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Understanding the Risks of Human Resource Management in Iran's Gas Industry

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Highlights

- Identifying human resource management (HRM) risks at the entry stage
- Identifying HRM risks at the retention stage
- Identifying HRM risks at the exit stage
- Employing a mixed-methods approach
- Addressing the research gap concerning HRM risks in the Iranian gas industry
- Understanding HRM risks through heat mapping

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Abstract

Iran's gas industry plays a strategic role in supplying and distributing natural gas to society. The project-based, operational, and service-oriented nature of this industry, coupled with its large workforce, underscores the necessity of addressing the risks confronting its human resource management (HRM) system. This study aimed to identify and analyze these HRM risks. A mixed-methods approach was employed. In the qualitative phase, the researcher's lived experience was used to identify and categorize 35 HRM risk factors in Iran's gas industry. In the quantitative phase, a risk management framework was applied to evaluate each identified factor based on two key dimensions: risk probability and risk impact. The assessment results were subsequently visualized using a heat map. The findings indicated that none of the indicators fell within the low-risk zone, with 15 indicators classified as medium-risk and 20 as high-risk. Two critical indicators—imposition of salary and benefit restrictions, with a risk rating of 9, and dependence on political affiliations for filling key positions, with a risk rating of 8—were identified as the most significant challenges facing the HRM system in Iran's gas industry.

Keywords: Entry stage risk, Exit stage risk, Heat map, Maintenance stage risk, Mixed method.

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1. Introduction

Iran holds the world's largest natural gas reserves and ranks as the third-largest natural gas producer globally, following Russia and the United States (British Petroleum, 2019). The country's proven

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natural gas reserves amount to 1,192 trillion cubic feet (TCF), representing 20.9% of global reserves. The South Pars field, Iran's largest gas field, contains approximately 40% of the nation's total gas reserves. Notably, a substantial portion of Iran's gas resources remains undeveloped, with many fields still in the exploration phase (Ebrahimi, Gholami, & Yousefi, 2017). The National Iranian Gas Company (NIGC) is a state-owned enterprise engaged in the exploration, refining, transmission, and distribution of natural gas. As one of the four major subsidiaries of the Ministry of Petroleum, its core mandate encompasses supplying gas for residential consumption, meeting industrial sector demands, fueling power plants, and managing export operations. The NIGC's activities span both national and international levels: nationally, it is responsible for the supply and distribution of natural gas to household, commercial, and industrial sectors, while internationally, it is tasked with the export of gas products.

Given this overview, the NIGC can be considered a large-scale organization in terms of gas refining, transmission, distribution, and export volumes; number of employees; government ownership; scale of gas projects; and its role in national and international contexts. With a clear understanding of the NIGC's mission, activities, responsibilities, and roles, it is evident that human resources (HR), as one of the company's most fundamental pillars, are constantly exposed to risks. Failure to effectively manage these risks could seriously challenge the HR management system and impede the achievement of the NIGC's goals and mission.

The NIGC faces significant human resource management challenges (Mohammadi, 2020), including the departure of experienced managers and specialists through retirement and early retirement schemes; increased internal staff transfers; appointment of unqualified personnel to key positions without merit-based consideration; insufficient attention to employee growth and development through personal development initiatives; annual performance evaluations conducted without pre- and post-assessment interviews; growing conflicts between managers and employees, particularly due to a lack of conflict resolution skills among labor relations unit heads; and financial constraints affecting employee motivation systems.

With over 20 years of experience in human resource management within Iran's gas industry, the author has consistently observed and understood the risks confronting the sector's workforce. While industry leaders emphasize employee development and empowerment, many of these risks arise from flawed policies imposed by administrative (government) and political (parliamentary) systems, which have directly impacted HR management. Furthermore, given the state-owned nature of the company, some HR management challenges result from political interference and power dynamics, which have diminished the efficiency of HR management in Iran's gas industry. Therefore, the human resource management risks faced by the NIGC can be analyzed from both internal and external environmental perspectives.

Effective management of these risks requires their accurate identification; in other words, risk identification serves as the primary driver of HR risk management. Based on lived experience within the NIGC, the author has systematically identified and articulated HR management risks through cognitive processing and organization of insights. Within this framework, the risks have been analyzed and explained through the lens of the HR management system. In this study, risks were examined within the context of the human resource management system, defined as the collection of HR strategies, policies, procedures, and practices that contain deficiencies potentially disrupting both HR processes and company operations. Examining risks through this HR management framework enables a more comprehensive understanding of organizational vulnerabilities.

The necessity of this research is further supported by the findings of Filemon et al. (2024), which acknowledge that HR-related risks can disrupt operations and create significant challenges for organizations. Effective HR risk management is essential to mitigate these risks, and a robust HR risk management framework can ensure compliance with labor regulations while preventing costly legal issues. In public sector organizations such as the NIGC, proactive management of potential HR risks can help attract and retain top talent, enhance employee morale, strengthen institutional legitimacy, foster public trust, and more effectively achieve organizational objectives.

