

## ARTICLE

**Human resource policies in the scientific sector: Comparative analysis across selected countries****Bayarbaatar Adiyasuren<sup>1\*</sup> and Batkhurel Gombodorj<sup>2</sup>**<sup>1</sup> School of Management, Mongolian University of Science and Technology,  
Ulaanbaatar, Mongolia<sup>1</sup> Presidium Office, Mongolian Academy of Sciences,  
Ulaanbaatar, Mongolia<sup>2</sup> School of Management, Mongolian University of Science and Technology,  
Ulaanbaatar, Mongolia*ARTICLE INFO: Received: 09 Feb, 2026; Accepted: 24 July, 2026.*

**Abstract:** Human resource (HR) policies shape the capacity of scientific systems to attract, develop, and retain researchers. This study compares scientific-sector HR policies in the United States, Germany, South Korea, China, India, Finland, and Mongolia through a structured qualitative document analysis. Official strategies, agency reports, legislation, and selected scholarly literature were reviewed and coded against an adapted Institutional Human Resource Management (IHRM) framework comprising four dimensions: talent acquisition and recruitment; capacity building and development; retention and career progression; and governance and institutional support. Evidence was organized in a country-by-dimension matrix and examined through descriptive coding, cross-case comparison, and contextual interpretation. Unlike earlier work that has concentrated mainly on research funding and national innovation outputs, this study focuses on the institutional HR policy arrangements that connect recruitment, researcher development, careers, and governance. The comparison indicates that Finland, Germany, and South Korea combine relatively coherent coordination mechanisms with sustained development support and more structured career pathways. China and India demonstrate rapid expansion but also tensions associated with output-oriented incentives, institutional variation, and fragmented implementation. The United States combines a decentralized system with strong agency and institutional capacity.

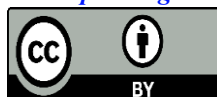
Mongolia, the focal policy case, shows its most consequential weakness in governance and institutional support, which constrains the other three IHRM dimensions. The study recommends a sequenced reform agenda beginning with national coordination and an operational scientific-workforce HR framework, followed by transparent career pathways, stable capacity-development funding, and mobility mechanisms adapted to Mongolia's institutional and fiscal context.

**Keyword:** *human resource policy; scientific workforce; comparative institutional analysis; research careers; Mongolia;*

**INTRODUCTION**

Scientific progress depends not only on research funding and infrastructure but also on institutions' ability to recruit, develop, motivate, and retain qualified

researchers. In research organizations, HR policy influences the continuity of expertise, the quality of research leadership, collaboration, ethical practice and the

*Corresponding author, email: bayarbaatar@mas.ac.mn*<https://orcid.org/0009-0007-8276-4301>

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renewal of scientific capabilities [1], [2]. Scientific work also has distinctive employment characteristics—including long training periods, project-based funding, international mobility, disciplinary labor markets, and uncertain early-career pathways—that require more specialized HR arrangements than generic personnel administration [3], [4].

These features make country-specific institutional analysis necessary. National science systems differ substantially in their fiscal capacity, governance traditions, organizational autonomy, and labor-market maturity; therefore, similar HR instruments can produce different results across contexts. Comparative institutional HRM emphasizes that HR practices are embedded in national regulatory, educational, and organizational environments rather than operating as universally transferable techniques [5].

Mongolia's scientific sector is at a critical stage of development. The country seeks to strengthen research and innovation capacity while continuing to face constrained funding, researcher out-migration, uneven professional-development opportunities, and weak coordination across research institutions and universities [6]-[8]. Recruitment and promotion are largely institution-based, while national mechanisms for scientific mobility, workforce planning, and cross-institutional career development remain limited. These constraints are especially consequential because Mongolia's relatively small scientific workforce depends on effective coordination and careful use of scarce human and financial resources.

The Government's Science and Technology Sector Human Resource Strategy 2023-2030 provides an important policy basis for strengthening scientific talent [8]. However, a strategy document alone does not ensure implementation. Its effectiveness depends on operational responsibilities, financing, monitoring, institutional incentives, and alignment with

recruitment, training, evaluation, and promotion practices. A systematic comparison with both mature and rapidly developing science systems can therefore clarify which institutional functions Mongolia should prioritize and which international practices require contextual adaptation.

Previous research has predominantly examined R&D expenditure, innovation-system performance, publication productivity, or individual academic careers. Less attention has been paid to how institutional HR policy structures connect recruitment, capacity development, career progression, and governance within national scientific sectors. To date, no comparative IHRM study identified in the reviewed literature has systematically benchmarked Mongolia's scientific HR policy arrangements against a deliberately mixed group of mature, coordinated, rapidly expanding, and decentralized science systems. This study addresses that gap by treating Mongolia both as one of seven comparison cases and as the focal case for policy interpretation.

