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Professional Accreditation for Mineral Resource Reporting in Pakistan, Examining Criteria, Identifying Gaps, and Proposing a Phased Multi-Disciplinary Framework

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Abstract
The present paper is the technical sequel to a preceding institutional analysis by this author that established the rationale for a CRIRSCO-aligned Pakistan Reporting Code and proposed a phased pathway toward a Pakistan Mineral Resources Reporting Council (PMRRC) [1]. This paper makes two original contributions. First, it analyses the four-section JORC Code 2012 Table 1 checklist criterion by criterion, examining how each criterion applies to Pakistan's principal deposit types: porphyry copper-gold in the Chagai metallogenic belt, sub-bituminous and lignite coal at Thar and associated coalfields, ophiolite-hosted chromite in the Muslim Bagh belt, and industrial minerals and dimension stone across multiple provinces. Second, it proposes a Pakistan Stock Exchange (PSX) and Securities and Exchange Commission of Pakistan (SECP) anchored Pakistan Mineral Resources Reporting Council (PMRRC) as an umbrella accreditation body, drawing from two domestic professional streams and a phased geoscience pathway. Stream A covers engineering professionals registered with the Pakistan Engineering Council (PEC). Stream B, recognising that no active statutory geoscience registration body currently exists in Pakistan, is structured in two phases: in Phase 1, geoscience professionals qualify through membership of a foreign Recognised Professional Organisation (RPO) with a geoscience remit; in Phase 2, triggered by its incorporation as a statutory body, registration with the proposed Council of Geoscientists Pakistan (CGP) satisfies the relevant eligibility conditions directly. Stream C covers all members of foreign RPOs such as AusIMM, AIG, and CIM, who receive weighted recognition of their existing accreditation. The paper argues that this phased approach is more defensible and practically implementable than naming inactive or unverified domestic geoscience bodies, and that the PSX listing-rule mechanism provides the enforceable market linkage that converts a professional framework into a condition of capital-market participation.
Keywords: JORC Table 1; Pakistan Qualified Person; Pakistan Engineering Council; Council of Geoscientists Pakistan; Pakistan Stock Exchange; Pakistan Mineral Resources Reporting Council; mineral resource reporting; CRIRSCO; NI 43-101; Recognised Professional Organisation; phased accreditation.

I. INTRODUCTION

A credible national mineral resource reporting code requires two parallel foundations. The first is institutional: the policy, legal, and regulatory architecture that connects technical disclosure to market access and professional accountability. The second is technical: a clear, criterion-specific understanding of what a reporting

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code requires practitioners to assess and disclose, and whether the professional community of a given jurisdiction is equipped to produce reports that meet those requirements [1]. A preceding paper by this author addressed both dimensions, documenting the governance cost of weak mineral disclosure through the Poseidon NL and Bre-X Minerals episodes and the USD 5.976 billion Reko Diq arbitration award, and proposing a phased framework toward a Pakistan Reporting Code and Pakistan Mineral Resources Reporting Council (PMRRC) [1]. The present paper extends that analysis in two respects.

First, it provides a criterion-by-criterion analysis of JORC Table 1 applied to Pakistan's specific deposit types. Second, it proposes a PSX-anchored PMRRC framework that draws from two domestic professional streams and a geoscience pathway structured in two phases. The phased geoscience pathway is a direct response to the absence of an active, registered, statutory geoscience professional body in Pakistan as of mid-2025: rather than naming a dormant or unverified organisation, the paper structures geoscience participation through existing foreign RPO membership in Phase 1 and recommends the incorporation of a Council of Geoscientists Pakistan (CGP) as a statutory body in Phase 2. The evidence base is limited to information available as of 30 June 2025, consistent with [1].

II. JORC Table 1 Structure and Application to Pakistani Deposit Types

JORC Table 1 is a four-section checklist of assessment and reporting criteria accompanying every Public Report of Exploration Results, Mineral Resources, or Ore Reserves prepared under the JORC Code 2012 edition [2]. The four sections are: Section 1, Sampling Techniques and Data, applicable to all report types; Section 2, Reporting of Exploration Results; Section 3, Estimation and Reporting of Mineral Resources; and Section 4, Estimation and Reporting of Ore Reserves [2]. Reporting is required on an 'if not, why not' basis, meaning that if a criterion is not applicable or material, the Competent Person must state why, rather than omitting it [2]. Table I summarises the structure and Table II maps critical compliance challenges against Pakistan's four principal deposit categories.