2. Literature review

In the Oxford Dictionary, "risk" is defined as the possibility of something bad happening in the future, a situation that could be dangerous or have a negative outcome, or a person or thing that is likely to cause problems or danger. The author of the present study contends that this concept of risk can be understood and generalized at two levels in human resource management (HRM). The first component relates to deficiencies in HR processes, practices, decisions, and policies, which may increase HR risks. The second component pertains to employees themselves, indicating that any individual within an organization can potentially be a source of risk.

The concept of human resource risk management involves maintaining HR risks within the limits established by HR strategies, addressing issues that require resolution, and defining goals that encompass the factors and sources of HR risks within the organization. It also includes principles, functions, tools, and managerial methods designed to prevent or mitigate losses (Babkin et al., 2023). In Iran's administrative system, the concept of employee risk is addressed in the Labor Law and Social Security regulations, where risk is considered a critical element associated with work-related accidents and occupational diseases. Article 65 of the Labor Law mandates that employers take immediate measures to prevent the worsening of injuries when occupational accidents occur, with the Social Security Organization covering the potential costs of these measures. Additionally, Article 92 requires that all units whose workers are exposed to occupational diseases maintain medical records for all employees and conduct medical examinations at least once per year. If a worker is diagnosed with an occupational disease, the employer must transfer them to a more suitable position without any reduction in salary.

Based on their lived experience in Iran's gas industry, the researcher of this study defines human resource management risk in this sector as deficiencies in policies and inadequacies in HR processes and practices that negatively impact employee performance and industry operations in relation to society, such as reduced gas supply service quality, failure to improve work processes, or instability in gas flow (Source: The Researcher).

Yul Andersen (2015) argues that HRM and risk management are intrinsically linked, to the point that they are inseparable. Risk management is part of every functional role, as every decision inherently contains a risk management component. Effective risk management is essential to strong organizational performance and is the responsibility of all employees. Similarly, Berger (2022) maintains that HR risks are closely connected to organizational strategies and should be integrated into the strategic planning process. Given the critical role of human resources in organizations, HR risks cannot be considered independently of organizational strategies, as every strategic risk is inherently linked to human resources.

Cuskelly and Auld (1989) examined risk management strategies by considering two factors: risk consequences (horizontal axis) and risk probability (vertical axis), developing a risk assessment matrix. Building on this model, Wilks and Davis (2000) introduced four strategies for managing HR risks: risk

retention (acceptance), risk transfer, risk reduction, and risk avoidance. Ackerman (1999) was among the first to develop a comprehensive approach to human resource risk management, identifying both human resources and HR management practices as potential sources of organizational risk. This approach led to a four-level risk analysis framework: (1) risks related to employees; (2) risks arising from employees; (3) risks related to HR management; and (4) risks stemming from HR management practices.

A novel approach in human resource risk management emphasizes behavioral foundations and cognitive sciences (Shefrin, 2016). This perspective highlights that many risks arise not from intentional actions but from cognitive biases, habits, and social norms. Individuals with a sound understanding of the psychology of risk and the ability to identify its practical manifestations can develop frameworks incorporating these principles, enabling reasoned judgments and appropriate decisions. Conversely, those lacking this understanding are forced into an ad hoc and uncertain approach to risk management, often doing what should not be done and failing to do what should be done.

Risk Homeostasis Theory (Wilde, 1982) posits that when individuals accept lower risks in one domain, they compensate by taking greater risks in another. If this principle applies across other behavioral domains, the theory could be generalized into a comprehensive framework for understanding human behavior in relation to injury, illness, and mortality risks. This proposition appears intuitively valid, as it would be surprising if the mechanisms governing risk tolerance differed fundamentally from those operating in other behavioral contexts, such as occupational life, health habits, and physical activity. In other words, based on a general formulation, the Risk Balancing Theory predicts that the per capita frequency of occupational injuries and fatal accidents decreases proportionally with reduced working hours, while non-occupational accidents increase correspondingly.

Researchers have proposed various approaches to human resource risk management. Kioskli et al. (2025) advocate an enhanced ISO 27001-based HR risk assessment framework that incorporates the human factor. Their approach combines social measures—including awareness programs, training initiatives, and behavioral interventions—with technical controls during the human-centric risk management phase. This integrated methodology aims to enhance organizational resilience while mitigating human-related risks. Philomen et al. (2024) argue that every individual within an organization may be considered a potential source of risk. Their framework categorizes human resource-related risks into seven dimensions: (1) integrity; (2) stress adaptability challenges; (3) change management; (4) recruitment and retention costs; (5) reskilling requirements; (6) industrial relations; and (7) workforce aging characteristics.

Becker and Smith (2016) emphasize the integration of risk management into HR practices. Paul and Mitlacher (2008) contend that developing a comprehensive HR risk management system requires first analyzing relevant external factors and their potential impacts on HR strategy, structure, management, and tools, asserting that external factors form the foundation for designing an HR risk management system. The economic environment includes factors such as labor market developments and information technology advancements. The political environment encompasses labor law considerations, which represent sources of HR risks. Cultural environment risks involve demographic shifts and changing worker values, with demographic changes affecting labor and product markets as well as workforce age structure. An aging workforce may introduce HR risks, including the impending retirement of many skilled workers.