The study has three objectives: (1) to identify and compare the principal scientific-sector HR policy arrangements of seven selected countries across four IHRM dimensions; (2) to determine the cross-cutting institutional patterns associated with greater HR-policy coherence; and (3) to derive sequenced, context-sensitive policy priorities for Mongolia.

The analysis is guided by the following research questions:

1. RQ1. How do the seven countries organize talent acquisition, researcher development, career progression, and governance support in their scientific sectors?
2. RQ2. Which cross-country institutional patterns are associated with more coherent scientific-workforce HR systems?
3. RQ3. Which gaps are most consequential in Mongolia, and which

reforms should be prioritized under Mongolia's institutional and resource conditions?

## MATERIALS AND METHODS

### Research design and rationale

The study used qualitative document analysis combined with structured cross-case comparison. Document analysis is appropriate for policy research because formal strategies, legislation, agency reports, and institutional guidelines contain the objectives, instruments, responsibilities, and implementation assumptions through which governments and organizations define HR policy [9]. It also permits systematic comparison where primary fieldwork across multiple national systems is not feasible. To strengthen analytical rigor, the study followed an explicit sequence of source identification, eligibility screening, framework-based coding, comparative mapping, and contextual interpretation. The approach is interpretive rather than statistical: the purpose is to identify policy configurations and institutional contrasts, not to estimate causal effects.

### Case selection and Mongolia's dual role

The United States, Germany, South Korea, China, India, Finland, and Mongolia were selected purposively to maximize institutional variation relevant to Mongolia. Selection considered innovation capacity, R&D intensity, scientific output, researcher density, the visibility of national science and talent policies, regional representation, and the availability of comparable documentation [10], [11], [12]-[14].

The United States represents a decentralized but strongly resourced system; Germany, Finland, and South Korea represent comparatively coordinated systems with structured public support; China and India represent large, rapidly expanding systems; and Mongolia is included both as a comparison country and as the focal policy case. This dual role means that Mongolia was coded using the same four dimensions as all other countries, while the Discussion applies the

comparative findings specifically to Mongolia's institutional and fiscal context.

### Source identification and eligibility

Sources were drawn from the reference corpus used in the manuscript and supplemented during revision with recent evidence on comparative institutional HRM and research careers. Priority was given to: (a) official national strategies, legislation, and ministry or agency reports; (b) reports from OECD, UNESCO, WIPO, UNDP, and comparable international organizations; and (c) peer-reviewed research directly addressing comparative HRM, scientific careers, mobility, or researcher development. A source was included when it provided evidence for at least one IHRM dimension and clearly referred to the relevant national or institutional context. Sources were excluded when they were purely promotional, lacked identifiable institutional authorship, duplicated evidence without adding detail, or concerned general labor markets without a defensible link to scientific personnel policy. The reviewed sources were mainly published between 2012 and 2024, with older foundational works retained where methodologically or conceptually necessary.

### Analytical framework and coding procedure

The adapted IHRM framework comprised four dimensions: (1) talent acquisition and recruitment, including openness, merit criteria, international recruitment, diaspora or returnee instruments, and early-career entry; (2) capacity building and development, including doctoral and postdoctoral support, training, mentoring, leadership development, mobility, and lifelong learning; (3) retention and career progression, including career ladders, tenure or contract systems, promotion criteria, incentives, and employment security; and (4) governance and institutional support, including national coordination, institutional autonomy, funding continuity, accountability, and

alignment with science, technology, and innovation policy.

The first author conducted the primary coding and comparative mapping, consistent with the stated author contributions. The second author reviewed the source matrix, literature interpretation, and country summaries and participated in resolving coding questions through discussion. No formal inter-rater reliability coefficient was calculated; this is reported transparently as a limitation rather than retrospectively claimed. Coding proceeded in three stages. First, relevant statements

were extracted and assigned to one or more IHRM dimensions. Second, evidence was summarized in a country-by-dimension matrix. Third, cross-case patterns were identified by comparing the presence, degree of coordination, and apparent institutional integration of the four dimensions. Where documents differed in scope or date, interpretations were checked against additional institutional or scholarly sources when available. Disagreements or ambiguous classifications were resolved through author discussion and retained only when a defensible source-to-claim link could be established.

### Source inventory

**Table 1. Provides a transparent inventory of the principal source groups used for each country. It does not imply that all sources are equivalent in legal status or evidentiary strength; rather, it shows the basis on which each national case was characterized.**

| Country       | Principal sources                                                                                                    | Source type                                                  | Years represented | Main dimensions                                       |
|---------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------|-------------------------------------------------------|
| United States | NSF Science and Engineering Indicators; NIH/NSF program evidence; research-career literature [14], [15]              | Agency reports and scholarly literature                      | 2012-2022         | Recruitment; development; careers; governance         |
| Germany       | DFG Excellence Strategy; OECD science and career evidence [16]                                                       | Official strategy and international reports                  | 2019-2024         | Development; careers; governance                      |
| South Korea   | BK21 and talent-development policy reports; OECD innovation review [17]-[19]                                         | Ministry/program reports and international review            | 2012-2020         | Recruitment; development; incentives; coordination    |
| China         | National talent-development planning; recent scholarly evidence on R&D and incentives [20], [21]                     | Official plan and peer-reviewed literature                   | 2021-2023         | Recruitment; development; performance; governance     |
| India         | DST annual report; national education and research-talent documentation [22], [23]                                   | Government reports and policy documents                      | 2020-2021         | Recruitment; programs; careers; fragmented governance |
| Finland       | Academy of Finland strategy; OECD evidence; European research-career framework [24], [25], [26]                      | Official strategies and international policy evidence        | 2019-2024         | Recruitment; lifelong learning; careers; coordination |
| Mongolia      | Science and Technology Sector Human Resource Strategy 2023-2030; NSO statistics; Mongolian sector literature [6]-[8] | National strategy, statistics, and scholarly/sector evidence | 2021-2023         | All four dimensions; focal implementation analysis    |

## RESULTS AND DISCUSSION

### Talent acquisition and recruitment

Recruitment arrangements varied principally by the balance between institutional autonomy and national steering. The United States and Germany rely heavily on institutional recruitment within broader funding and accountability environments, whereas South Korea and China use visible national programs to attract young scholars, returnees, or strategically important talent [14], [16]-[20]. Finland combines institutional hiring with transparent, internationally oriented standards. India uses central programs and national bodies, but implementation varies across institutions. Mongolia relies predominantly on institution-level hiring and lacks a sufficiently developed national mobility, returnee, or early-career recruitment mechanism [6]-[8].

The cross-country contrast is therefore not simply centralized versus decentralized recruitment. Stronger systems pair institutional discretion with transparent criteria, portable opportunities, competitive funding, and recognizable entry routes. National programs are most useful when they complement rather than replace institutional recruitment capacity.

### Capacity building and development

Finland, Germany, South Korea, and the United States show comparatively dense development ecosystems that include doctoral and postdoctoral support, fellowships, leadership development, mobility, and institution-based training. China has expanded graduate and talent-development programs through national planning. India offers major schemes such as INSPIRE and programs for women scientists, although uptake and continuity vary across institutions. In Mongolia, professional development is more fragmented and vulnerable to short-term financing, and systematic mentoring, research leadership development, and mobility support are not yet embedded across the sector [6]-[8].

Recent international evidence reinforces the importance of treating development as a career-long system rather than a collection of isolated courses. OECD evidence shows that research careers vary widely across countries and that incentives often overemphasize publication output while undervaluing teaching, engagement, and other contributions [25]. European policy has consequently emphasized attractive working conditions, transferable skills, mobility, and recognition of diverse research careers [26].

### Retention and career progression

The clearest contrast concerned the transparency and structure of career pathways. Germany and Finland provide comparatively recognizable promotion routes supported by institutional frameworks or collective arrangements. The United States' tenure-track model offers a formal pathway but coexists with postdoctoral and fixed-term precarity. South Korea and China make extensive use of output-based assessment and incentives. These systems can strengthen accountability, but narrow publication or patent indicators may create distortions when they are not balanced by quality, collaboration, societal contribution, and disciplinary differences [19], [21], [25]. India shows substantial institutional variation, with seniority remaining influential in some settings [23].

Mobility also interacts with career progression. Empirical research indicates that national and international mobility can affect promotion opportunities differently depending on institutional rules, language, and local hiring practices [27]. This suggests that mobility policies should be linked to transparent recognition and reintegration mechanisms. Mongolia currently lacks sufficiently clear sector-wide career ladders and transparent links between performance, professional development, and advancement [7], [8].

**Governance and institutional support**

Governance emerged as the dimension most strongly associated with coherence across the other three dimensions. Finland and South Korea show relatively integrated policy coordination, while Germany combines federal-state coordination with substantial institutional autonomy. The United States is decentralized, yet strong agencies, funding mechanisms, and institutional capacity provide a functional coordinating environment. China uses centralized strategic planning. India's multiple ministries and institutional diversity create implementation fragmentation. Mongolia's principal weakness is not the complete absence of policy intent but the limited operational integration of HR policy into STI planning, financing, monitoring, and institutional accountability [8].