TABLE I. STRUCTURE OF JORC TABLE 1 (2012 EDITION): SECTIONS, APPLICABILITY, AND SELECTED CRITERIA [2]

Section	Title	Applies to	Key criteria (selected)
1	Sampling Techniques and Data	All report types	Sampling techniques; drilling; sample quality and security; logging; sample preparation; QA/QC; verification; data location; data spacing; orientation; audits

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2	Reporting of Exploration Results	Exploration results; also required with Sections 3 and 4	Mineral tenement; geology; exploration history; drillhole information; data aggregation; width of intersections; diagrams; balanced reporting
3	Estimation and Reporting of Mineral Resources	Mineral Resource estimates	Database integrity; site visits; geological interpretation; estimation and modelling techniques; moisture; cut-off parameters; bulk density; classification; relative accuracy; reasonableness checks
4	Estimation and Reporting of Ore Reserves	Ore Reserve estimates	Mining, metallurgical, infrastructure, economic, environmental, social, and legal Modifying Factors; classification; relative accuracy

TABLE II. JORC TABLE 1 COMPLIANCE CHALLENGES BY SECTION AND PAKISTANI DEPOSIT TYPE [2], [4], [5]

Table 1 criterion	Porphyry Cu-Au	Thar sub-bituminous coal	Chromite / Iron Ore / Manganese	Industrial minerals and dimension stone

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Sec. 1: Sampling and drilling	Diamond core HQ/NQ preferred; RC acceptable at early stage; recovery monitoring critical in oxide zones	Whole-core or borehole sampling over seam intervals; recovery in soft sub-bituminous seams must be reported	Channel sampling across podiform ore; representative sampling challenged by highly irregular geometry	Bulk or channel sample for quality; quarry face mapping for dimension stone block yield
Sec. 1: QA/QC programme	Multi-element CRMs; field and pulp duplicates; blanks after mineralised intervals; Au fire assay umpire check	Coal quality CRMs (ASTM/ISO) for CV, ash, moisture, sulphur; umpire lab check essential for export projects	CRMs; duplicate sampling critical given grade variability	Quality specification CRMs relevant to end-use; less complex than metallic deposit programmes
Sec. 2: Land tenure and balanced reporting	EL/ML under Balochistan Mines and Minerals Act 2025 [11];	SCA/ Directorate of Coal Mine Development licence framework; Thar block-specific agreements with SECMC require explicit description	KPK or Balochistan licensing; often informal small-scale tenure that must be identified and described	Punjab or KPK quarry leases with block-size limitations; expiry and renewal conditions must be described
Sec. 3: Estimation and classification	Ordinary kriging or MIK; classification by geological continuity and drill spacing; top-cut required for Au	Inverse distance or kriging for seam thickness and quality; Measured/Indicated supported by existing Thar borehole density	Nearest neighbour or IDW acceptable for Inferred; irregular geometry restricts Indicated/Measured without dense sampling	Simple geometric methods often adequate for tabular bodies; quality parameters may need multiple estimation approaches

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Sec. 4: Modifying Factors	Geotechnical assessment for deep open pit; concentrate logistics from remote Chagai; metallurgical variability; community and environmental approvals	Dewatering cost and complexity, Mine-mouth power plant efficiency; sulphur and emissions; water availability in Thar desert; stripping ratio and hydrogeology	Underground stope stability in dunite; smelter specification for Cr2O3 and Fe:Cr ratio; selectivity constraints in podiform ore	Block size yield and dimensional specification for dimension stone; purity and market specification for industrial minerals

Three cross-cutting compliance issues apply across all deposit types. First, historical data from the Geological Survey of Pakistan and provincial departments, commonly collected between the 1960s and 1990s before modern QA/QC standards existed, requires independent assessment before use in resource estimation; data that cannot be verified to current standards may not support Indicated or Measured Resource classification [2]. Second, database integrity, which Section 3 requires to be specifically addressed, is frequently weak in Pakistani projects where data resides in unvalidated spreadsheets or paper records. Third, the Section 2 balanced reporting obligation prohibits selective highlighting of high-grade intersections without disclosure of surrounding low-grade data, a practice that a Pakistan Reporting Code must expressly prohibit [1], [2].