Brand-Nowe (1999) proposes a framework categorizing HR risks into seven types: (1) understaffing; (2) overstaffing; (3) aging workforce; (4) failure in employee development; (5) obsolete organizational culture; (6) corporate ethics perception; and (7) organizational culture incompatibilities. The COSO

framework (2004) provides a scientific standard for organizational risk management, defining risk as "the likelihood of events occurring and their impact on the achievement of strategic and organizational objectives." This definition encompasses both negative impacts, such as decreased revenue or reputational damage, and positive effects, including emerging market opportunities or cost-saving initiatives (The Committee of Sponsoring Organizations of the Treadway Commission, 2004).

ISO 31000 is an international standard that provides principles and guidelines for risk management. This standard outlines a comprehensive approach for identifying, analyzing, evaluating, treating, monitoring, and communicating risks within an organization (International Organization for Standardization, 2018).

To review the empirical background, this study examined not only research related to human resource (HR) risks in the oil and gas industry but also relevant studies from other organizations and sectors, in line with the aim and problem of the present research. Focusing on these studies facilitates a more scholarly understanding and better recognition of HR risks. Therefore, the search and selection of articles followed a clearly defined logical framework: (1) articles must focus on human resource management risks; (2) articles must employ qualitative or mixed-methods approaches to explain HR risks; (3) articles must be sourced from reputable international databases such as ScienceDirect, Emerald, Sage, Taylor & Francis, and Wiley; and (4) articles must include a Digital Object Identifier (DOI) or a URL.

Varshosaz et al. (2015) quantified human error risks in gas pressure boosting and desalination units at Maroon Oil Company using the Human HAZOP method. Their findings revealed that job negligence and human errors were the most significant causes of operational failures. Mehrdad et al. (2019) developed a model for assessing and ranking HR risks using a neuro-fuzzy approach at the National Iranian Gas Company, evaluating HR risk dimensions across three criteria: (1) value-related risks, (2) behavioral risks, and (3) contextual risks. Kazemi, Ehtesham-Rassi, and Hosseini (2020) studied Pars Oil and Gas Company and identified critical operational risks, including electrocution hazards and leakage risks during startup operations caused by entanglement of maintenance personnel's clothing or body parts in rotating and stationary equipment. Mousavi and Mousavi (2020) found that employee perspectives and organizational trauma had the most significant impact on HR risks. Stefánsdóttir (2017) reported that organizations in Iceland must first identify and subsequently mitigate key factors contributing to internal workplace hazards. Kraev and Tikhonov (2019) highlighted that increased HR risks lead to loss of confidential information, business losses, reduced profitability, and weakened organizational credibility, whereas appropriately mitigating employee risks enhances workforce quality and reduces losses arising from realized risks.

The research further emphasized that failure to address critical risk factors, such as knowledge loss, jeopardizes organizational competitive advantage. Mathisen, Tjora, and Vestly Bergh (2022) demonstrated that fostering healthy work environments in Norway's oil and gas industry—where employees have the capacity and organizational support to voice concerns and prevent safety issues—is essential for strengthening safety communication in high-risk petroleum operations. Liraviniya, Modiri, and Fathi-Hafshejani (2023) identified unsafe and hazardous working environments as critical factors in design risk assessments within Iran's oil, gas, and petrochemical industries. Oyewole et al. (2024) reported that Nigeria's oil and gas sector requires robust HR management strategies to mitigate inherent operational risks, recommending interventions such as safety culture development, workforce training programs, and proactive risk management frameworks. According to Ambarwati et al. (2024), maintenance and repair activities, environmental concerns, occupational health and safety, and financial considerations constitute the primary domains contributing to human risks. Finally, Qablawi and Abuttahir (2025) found at Saudi Aramco that transformational and transactional leadership styles

significantly influence risk management practices and organizational effectiveness, with transformational leadership enhancing organizational resilience and risk management efficacy, while transactional leadership provides a structured approach to risk governance.

Table 1

Summary of the empirical research background

Researchers' Names	Year	Research Method	Findings
Varshosaz et al.	2016	Mixed	Non-fulfillment of job duties and human errors are the primary causes of human resource risks.
Stefánsdóttir	2017	Mixed	Organizations are obligated to identify the main factors causing internal risks to employees and implement measures to mitigate these risks, such as knowledge loss.
Kraev and Tikhonov	2019	Library	Increased human resource risks can lead to loss of critical confidential information, commercial losses, reduced profitability, and diminished organizational credibility.
Mahrad et al.	2020	Quantitative	Human resource risk assessment can be conducted across three criteria: value-based, behavioral, and contextual risks.
Kazemi et al.	2020	Mixed	Critical human resource risks may arise from factors such as electric shock hazards, leakage hazards during startup operations due to clothing entanglement, and entrapment of maintenance personnel's body parts between rotating and stationary equipment.
Mousavi and Mousavi	2020	Quantitative	Employee perspectives and organizational trauma are among the most significant factors contributing to the emergence of human resource risks.
Mathisen et al.	2022	Quantitative	Providing employees with the necessary support to voice concerns and prevent safety issues and hazards.
Liravinia et al.	2023	Quantitative	Preventing the emergence of unsafe and hazardous work environments.
Tolulope Oyewole et al.	2024	Quantitative	Controlling operational risks through strategies such as developing a safety culture, implementing staff training programs, and establishing proactive risk management frameworks.
Ambarwati et al.	2024	Quantitative	Maintenance and repair activities, environmental concerns, occupational health and safety, and financial considerations are the primary factors contributing to human risks.
Qablawi and Abuttahir	2025	Quantitative	Transformational and transactional leadership styles significantly influence risk management practices and organizational effectiveness.

A review of the empirical literature highlights three distinctive features of this study compared to prior research: (1) whereas most studies focus exclusively on employee-related factors in HR risk analysis, this investigation examines risks inherent in the HR management system itself; (2) methodologically, existing research predominantly employs quantitative or limited mixed-methods approaches, whereas this study adopts a qualitative approach grounded in the researcher's lived experience within Iran's gas industry; and (3) domestic studies typically address HR risks at the micro-level within subsidiaries of national oil companies, whereas this research analyzes HR management risks at the macro level within the National Iranian Gas Company.

3. Methodology

This study adopts an applied research orientation, systematically delineating human resource (HR) risks to provide a comprehensive mapping of threats confronting HR management systems in Iran's gas industry. The findings aim to equip industry decision-makers with the knowledge to formulate effective strategies, policies, and interventions to enhance HR processes.

Grounded in an interpretivist philosophy, the study draws upon the researcher's lived experience within the industry to develop an empirically informed understanding of HR management risks. Through this phenomenological approach, the study captures the contextual realities of organizational hazards affecting HR policies, processes, and practices in Iran's gas sector.

An inductive research approach was employed, whereby systematic observation, experiential perception, and contextual understanding of HR management system vulnerabilities enabled the researcher to identify and codify propositional statements concerning human capital risk factors. The study utilizes an ethnographic research strategy, leveraging the researcher's dual role as both scholar and practitioner with over two decades of HR management experience. Through systematic observation, interpretive analysis, and reflexive engagement with HR policies, processes, and decision-making practices, the study contributes to: (1) understanding the phenomenology of HR risks; (2) documenting organizational risk manifestations; and (3) formulating evidence-based propositions about workforce vulnerabilities. The researcher's professional credentials include advanced training in HR management, supervision of multiple HR theses and dissertations, implementation of organizational development initiatives, and firsthand confrontation with operational HR risks. This practitioner-scholar positioning enables theoretically informed analysis grounded in empirical industry experience.

A descriptive research design was employed, using systematic proposition development to characterize and elucidate HR management risks within the target industry. To mitigate bias stemming from reliance on the researcher's lived experience, the following steps were taken: (1) developing a systematic and reflective framework for HR management risks (see Table 2); (2) transparent disclosure of the researcher's positionality, including beliefs and interests related to HR management; (3) disclosure of relevant professional experience in the HR department of Iran's oil and gas industry; (4) consultation with three HR experts from the Iranian gas industry to validate identified risks; and (5) use of reflective notes and observational records, with continuous self-questioning regarding potential inaccuracies in attitudes, perceptions, and observations about HR risks.

Methodological rigor was ensured using Guba and Lincoln's (1982) four trustworthiness criteria: (1) reliability—through non-participant observation, a common data collection method in ethnographic research; (2) transferability—by examining both the content and context of the study; (3) dependability—via repeated review, re-reading, and refinement of explanatory propositions; and (4) confirmability—through comparison of the study's methodology, results, and findings with relevant domestic and international research in the oil and gas industry.

To assess HR risks, a researcher-developed questionnaire was employed, with each indicator measured along two dimensions: risk probability and risk impact. Using purposive sampling, the questionnaire was distributed to 20 HR experts in Iran's gas industry, all of whom completed it. The sample size was selected for two reasons: (1) the primary objective was to validate the framework through expert opinion rather than conduct large-sample statistical analysis; and (2) the qualitative richness and expertise of the participants were critical for validating HR risks in the gas industry. Expert selection criteria included: (1) relevant experience at operational and managerial levels in HR; (2) a minimum of 20 years of executive HR experience in the industry; (3) holding at least a master's degree in HR management; (4) comprehensive familiarity with HR processes; (5) thorough knowledge of administrative and

operational procedures; and (6) research experience and publication in HR-related topics. Twenty experts meeting these criteria were identified through consultation with managers and HR specialists.

Content validity was evaluated using two criteria: the Content Validity Ratio (necessity of questions) and the Content Validity Index (clarity and unambiguity). Seven experts assessed the necessity and clarity of questions, resulting in a Content Validity Ratio of 0.85 and a Content Validity Index of 0.92, both considered acceptable. Reliability was assessed using Cronbach's alpha, yielding a value of 0.91, indicating an acceptable level of reliability and confirming the internal consistency of the measurement tool.

4. Findings

This study employed a mixed-methods approach that integrated qualitative and quantitative analyses. The analytical procedures for each method are described separately below.

4.1. Data analysis using qualitative methods

In the qualitative section, to explain and analyze human resource management risks, the path illustrated in Figure 1 was designed and applied. A brief explanation of each stage is presented in the following section.

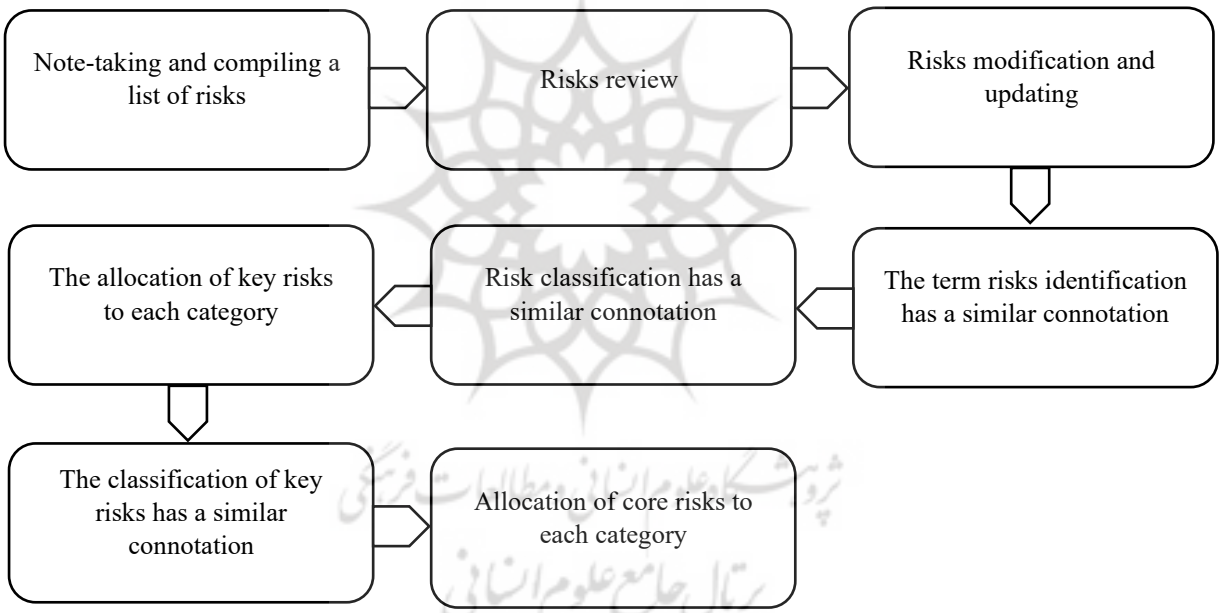

Figure 1

The path of qualitative data analysis

Based on lived experience, the researcher initially documented statements concerning human resource management risks through direct observations within the studied industry. These notes were subsequently reviewed, re-examined, revised, and refined across multiple stages over defined time intervals. The term "statements" refers to self-contained phrases that independently address specific aspects of human resource (HR) risks. In formulating these statements, particular attention was given to accurately capturing the essence of HR risks. Consequently, 35 distinct HR risk management statements were developed, as presented in Table 2.

Table 2

List of human resource management risk statements

(1) Management disregard for seniority in key appointments; (2) Lack of defined competency standards for filling key positions; (3) Placement of employees in roles without consideration of talent development processes such as succession planning and career progression; (4) Limited knowledge and awareness of managers and human resources staff regarding personnel regulations; (5) Insufficient understanding of core HR principles among managers and HR staff; (6) Hiring individuals without adherence to the recruitment process; (7) Poor engagement of managers and employees in effectively attending training courses; (8) Low engagement of managers and employees in the Training Needs Assessment (TNA) process; (9) Ineffective compensation system; (10) Financial inefficiency in the staff medical care system; (11) Exit of seasoned employees through retirement programs; (12) High employee retention in refinery and petrochemical units; (13) Stagnation in process improvement caused by managers' immersion in daily administrative and operational routines; (14) Political influence over key staffing decisions in state-owned enterprises; (15) Inadequate leadership capabilities at various management levels; (16) Knowledge–experience mismatch between certain HR personnel and the essential functions of the HR domain; (17) Nepotism through exploitation of contractor hiring systems; (18) Nepotism through unregulated recruitment of permanent personnel; (19) Absence of a strategic HR blueprint and clearly defined roadmap; (20) Resistance to adopting contemporary HR management practices among managers and employees; (21) Rising culture of indolence and procrastination in task performance; (22) Suppression of employee innovation through excessive administrative rigidity; (23) Pervasiveness of hypocritical behavior in organizational dealings; (24) Employee tendency to prioritize individual interests over organizational goals; (25) Increasing levels of occupational stress, fatigue, and diminished motivation among both managers and staff; (26) Spread of unofficial networks throughout the organization; (27) Management emphasis on performance appraisal rather than performance management; (28) Deficiency in conflict resolution skills among managers; (29) Ineffective promotion mechanisms and prolonged career plateauing; (30) Utilization of contract labor without adherence to standard hiring processes such as testing and interviews; (31) Obsolescence of employee job descriptions and failure to align them with evolving scientific, technical, and technological standards; (32) Ineffective training programs and limited staff learning outcomes; (33) Instrumental and mechanistic managerial approaches toward employees; (34) Management treatment of modern HR tools (e.g., knowledge management) as mere luxury accessories; (35) Growing prevalence of occupational health conditions, including hyperlipidemia, back pain, and diabetes in the workforce.

Subsequently, each formulated proposition was analyzed, and semantically related statements were grouped into distinct categories, resulting in the development of 14 thematic clusters. Table 3 presents these propositions along with their conceptual affinities.

Table 3

Classification of HRM risk propositions based on semantic similarity

Cluster number	Count of semantically-related propositions	Cluster number	Count of semantically-related propositions
1	2, 3, 14, 29	2	6
3	7, 8, 32	4	9, 10
5	13	6	18, 23, 26
7	22	8	15, 27
9	4, 5, 16, 19, 20, 33, 34	10	21, 24
11	25, 35	12	31
13	11, 12	14	17, 30

Subsequently, each cluster was assigned a core HR risk, defined as a pivotal human resource management risk that thematically encompasses all related propositions. Table 4 presents these primary HRM risks corresponding to each cluster identified in Table 3.

Table 4

Primary HRM risks

Cluster	Primary risk title	Cluster	Primary risk title
1	Risks facing the appointment system	2	Risks facing the formal recruitment system
3	Risks facing the education system	4	Risks facing the financial compensation system
5	Risk of managerial failure to delegate authority	6	Risk of personal relationship expansion and HR-related corruption
7	Risk of hyper-centralization stemming from functional structure	8	Risk of managers' lack of personal development
9	Risk of unprofessionalism in human resource management	10	Risk of employee disregard for organizational and citizen interests
11	Risk of work–life imbalance	12	Risk of outdated job descriptions and role definitions
13	Risk of increased internal employee transfers	14	Risk of failing to develop successors and future leaders
15	Risk of unregulated hiring of informal (contract) workers		

Subsequently, principal risks exhibiting semantic similarity were grouped into clusters, with each cluster assigned a core risk. Core risks are defined as fundamental human resource management risks that thematically encompass all related propositions and principal risks. Table 5 presents these core HRM risks corresponding to each cluster identified in Table 4.

Table 5

Core HRM risks

Cluster	Core risks	Allocation of core risks
2	Risks facing the formal recruitment system	Organizational entry phase risks
7	Risk of hyper-centralization stemming from functional structure	
12	Risk of outdated job descriptions and role definitions	
15	Risk of unregulated recruitment of informal (contract) workers	
1	Risks facing the appointment system	Retention phase risks
3	Risks facing the financial compensation system	
4	Risks facing the education system	
5	Risk of managerial failure to delegate authority	
6	Risk of personal relationship expansion and HR-related corruption	
8	Risk of managers' lack of personal development	
9	Risk of unprofessionalism in human resource management	
10	Risk of employee disregard for organizational and citizen interests	
11	Risk of work–life imbalance	
13	Risk of increased internal staff transfers	Organizational exit phase risks
14	Risk of failing to develop successors and future leaders	

4.2. Data analysis using quantitative methods

To evaluate the risk factors in human resource management, a questionnaire was developed. Each risk

statement was assessed across two dimensions: probability of risk and impact of risk. A three-point scale was employed, comprising low risk (score 1), medium risk (score 2), and high risk (score 3). The risk score for each statement was calculated by multiplying its probability and impact scores. Based on the resulting risk score, each statement was classified into one of three risk zones: low risk (green zone, score 1–3), medium risk (yellow zone, score 4–6), or high risk (red zone, score 7–9). The risk zone classification for each statement is presented in Table 6.

Table 6

Risk zone classification of statements

Statements	Primary risk	Risk score
Hiring personnel without adherence to standard recruitment procedures	Risks facing the formal recruitment system	5
Failure of employees to implement novel and innovative ideas due to excessive bureaucratic constraints	Risk of hyper-centralization stemming from functional structure	6
Outdated job descriptions lacking revision to align with scientific, technical, and technological standards	Risk of outdated job descriptions and role definitions	7
Hiring of informal (contract) workers without conducting job tests or interviews	Risk of unregulated hiring of informal (contract) workers	7
Hiring of informal (contract) workers based on nepotism and political relationships		7
Failure of managers to recognize the seniority factor when assigning personnel to key positions	Risks facing the appointment system	7
Lack of competency-based criteria in staffing key organizational positions		7
Staffing positions without consideration of individual development mechanisms such as succession planning and career pathing		7
Dependence of certain individuals on political connections to secure key positions		8
Absence of systematic promotion processes resulting in prolonged role stagnation	Risks facing the education system	7
Low participation rates among managers and employees in effective training programs		7
Weak participation of managers and employees in training needs assessment processes		6
Inadequate learning outcomes from implemented training programs		6
Reduction in financial support for employees and their families' medical expenses	Risks facing the financial compensation system	7
Restrictive compensation and wage policies		9
Excessive involvement of managers and employees in routine activities, with insufficient strategic thinking for process improvement	Risk of managerial failure to delegate authority	7
Increased employee turnover due to preference for employment in refineries and petrochemical plants	Risk of increased internal employee transfers	5
Unregulated hiring of permanent employees based on nepotism and political relationships		6

Expansion of a workplace culture characterized by hypocrisy, demagoguery, and duplicity	Risk of personal relationship expansion and HR-related corruption	6
Lack of conflict resolution skills among managers and supervisors		6
Limited managerial proficiency in directing and leading subordinates	Risk of managers' lack of personal development	7
Conducting performance appraisal in place of comprehensive performance management		7
Growing indolence, procrastination, and negligence in work performance	Risk of employee disregard for organizational and citizen interests	6
Low employee commitment to organizational goals and benefits, with prioritization of personal interests		6
Escalating occupational burnout syndrome resulting from chronic stress, exhaustion, and emotional detachment	Risk of work–life imbalance	7
Rising incidence of work-related illnesses, including hyperlipidemia, back pain, and diabetes		7
Exit of numerous experienced personnel through retirement	Risk of failing to develop successors and future leaders	7

Since this study adopted a risk management approach, a heat map was developed (Figure 2) to provide a clearer understanding of human resource management risks. The heat map serves as a visual tool to illustrate the distribution of HRM risks within a defined framework. The Python programming language was used to generate the heat map. As shown, the frequency of respondents' ratings for both the probability and impact of occurrence is displayed across nine distinct zones. Based on the chart, the highest average of respondents' ratings falls within the zone of high probability and high impact, while the lowest average corresponds to the zone of high probability and low impact.

For data normalization in constructing the heat map, the standard deviation was calculated. The mean (μ), population standard deviation (σ), and sample standard deviation (s) were determined as 11.08, 11.90, and 12.62, respectively. Given the relatively high standard deviation (≈12), the following observations can be made: (1) Cell 9 (36.97) is approximately 2.17 standard deviations above the mean and represents a very hot spot; (2) Cell 5 (21.34) and Cell 8 (0.86) are approximately 0.86 standard deviations above the mean and represent warm spots; (3) Cell 7 (0.17) is approximately 0.91 standard deviations below the mean and represents a cold spot. The relatively high standard deviation indicates substantial data dispersion, and the heat map provides strong contrast between hot and cold spots.

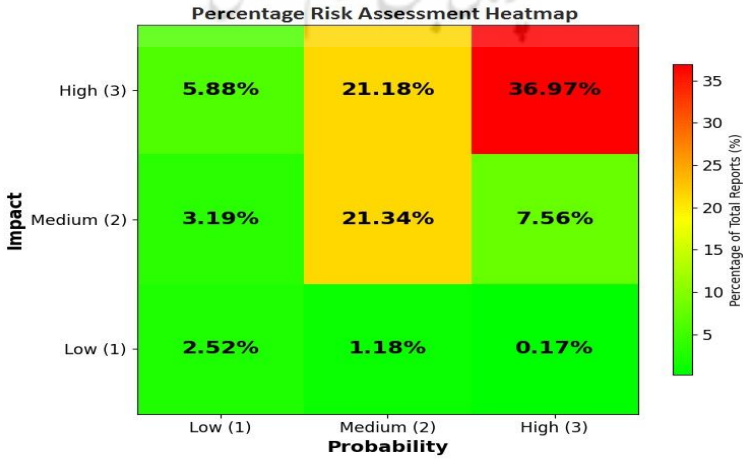

Figure 2
Heatmap of HRM risks

5. Conclusions and recommendations

Iran's gas industry, as the sole domestic supplier of natural gas and a major exporter of gas and its derivatives to global markets, relies on its human resources as the primary strategic factor for fulfilling its mission and achieving its objectives. Given the industry's long-standing history and extensive workforce, inherent risks and challenges exist within its internal human resource management (HRM) system. These risks manifest in areas such as HR strategies and policies, employee regulations, organizational structure, and HR processes and practices. Externally, it must be recognized that Iran's gas industry, due to its state-owned nature and the government's dominant role, has consistently been subject to political influence and stakeholder interests. This interference has introduced significant and often irreversible risks to the HRM system, particularly inefficiencies in recruitment and appointment processes. Structurally, Iran's gas industry comprises 31 gas distribution companies, 10 gas transmission regions, 8 gas refining companies, an engineering and development company, and the Iran Gas Trade Company, making it a large-scale sector. To ensure sustainability and the effective delivery of services to society, it is essential to identify and analyze the risks confronting its HRM system. This study was conducted to address this pressing need.

According to standard definitions of risk, which emphasize the potential occurrence of adverse events in the future, a critical question arises: Does this conceptualization of risk apply to Iran's National Gas Company? To answer this, several key points must be considered:

1. **International Challenges:** Iran's National Gas Company faces considerable challenges in the global export of gas and its derivatives, many of which stem from international sanctions and volatile energy prices. These factors threaten the company's revenue streams, thereby heightening risks to its employee retention system. Declining revenues may result in dissatisfaction with wages, reduced healthcare benefits, and diminished insurance coverage, all of which undermine workforce stability.
2. **Political Interference:** As a state-owned enterprise, the company remains persistently vulnerable to negative political influences. Such interference has introduced risks to managerial competency, appointment processes, and promotion systems. If left unchecked, this trend could lead to the departure of skilled professionals or erode employee motivation over time.
3. **Bureaucratic Inefficiencies:** Given the company's large-scale operations and extensive workforce, structural bureaucracy has become a major challenge. Excessive complexity, rigid formalities, and resistance to reform have hindered the revision and modernization of HR policies, processes, and practices. As a result, risks such as low employee motivation, inflexible HR structures, overreliance on rigid regulations, and suppression of innovative employee ideas have emerged and will persist without intervention.

Several studies have emphasized that human resource (HR) risks should be regarded both as a national priority and as a matter of governance. Meyer, Roodt, and Robbins (2011) demonstrated that poor management of HR risks contributed to weak governance in South Africa. Their study, conducted under the South African Human Resource Research Council's "People's Action Board" initiative, identified HR risk management as one of the most significant opportunities for HR professionals to add value to the country's new governance system. Furthermore, Berger (2022) revealed that under Germany's Stock Corporation Act, supervisory boards require comprehensive information about corporate risks—including HR-related risks—as they constitute an integral part of strategy development and implementation. The study emphasized that data on the prevalence and severity of such risks is essential for informed strategic discussions within supervisory boards.

Findings of the present study indicated that none of the HR risk factors in Iran's gas industry fell within the low-risk zone. Instead, 15 factors were classified as medium risk, and 20 were identified as high risk. Notably, the factors "restrictions on salary and benefit payments for managers and employees" (risk score: 9) and "dependence on political affiliations for filling key positions" (risk score: 8) emerged as critical threats to the HR management system. Consequently, all HR risk factors in Iran's gas industry were categorized within the yellow (medium) and red (high) risk zones, underscoring serious challenges facing the sector's HR management framework. Senior executives—particularly HR managers—must prioritize revising and reforming policies, strategies, structures, processes, and HR practices. Such measures will mitigate risks in employee recruitment, retention, and exit systems, while transitioning high-risk factors to medium- and eventually low-risk levels through effective HR policies. Moreover, continuous monitoring of HR performance is essential to reduce systemic risks and prevent low-risk factors from escalating into higher-risk zones. This approach highlights the practical application of human resource risk management (HRRM) within the industry.

Limited research has been conducted on identifying and analyzing HR risks in Iran's oil and gas industry. Given the operational nature of this sector, further studies are required to delineate HR management risks across subsidiary companies of Iran's oil industry—including the National Iranian Oil Company (NIOC), National Iranian Gas Company (NIGC), Iranian Petrochemical Company, and National Iranian Oil Refining and Distribution Company (NIORDC). Each of these companies has a distinct societal mission and undoubtedly faces unique HR management risks. A review of existing literature by the present researcher revealed that most studies on the oil and gas industry—both domestically and internationally—have focused primarily on financial and investment risks in projects, thereby sidelining HR risk considerations. Few studies have addressed HR management risks in this sector. The current study underscores the critical need to prioritize human resources and mitigate challenges confronting HR management systems in the gas industry.

Based on the findings of this study, the following recommendations are proposed:

1. Since all indicators of human resource management risks fell within the medium- to high-risk range, it is recommended that the gas industry's HR management develop a comprehensive human resource risk management guideline.
2. As imposing limits on the salary and benefits ceiling for employees—with a risk score of 9—was identified as the most critical challenge facing the HR management system in Iran's gas industry, and since this factor could lead to the departure of skilled and knowledgeable personnel, it is suggested that this issue be addressed appropriately and professionally by senior industry managers. Moreover, given the prominent role of Iran's gas industry in enhancing social welfare, reducing or eliminating the salary ceiling in light of prevailing inflation could enhance employee motivation to provide valuable services to citizens.
3. Since dependence on political affiliations to secure key positions (with a risk score of 8) was identified as one of the primary risks to Iran's gas industry HR management system—potentially disrupting appointment processes, promoting incompetence, and demotivating employees or driving experts out of the industry—it is recommended that senior gas industry managers:
    - Redefine competency-based management mechanisms, considering the gas industry's sensitive and strategic role domestically and internationally.
    - Base key position appointments solely on assessment center results, rigorously avoiding political recommendations, particularly for critical roles.

4. It is recommended that researchers in the field of human resource management examine HR risks in Iran's gas industry, considering the state-owned nature of this sector. Such studies should focus on the impact of governmental policies (both financial and non-financial) on the HR management system, as well as the future reduction of required skills due to the retirement of experienced employees.
5. It is further recommended that researchers investigate HR risks in Iran's gas industry using behavioral and psychological approaches, as this perspective has received limited attention in identifying, assessing, and analyzing human risks in this sector.

Nomenclature

COSO	Committee of sponsoring organization
DOI	Digital object identifier
HAZOP	Hazard and operability
HR	Human resources
HRM	Human resource management
HRMR	Human resource management risk
HRRM	Human resource risk management
HRRs	Human resource risks
HRs	Human risks
ISO	International standard organization
KM	Knowledge management
NIGC	National Iranian Gas Company
NIOC	National Iranian Oil Company
NIORDC	National Iranian Oil Refining and Distribution Company
TCF	Trillion cubic feet
TNA	Training needs assessment
URL	Uniform resource locator

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