**Cross-cutting comparative patterns**

Three patterns cut across the national cases. First, national coordination is most effective when it establishes direction, financing, and accountability while preserving institutional flexibility in recruitment and development. Second, structured career pathways are more sustainable when promotion criteria recognize multiple forms of contribution rather than relying exclusively on either seniority or narrow output counts. Third, researcher mobility produces greater institutional value when it is connected to career recognition, return or reintegration opportunities, and knowledge transfer rather than treated as a stand-alone travel program.

**Table 2. Summarizes the country evidence. Its most important contrast is between systems in which the four dimensions reinforce one another and systems in which individual programs exist without a sufficiently integrated governance architecture.**

| Country       | Talent acquisition and recruitment                                                        | Capacity building and development                                                  | Retention and career progression                                                               | Governance and institutional support                                                                          |
|---------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| United States | Open, merit-oriented and internationally visible; diversity emphasis                      | Strong federal and institutional support for training and postdoctoral development | Tenure-track pathways coexist with postdoctoral precarity                                      | Decentralized but supported by strong agencies, funding, and institutional accountability                     |
| Germany       | Institutional autonomy with structured early-career entry                                 | Excellence initiatives and research-organization development systems               | Junior professorships and increasingly structured tenure options                               | Federal-state coordination with institutional autonomy and funding oversight                                  |
| South Korea   | National programs attract young scholars and returnees                                    | Fellowships, international exposure, and sustained HRD investment                  | Performance-oriented contracts and incentives                                                  | Strong national STI coordination across ministries                                                            |
| China         | State-led attraction and returnee programs                                                | Large-scale graduate and strategic talent development                              | Strong output orientation, with risks from narrow metrics                                      | Central strategic planning and policy alignment                                                               |
| India         | Central agencies and diaspora initiatives, with institutional variation                   | Major national schemes but uneven uptake and continuity                            | Career rules vary; seniority remains influential in parts of the system                        | Multiple ministries and overlapping responsibilities create fragmentation                                     |
| Finland       | Transparent, international recruitment aligned with European principles                   | Lifelong learning, transferable skills, and digital capability                     | Clearer promotion frameworks and collective arrangements                                       | Integrated national coordination across education, research, and innovation                                   |
| Mongolia      | Institution-based hiring; limited national mobility and strategic recruitment instruments | Underfunded and fragmented professional development                                | Unclear sector-wide pathways and weak linkage between development, contribution, and promotion | Strategy exists, but operational coordination, financing, monitoring, and institutional alignment remain weak |

### **Interpretation through comparative institutional HRM**

The findings support the central proposition of comparative institutional HRM: HR arrangements derive their meaning and effectiveness from the institutional systems in which they are

embedded [5]. No single recruitment, training, or promotion mechanism explains the stronger cases. Instead, coherence arises when policy direction, financing, institutional autonomy, development opportunities, and career rules are mutually reinforcing.

This explains why the United States can maintain a strong scientific workforce despite decentralization, while other fragmented systems struggle: decentralization is not inherently weak when capable agencies, institutions, and accountability mechanisms provide coordination through funding and standards.

The study therefore contributes to the literature by shifting the unit of analysis from isolated HR practices or aggregate innovation outcomes to the institutional configuration connecting four workforce dimensions. This responds directly to the identified gap. The comparison shows that scientific HR policy should be evaluated as a system: weak governance can undermine recruitment transparency, make development episodic, and leave promotion criteria disconnected from national research priorities.

### **Mongolia across the four IHRM dimensions**

Mongolia's challenges are visible across all four dimensions, but governance and institutional support constitute the most critical constraint. In talent acquisition, institutions recruit without sufficiently strong national mobility, diaspora, or early-career mechanisms. In capacity development, opportunities are fragmented and financing is unstable. In retention and career progression, sector-wide pathways and balanced promotion criteria remain unclear. These three weaknesses are difficult to correct sustainably without governance arrangements that assign responsibility, secure financing, establish shared standards, and monitor implementation of the 2023-2030 strategy [8].

This diagnosis refines the policy problem. Mongolia does not need to begin by copying a foreign tenure model or launching multiple disconnected talent programs. It first needs an operational governance architecture that can translate the national strategy into institution-level responsibilities, funded actions, shared

definitions, monitoring indicators, and periodic review. Recruitment, development, and career reforms can then be phased within that architecture.

### **Transferability and contextual limits**

The comparison countries should not be treated as ideal templates. Finland and Germany operate with greater fiscal capacity, mature institutions, and long-established research organizations. South Korea and China have used strong national steering and substantial investment that Mongolia cannot reproduce at the same scale. The United States depends on a large, internationally attractive labor market and diversified funding base. India's experience demonstrates that national programs alone do not guarantee consistent institutional implementation. Accordingly, transferability should be functional rather than literal: Mongolia should adapt the underlying functions—transparent entry, sustained development, recognizable careers, coordination, and accountability—to its smaller system and resource constraints.

### **Implications for policy sequencing**

A sequenced approach is more feasible than simultaneous reform. The first phase should establish coordination, clarify institutional responsibilities, and operationalize the national HR strategy. The second should define transparent career stages and balanced evaluation principles while securing predictable development funding. The third should expand mobility, returnee, mentorship, and leadership programs and evaluate their effects. This order reflects the comparative finding that programs are less durable when governance and career architecture remain unresolved.

### **Limitations and future research**

The study has five limitations. First, it relies on publicly accessible documents and therefore evaluates formal policy design more directly than implementation practice. Second, the breadth of seven national cases limits institutional and subnational depth. Third, translated summaries and international reports were

used where original-language documents were not accessible, which may introduce interpretation bias. Fourth, source years differ across countries, and reforms may have evolved after publication. Fifth, although coding was reviewed by both authors and disagreements were resolved through discussion, no formal inter-rater reliability statistic was calculated and no interview or survey data were available for triangulation. These limitations mean that the results should be interpreted as a structured policy comparison rather than a causal evaluation of national HR-system performance.

Future studies should test the framework through interviews with researchers, HR managers, ministry officials, and research-institution leaders; compile longitudinal workforce indicators; and conduct institution-level case studies. Research should also examine gender and disciplinary inequalities, the outcomes of mobility and returnee programs, and whether broader evaluation criteria improve career development without weakening research quality.

## CONCLUSIONS

Scientific-workforce policy is most coherent when recruitment, development, career progression, and governance operate as an integrated institutional system. Finland, Germany, and South Korea illustrate different forms of coordination and structured support; the United States demonstrates that decentralization can function effectively when backed by strong agencies and institutions; and China and India show both the possibilities and tensions of rapid expansion. For Mongolia, the most consequential weakness lies in governance and institutional support because this dimension conditions the effectiveness of the other three. The central contribution of this study is therefore to frame Mongolia's scientific HR challenge not as a shortage of isolated programs but as a problem of institutional integration and implementation.

## Policy Recommendations

*Priority 1 - Establish an operational coordination mechanism.* Designate a national coordinating body or formal interagency mechanism responsible for implementing, financing, monitoring, and periodically reviewing scientific-workforce HR policy. Clarify the responsibilities of ministries, the Mongolian Academy of Sciences, universities, and research institutes.

*Priority 2 - Translate the 2023-2030 strategy into an implementation framework.* Develop measurable actions, timelines, responsible institutions, financing sources, and indicators across the four IHRM dimensions. Use a common sector-wide workforce data system to support planning and accountability.

*Priority 3 - Institutionalize transparent career pathways.* Define career stages, minimum competency expectations, transparent recruitment and promotion procedures, and balanced evaluation criteria that recognize research quality, innovation, collaboration, mentoring, and societal contribution rather than publication counts alone.

*Priority 4 - Secure predictable capacity-development funding.* Create multi-year funding lines for doctoral and postdoctoral support, mentoring, research leadership, technical skills, and continuous professional development, with equitable access across institutions.

*Priority 5 - Link mobility to careers and knowledge transfer.* Introduce competitive mobility, returnee, visiting-researcher, and diaspora mechanisms with explicit reintegration, recognition, and institutional knowledge-transfer provisions.

*Priority 6 - Pilot, evaluate, and localize international practices.* Test reforms in selected institutions, assess implementation and unintended effects, and scale only those instruments that are financially and institutionally suitable for Mongolia.

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**Ethical approval**

This study analyzed publicly available policy documents, institutional reports, and published literature. It involved no human participants or identifiable personal data; therefore, ethical approval was not required.

**Author contributions**

The authors confirm contribution to the paper as follows: BA conceptualized the study, designed the methodology, conducted the primary document coding and policy analysis, and prepared the original manuscript. BG contributed to source collection, reviewed the coding matrix and comparative interpretation, contributed to the literature review, and reviewed and edited the manuscript. Both authors discussed ambiguous classifications and approved the final manuscript.

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**Conflict of interest**

The authors declare no conflict of interest.

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