III. The Pakistani Professional Landscape and the Case for a Phased Approach

Mineral resource reporting is a shared professional domain of mining engineers and geoscientists. The JORC Code explicitly lists the Australian Institute of Geoscientists (AIG) alongside the Australasian Institute of Mining and Metallurgy (AusIMM) as co-sponsors of the Competent Person system [2]. NI 43-101 defines a Qualified Person as 'an engineer or geoscientist' without privileging one profession [7]. The CRIRSCO International Reporting Template similarly requires membership of a professional association covering engineering and geoscience disciplines [3]. Table 1 criteria in Sections 1 and 2 are primarily geological in nature; Section 3 requires combined geological and quantitative skills; and Section 4 brings in mining engineering, metallurgy, and geotechnical specialisms. A Pakistan Qualified Person, PQP framework confined to engineers alone creates a structural competence gap in the sections of Table 1 most dependent on geoscience expertise.

Designing around this gap requires an honest assessment of what professional infrastructure currently exists in Pakistan. The Pakistan Engineering Council (PEC), established under the PEC Act 1976, registers Professional Engineers in mining and geological engineering through the Graduate Engineer to Professional Engineer pathway, including the Engineering Practice Examination [6]. This infrastructure is

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functional, statutory, and nationally recognised. In contrast, no equivalent statutory body exists for geoscientists. The National Geological Society of Pakistan has not achieved formal registration as of mid-2025 and has not demonstrated active professional governance capacity. The Pakistan Association of Petroleum Geoscientists (PAPG) is active and functions as an AAPG chapter, but its membership and professional focus are specific to the petroleum sector and do not extend to mineral resource reporting. There is therefore no existing Pakistani geoscience body capable of satisfying the Recognised Professional Organisation criteria required by JORC, NI 43-101, or the CRIRSCO template in the near term [2], [3], [7].

The proposed response to this gap is a phased framework. In Phase 1, the transitional period following adoption of the Pakistan Reporting Code, geoscience professionals qualify for PQP accreditation through membership of a foreign RPO with a geoscience remit, principally AIG, AusIMM, SAIMM or AAPG in the context of CRIRSCO-aligned mineral reporting. In Phase 2, triggered by the incorporation of a Council of Geoscientists Pakistan (CGP) as a statutory body, CGP registration satisfies the relevant PQP eligibility conditions directly.

IV. The PSX-Anchored PMRRC Framework

A. PSX and SECP as Regulatory Anchors

The most important design lesson from the JORC, NI 43-101, and SAMREC systems is that a reporting code achieves real market effect only when compliance is mandated as a condition of market access [1], [2], [13]. The ASX Listing Rules require JORC-compliant reports as a condition of continuous disclosure for mining companies. The JSE Listings Requirements make SAMREC compliance mandatory for mineral companies. NI 43-101 operates through provincial and territorial securities regulation, making a non-compliant report unusable for fundraising purposes.

In Pakistan, the PSX Rulebook and SECP Regulations provide the legal infrastructure through which an equivalent requirement can be introduced. The PSX Rulebook imposes sector-specific obligations on listed companies in banking, insurance, and real estate. A dedicated mining disclosure chapter in the PSX Rulebook, requiring that any public announcement of Exploration Results, Mineral Resources, or Ore Reserves be supported by a PQP-certified report, could be incorporated through SECP-approved amendment without requiring primary legislation [9]. SECP's authority over prospectuses and public offer documents provides a parallel mechanism: any document in which a company makes representations about mineral assets would require a PQP-certified technical report as a condition of regulatory approval.

B. The PMRRC as Umbrella Body

The PMRRC is proposed as an independent statutory body co-sponsored by PSX and SECP. Its governing board should include representatives from PEC, PSX, SECP, the Geological Survey of Pakistan (in a technical advisory capacity), provincial mining departments, and, in Phase 2, the Council of Geoscientists Pakistan. Its functions are to develop and maintain the Pakistan Reporting Code; operate the PQP register with commodity-specific endorsements; operate a disciplinary committee; recognise foreign RPOs; and report annually on mineral disclosure standards to PSX and SECP.

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The PMRRC does not replace PEC or the future CGP; it operates above them as an accreditation umbrella, accepting qualified members of those bodies into the PQP register provided they satisfy the additional deposit-specific and activity-specific experience criteria that registration alone does not verify.

C. Three Streams and Phased Geoscience Pathway

Stream A covers PEC-registered Professional Engineers in mining engineering or geological engineering. Stream B is the geoscience pathway, structured in two phases. During Phase 1, geoscience professionals qualify through foreign RPO membership: AIG and AusIMM members may certify under a geoscience competence category provided they meet the deposit-specific experience requirements; AAPG members may similarly qualify where their experience extends to hard-rock mineral resource estimation rather than exclusively petroleum geology. During Phase 2, following the incorporation of the CGP as a statutory body, CGP registration will satisfy Conditions 1 and 4 of the PQP eligibility criteria directly, removing the requirement for a foreign RPO membership for domestic geoscientists. Stream C covers all members of PMRRC-listed foreign RPOs, who receive automatic satisfaction of Conditions 1 and 4, with Conditions 2, 3, and 5 still applicable to all streams.

D. PQP Eligibility Criteria

Table III sets out the five PQP eligibility criteria and their treatment across the three professional streams. Figure 1 presents the complete institutional framework in flowchart form, including phase labels.

TABLE III. PQP ELIGIBILITY CRITERIA AND TREATMENT ACROSS THREE PROFESSIONAL STREAMS, INCLUDING PHASED GEOSCIENCE PATHWAY

Eligibility Criterion	Stream A: PEC Engineers	Stream B: Geoscience (Phase 1 / Phase 2)	Stream C: Foreign RPO Members
1. Professional registration	Current PEC Professional Engineer (PE) in mining or geological engineering	Phase 1: current AIG, AusIMM, or AAPG membership. Phase 2: CGP registration (once incorporated as statutory body)	Current membership of PMRRC-listed RPO (AusIMM, AIG, CIM, GSSA, or PERC-listed body). AUTO-SATISFIED.
2. Five years post-registration relevant experience	Experience in stated commodity category and reporting activity: exploration reporting, resource estimation, reserve declaration, or feasibility	Geological experience in deposit-type assessment, resource classification, geological modelling, or exploration data management in stated commodity category	Experience must demonstrate deposit-type relevance to Pakistani conditions in the stated commodity endorsement

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3. Signed competence declaration	Self-declaration of competence for stated commodity category and reporting activity, submitted at registration and for each endorsement	Same requirement for all geoscience applicants in both phases	Same requirement; declaration submitted to PMRRC
4. PMRRC Code of Ethics and disciplinary submission	Submission to PMRRC disciplinary authority in addition to PEC disciplinary processes	Phase 1: submission to PMRRC; covered by foreign RPO ethics. Phase 2: PMRRC plus CGP disciplinary authority. AUTO-SATISFIED for Stream C ethics.	Covered by RPO parent disciplinary mechanism; submission to PMRRC for Pakistan-specific matters. AUTO-SATISFIED.
5. Annual CPD (30 hours minimum, 15 in reporting standards)	Recordable through PEC CPD framework (SRO 1310(I)/2008); mining-specific CPD content to be developed by a designated Professional Engineering Body	Phase 1: recordable through foreign RPO CPD programme. Phase 2: CGP CPD programme. Pakistan deposit-specific content required in all phases.	Recordable through RPO parent body CPD; must include Pakistan deposit-specific content as PMRRC publishes guidance notes

V. Institutional Framework Flowchart

Figure 1 presents the complete proposed framework. The phase labels on the left margin identify the regulatory mandate layer, the Phase 1 transitional period during which the geoscience pathway operates through foreign RPO membership, the reporting outputs and enforcement layer, the Phase 2 legislative recommendation for CGP incorporation, and the CRIRSCO membership pathway. The decision diamond represents the PMRRC eligibility assessment; failed applications return to the applicant with identified gaps for correction.

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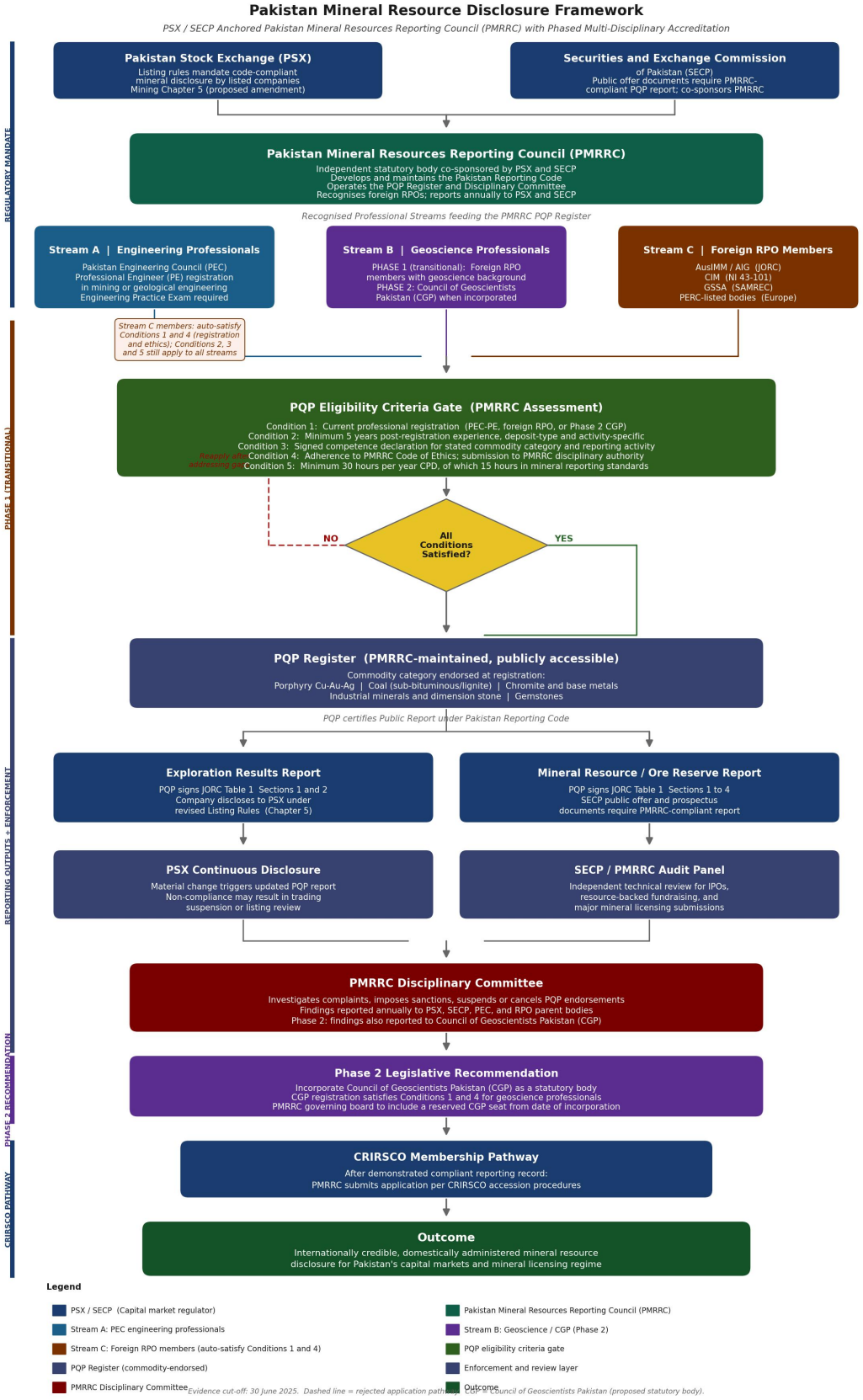

Fig. 1. Proposed Pakistan Mineral Resource Disclosure Framework: PSX and SECP anchored PMRRC with three professional streams, phased geoscience pathway,

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commodity-endorsed PQP register, PSX listing-rule enforcement, and CRIRSCO membership pathway.

VI. Commodity Categories, Phase 2 Recommendation, and Academic Integration

A. Commodity-Specific PQP Competence Categories

Table IV sets out proposed commodity-specific PQP competence categories. A PQP may hold endorsements in more than one category, provided the relevant experience criteria are separately satisfied. The PMRRC-maintained public register will display each PQP's name, registration stream, phase classification, commodity endorsements, and any disciplinary restrictions, so that investors, lenders, and provincial licensing authorities can verify a PQP's scope of practice before relying on a report.

TABLE IV. PROPOSED PQP COMMODITY-SPECIFIC COMPETENCE CATEGORIES FOR A PAKISTAN REPORTING CODE

Competence Category	Principal deposits	Minimum relevant experience	Reporting activities covered
Porphyry and epithermal Cu-Au-Ag	Chagai belt: Reko Diq, Saindak, Tang Kaur, North Waziristan, Chitral	5 years in porphyry or epithermal exploration, resource estimation (OK/MIK), or Cu-Au feasibility work	Exploration results; Mineral Resource estimates (Inferred to Measured); Ore Reserve declarations
Coal (sub-bituminous and lignite)	Thar (Sindh), Lakhra, Mach, Salt Range	5 years in coal exploration, seam correlation, coal quality analysis, or coal resource estimation	Coal Resource estimates; Coal Reserve declarations; coal quality reporting to ASTM/ISO standards
Chromite and base metals (ophiolite-hosted)	Muslim Bagh, Waziristan, Zhob ophiolite belts	5 years in ophiolite-hosted chromite or base metal exploration, or underground/surface mining resource estimation	Exploration results; Mineral Resource estimates for chromite and associated base metals
Industrial minerals and dimension stone	Rock salt (Khewra), gypsum, marble and granite (KPK, Balochistan), silica sand	5 years in industrial mineral or dimension-stone exploration, quarry resource estimation, or quality specification assessment	Exploration results; Mineral Resource estimates; quarry reserve statements

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Gemstones	Emerald (Swat), ruby (Hunza), peridot (Mansehra), tourmaline (Skardu)	5 years in gemstone exploration, evaluation, and grading; familiarity with gemological classification standards	Exploration results and resource estimates for gemstone occurrences under CRIRSCO guidance

B. Phase 2 Legislative Recommendation: Council of Geoscientists Pakistan

The incorporation of the Council of Geoscientists Pakistan (CGP) as a statutory body is the single most important legislative action required to complete the domestic professional infrastructure for a Pakistan Reporting Code. The CGP would be constituted under enabling legislation analogous to the PEC Act 1976, establishing statutory registration, a code of professional conduct, an engineering practice examination equivalent calibrated to geoscience disciplines, and enforceable disciplinary powers. Its mandate would encompass geologists, geophysicists, and geochemists working in mineral exploration, resource estimation, geological mapping, and related geotechnical and environmental roles. On incorporation, CGP registration would automatically satisfy Conditions 1 and 4 of the PQP eligibility criteria for geoscience professionals, triggering the transition from Phase 1 to Phase 2 of Stream B. The PMRRC governing board would hold a reserved CGP seat from the date of incorporation. An alternative legislative route, analogous to Engineers Canada's model, would be to extend PEC's existing mandate to include geoscientists as a distinct registration category within the PEC framework, avoiding the need for a separate statutory body entirely.

C. Academic Integration and CPD

The long-term sustainability of the PQP register depends on Pakistani universities producing graduates capable of meeting the required competence categories. Mining engineering programmes at Mehran University of Engineering and Technology, the University of Engineering and Technology Lahore, the University of Engineering and Technology Peshawar, Balochistan University of Information Technology Engineering and Management Sciences, and Karakoram International University Gilgit, and geology programmes at the University of Peshawar, the University of the Punjab, University of Sindh and the University of Balochistan, provide the academic base. As of mid-2025, these curricula do not routinely include structured modules on CRIRSCO-compatible resource classification, geostatistical estimation methods, QA/QC programme design, or JORC Table 1 reporting requirements. Integration of a dedicated mineral reporting standards module into the final year of both mining engineering and geology programmes is the most immediately actionable step toward building domestic PQP capacity. PQPs should be required to complete a minimum of thirty hours of structured CPD per year, of which at least fifteen hours must relate directly to mineral resource and reserve estimation or reporting standards, recordable through PEC, foreign RPO, or, once constituted, CGP CPD frameworks.

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VII. Conclusion

This paper has proposed a PSX-anchored, phased, multi-disciplinary framework for professional accreditation in mineral resource reporting that directly addresses the structural gaps in Pakistan's current professional landscape. The phased geoscience pathway is the framework's most original institutional contribution: by routing Phase 1 geoscience participation through existing foreign RPO membership and reserving Stream B for a proposed Council of Geoscientists Pakistan in Phase 2, the framework avoids the credibility risk of naming inactive or unverified domestic bodies while still providing a clear and achievable pathway toward full domestic geoscience participation. The JORC Table 1 analysis in Tables I and II confirms that compliance requirements vary materially by deposit type across Pakistan's four principal mineral categories, and that the Pakistan Reporting Code must include deposit-specific guidance. The PSX listing-rule mechanism identified in Section IV provides the market linkage that converts the professional framework from a voluntary aspiration into an enforceable condition of capital-market participation. