	8.48	0.10	Confirmation of the second stage
	10	Career path management	12	9	1	0	0	8.70	0.15	Confirmation of the third stage
Empowerment factors	11	Talent management	6	11	1	4	0	7.35	0.10	Rejected
	12	Education	13	7	2	0	0	8.69	0.10	Confirmation of the third stage
	13	Knowledge management	15	5	2	0	0	8.88	0.18	Confirmation of the second stage
	14	Performance evaluation	11	6	4	1	0	8.11	0.10	Confirmation of the second stage
Behavioral factors	15	Arousal	15	3	4	0	0	8.68	0.10	Confirmation of the second stage
	16	Organizational culture	13	9	0	0	0	8.89	0.19	Confirmation of the second stage
	17	Creativity and innovation	16	4	2	0	0	8.97	0.10	Confirmation of the second stage
	18	Management and leadership	15	4	3	0	0	8.78	0.10	Confirmation of the second stage

Four out of 18 sub-factors were eliminated from the conceptual model of the research over the three stages of the survey, and the final model consisted of 14 sub-factors (Fig. 1), forming a model with the network structure of the research.

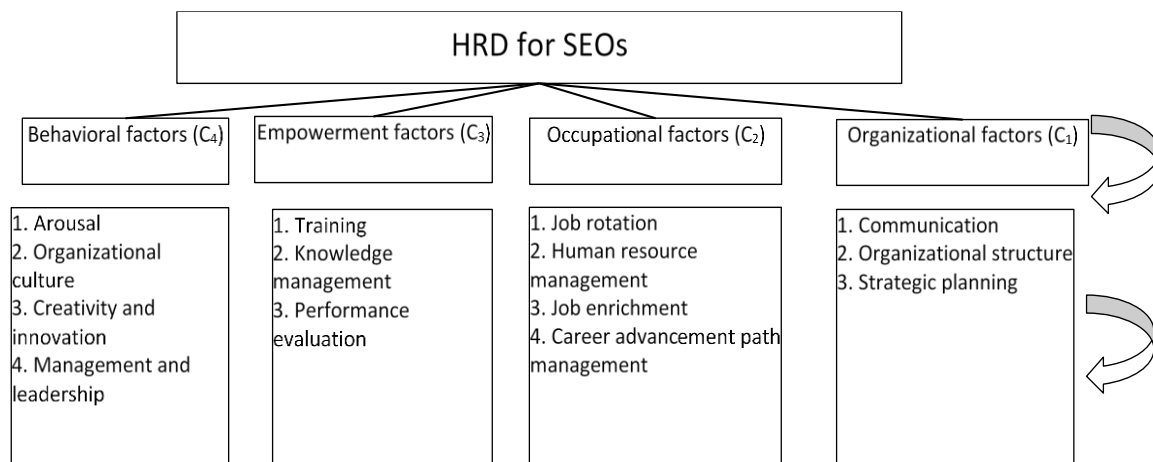


Fig. 1. The research model with an HRD network structure for SEOs.

Table 6. Fuzzy direct matrix among factors affecting HRD.

	Organizational Factors			Occupational Factors			Empowerment Factors			Behavioral Factors		
	Low	Middel	High	Low	Middel	High	Low	Middel	High	Low	Middel	High
Organizational factors	0	0	0	0.75	0.5	0.25	0.85	0.6	0.35	0.75	0.5	0.25
Occupational factors	0.55	0.3	0.05	0	0	0	1	0.9	0.65	0.9	0.7	0.45
Empowerment factors	0.5	0.25	0.05	0.55	0.3	0.1	0	0	0	0.9	0.7	0.45
Behavioral factors	0.4	0.15	0	0.65	0.4	0.15	1	0.9	0.65	0	0	0

In this section, the fuzzy DEMATEL method was applied to address the second research question. To this end, a paired comparison questionnaire was designed and provided to 22 experts to be completed. Afterwards, the responses were collected and analyzed by fuzzy DEMATEL coding in the Excel software. In addition, the significance of the impact of the identified factors and sub-factors on each other was determined, and the fuzzy direct relation matrix was obtained based on the primary DEMATEL step (see, Tables 5 and 6).

Afterwards, the fuzzy direct relation matrix was normalized using Eq. (2), and the general relation matrix was obtained based on Eq. (3). Following that, we obtained the sum of the rows and columns of the fuzzy general relation matrix using Eqs. (4) and (5). The interactions between the influential factors and sub-factors were determined by summing up the values of effectiveness and impressibility ($\tilde{D}_i + R_i$) and based on their correlations by subtracting the impressibility factors from the effectiveness factors ($\tilde{D}_i - R_i$) (Table 7).

Table 7. Fuzzy direct matrix among the sub-factors affecting HRD.

	C ₁₁			C ₁₂			C _{...}	C ₄₃			C ₄₄		
C11	0	0	0	0.75	0.55	0.3	...	0.75	0.5	0.25	0.6	0.35	0.1
C12	0.85	0.65	0.4	0	0	0	...	0.8	0.55	0.3	0.7	0.5	0.25
C13	0.8	0.55	0.3	0.85	0.6	0.35	...	0.8	0.55	0.3	0.75	0.5	0.25
C21	0.6	0.35	0.1	0.65	0.4	0.15	...	0.65	0.4	0.15	0.75	0.5	0.25
C22	0.75	0.5	0.25	0.9	0.7	0.45	...	0.7	0.45	0.2	0.65	0.4	0.15
C23	0.55	0.3	0.1	0.5	0.25	0	...	0.7	0.45	0.2	0.6	0.35	0.1
C24	0.7	0.45	0.2	0.8	0.55	0.3	...	0.6	0.35	0.15	0.6	0.35	0.15
C31	0.95	0.7	0.45	0.9	0.65	0.4	...	0.75	0.5	0.25	0.8	0.55	0.3
C32	0.85	0.65	0.4	0.65	0.4	0.15	...	0.75	0.5	0.25	0.9	0.65	0.4
C33	0.85	0.6	0.35	0.9	0.65	0.4	...	0.65	0.4	0.15	0.65	0.4	0.15
C41	0.85	0.65	0.4	0.75	0.55	0.3		0.8	0.55	0.3	0.55	0.3	0.05
C42	0.8	0.55	0.3	0.8	0.6	0.35		0.7	0.45	0.2	0.7	0.45	0.2
C43	0.9	0.65	0.4	0.75	0.5	0.25		0	0	0	0.6	0.35	0.15
C44	0.65	0.45	0.2	0.55	0.3	0.05		0.9	0.75	0.5	0	0	0

Table 8. Effective and impressible factors and the interaction between factors and subfactors affecting HRD.

Factors/Subfactors	Total Rows	Total Columns	Interaction Severity	Effectiveness/Impressibility Severity	Results
Organizational factors	1.424	0.762	2.186	0.662	The most effective
Communications	0.82	0.859	1.679	-0.0395	Impressible
Organizational structure	0.879	0.827	1.706	0.0517	Effective
Strategic planning	0.841	0.854	1.695	-0.0123	Impressible
Occupational factors	1.57	1.116	2.686	0.454	Effective
Job rotation	0.964	1.104	2.068	-0.14	Impressible
Human resource management	1.037	0.889	1.925	0.1479	Effective
Job enrichment	1.019	1.055	2.073	-0.0356	Impressible
Career advancement path management	1.1	1.072	2.172	0.0277	Effective
Empowerment factors	1.163	1.913	3.076	-0.75	The most impressible
Education	0.871	0.85	1.721	0.0207	Effective
Knowledge management	0.835	0.9	1.735	-0.0651	Impressible
Performance evaluation	0.865	0.82	1.685	0.0445	Effective
Behavioral factors	1.27	1.637	2.907	-0.366	Impressible
Arousal	0.907	0.978	1.885	-0.0704	Impressible
Organizational culture	1.057	1.113	2.17	-0.0563	Impressible
Creativity and innovation	1.05	1.009	2.059	0.0403	Effective
Management and leadership	0.987	0.901	1.888	0.0863	Effective

According to the information in Table 7, the organizational and occupational dimensions had positive \tilde{D} - R and affected the other factors. On the other hand, the behavioral and empowerment factors had negative \tilde{D} - R and were affected by the other factors. Fig. 2 depicts the level of significance, effectiveness, and impressibility of the identified factors and sub-factors. In this figure, the horizontal axis of the diagram

indicates the significance of the factors (\tilde{D}_i+R_i), while the vertical axis shows the effectiveness or impressibility of the factors (\tilde{D}_i-R_i). Based on the correlations between the factors shown in Fig. 2, the organizational factors affected the occupational, behavioral, and empowerment factors and were affected by none of the factors. On the other hand, the empowerment factors were affected by the other factors and impacted none of the other factors.

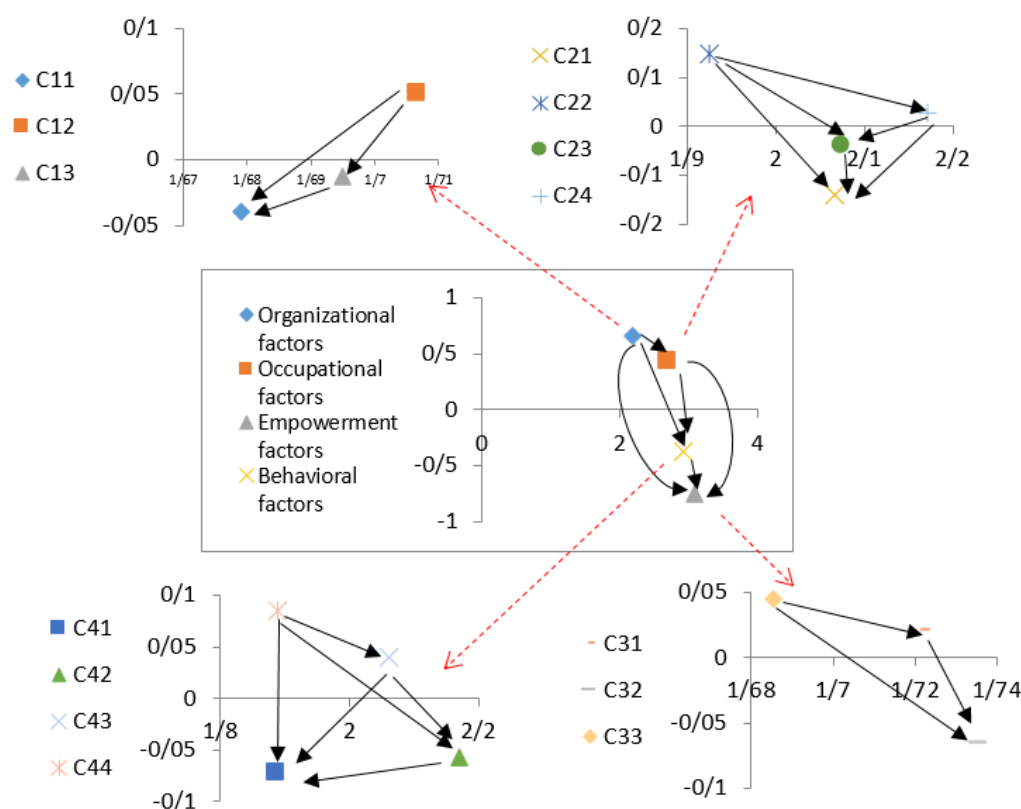


Fig. 2. Cause-effect diagram and network map of relations between factors and subfactors affecting HRD.

At this stage, the FANP was applied to determine the weight and significance of the HRD factors and sub-factors to address the third research question. To solve the FANP, we used the output of the fuzzy DEMATEL method and the general relation matrix results. The general relation matrix was normalized by Eq. (5), followed by obtaining a fuzzy weighted supermatrix. Afterwards, the weighted supermatrix was integrated at exponentiation seven through the equation $\lim_{K \rightarrow \infty} W^a)^K$, which led to the formation of a bounded supermatrix, where the weight of all the factors and sub-factors was repeated in exponentiation 7, and calculations were terminated. Accordingly, the number of the bounded supermatrix was identified as the final weight of the sub-factors. Table 8 shows the weight of the HRD factors and sub-factors.

Table 9. List of Arc lengths.

Weight and Importance of Factors		Sub-Factors	Final Weight of Sub-Factors	Final Importance of Factors
Organizational factors C1	0.119 (4)	Communications	0.041	(11)
		Organizational structure	0.039	(14)
		Strategic planning	0.039	(13)
		Job rotation	0.053	(8)
Occupational factors C2	0.194 (3)	Human resource management	0.04	(12)
		Job enrichment	0.05	(10)
		Career advancement path management	0.051	(9)

Table 9. Continued.

Weight and Importance of Factors		Sub-Factors	Final Weight of Sub-Factors	Final Importance of Factors
Empowerment factors		Education	0.117	(2)
C3	0.361	Knowledge management	0.132	(1)
	(1)	Performance evaluation	0.112	(3)
		Arousal	0.073	(6)
Behavioral factors		Organizational culture	0.103	(4)
C5	0.326	Creativity and innovation	0.076	(5)
	(2)	Management and leadership	0.073	(7)

According to the information in *Table 8*, the largest weight belonged to the empowerment factors (0.361), indicating that these factors had the foremost significance. As for the sub-factors, knowledge management had the most significant weight (0.132) and the foremost significance, followed by the education sub-factor (0.117).

6 | Discussion and Conclusion

The present study aimed to evaluate the influential factors in the HRD of SEOs by using a mixed method, including qualitative (content analysis) and quantitative approaches (fuzzy DEMATEL-based FANP). According to the obtained results, the organizational, behavioral, occupational, and empowerment factors affected OD. In addition, attempts were made to determine the correlations, effectiveness, and impressibility of the factors in the fuzzy DEMATEL method, and the findings indicated that the organizational factors had the most significant effect on the other factors (net effect = 0.662), as well as the first priority in terms of influence on HRD. Therefore, success in HRD begins with this factor and extends to other factors.

In SEOs, achieving HRD requires managers' attention to organizational communication, organizational structure, and strategic planning. In our country, communications in SEOs are extremely unilateral and top-down, which cannot be beneficial for HRD. Therefore, today's organizational structures are expected to be flat and horizontal to further exploit and develop human resources and have the necessary flexibility in achieving competitive advantage. In other words, organizational goals could be achieved through strategic planning since it properly determines policy and strategic coordination.

According to the results of the present study, the empowerment factors had the highest impact on HRD (net effect = -0.75), which requires urgent improvement. The impressibility of these factors has become a challenge in HRD, and the success or failure of HRD in SOEs largely depends on the features of human resource empowerment factors. Our findings were indicative of the dependence of HRD from human resource empowerment. Education, knowledge management, and proper performance evaluation were the identified sub-factors of the empowerment factors in the current research. Human resource education could improve job-related skills, which results in the better management of occupations and achieving the necessary productivity. Furthermore, knowledge management in organizations allows individuals to confidently share their knowledge, so that organizational jobs could be fulfilled more efficiently. Proper performance evaluation allows the abilities of individuals to be meticulously monitored and assessed to plan for improvement.

According to the FANP results, the knowledge management sub-factor was most significant in the HRD of SEOs. Therefore, attaining HRD requires the management of knowledge in organizational sectors since knowledge plays a pivotal role in the competitiveness of economic organizations. Therefore, it could be concluded that knowledge management is an essential tool for HRD. To improve this sub-factor, it is recommended that a knowledge management system be established based on the culture and structure of companies. SEOs often have a vertical structure, which must be changed towards a horizontal structure in order to properly implement knowledge management. Moreover, knowledge promotion should be

culturalized; for instance, knowledge sharing should be supported and motivated in every organization. On the same note, knowledgeable employees should be supported, and synergistic social networks, committees, and specialized associations of employees should be encouraged, so that they could effectively interact and share their knowledge and experiences in companies.

In the present study, the sub-factor of education had the second priority in HRD. Accordingly, education could increase employees' abilities in improving the overall organizational performance. In addition, investment in education increases the productivity of organizations, and employees' skills could be enhanced through education, so that the learned knowledge, attitude, and skills could be incorporated into daily activities for the higher efficiency of the employees' job. In order to enhance this sub-factor, it is suggested that: 1) needs assessment of education be carried out with proper planning. It is essential to focus on environmental changes and organizational needs in this regard, 2) employee education should be planned by paying attention to the hours required for education, educational areas, educational place, and transfer of educational contents through physical or electronic presence.

In the current research, the sub-factor of performance evaluation had the third priority. Accordingly, performance management could significantly affect employees' performance by assessing behaviors, rewarding favorable behaviors and performance, and providing the necessary training. A performance evaluation system is designed and implemented using proper techniques. In order to improve performance evaluation for HRD, it is recommended that: 1) behaviors and performance of employees be assessed based on appropriate criteria. In other words, an appropriate performance evaluation system should define and identify the most appropriate criteria in this regard, 2) performance should be constantly monitored and evaluated based on proper indices, and 3) feedback should be provided within the system to identify and plan for the strengths and weaknesses of each employee separately.

To the best of our knowledge, no prior research has assessed, identified, and prioritized the influential factors in HRD, and our findings cannot be compared in this regard. Nevertheless, similar studies have been focused on the identification of the influential factors in HRD. For instance, Hajilo et al. [28] evaluated HRD in three dimensions of empowerment, talent management, and knowledge management, which is consistent with our findings. In another study, Masoudi Alavi [5] identified individual, organizational, and environmental dimensions as the main influential factors in HRD in educational organizations. In the current research, the experts referred to organizational factors as the most significant HRD determinants, which is relatively congruent with the results of the mentioned study. Moreover, Mohammadi et al. [39] reported organizational, individual, and underlying factors as the main factors affecting the HRD of an armed force organization. In the present study, organizational factors were also observed to be significant influential factors in the research model, which is consistent with the results obtained by Mohammadi et al. [39].

In a research conducted by Dixit and Sinha [9], education and development were identified as the main factors affecting HRD. In the current research, the sub-factor of education had the highest significant and second priority, which is in line with the results of the mentioned study. In another research, Epstein and Harding [27] stated that managers must gain the necessary skills to ensure that their responsibilities are fulfilled efficiently. In the present study, the sub-factor of management and leadership affected HRD and had higher significance, which is in line with the results of the mentioned research.

Bunton [24] evaluated the emerging processes of using advanced technologies in HRD. In the current research, information technology was recognized as an important factor affecting HRD, while it was not a priority in the screening section from the perspective of the experts. This is inconsistent with the results obtained by Bunton [24] in this regard. In the research performed by Otto and Mishra [40], HRD measures such as job development, education, enhancement, and compensation were reported to influence employees' performance. In the current research, the occupational factors and performance evaluation affected HRD, which is consistent with the results obtained by Otto and Mishra [40]. The functional, organizational, and personal factors played a pivotal role in predicting the strategic position

of HRD. In our research, the identified organizational factors were the most significant influential factors in HRD, which is congruent with the results of the mentioned study.

The present study had some executive and scientific limitations. The research findings could be generalized to the SEOs in Mashhad, while generalization to other organizations with a similar structure should be with caution. Moreover, the factors were identified by content analysis and based on the experts' opinions, which may differ in various organizations, especially non-state or service organizations.

Given the structural, technical, communication, organizational, and human resource differences between industrial, service-providing, public, and private organizations, it is essential to identify and analyze the influential factors in HRD in other industries in order to reach a consensus in this regard. Since SEOs are often affected by the environment (e.g., political, social, market, and sanction philosophies), it is recommended that the environmental factors affecting HRD be assessed in further investigations.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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Conflicts of Interest

I am submitting a manuscript for consideration of publication in JARIE. The manuscript is entitled "Designing and Explaining a Model for Creation and Development of Knowledge-Based Cooperative Companies with a Mixed Qualitative-Quantitative Approach". It has not been published elsewhere and that it has not been submitted simultaneously for publication elsewhere.

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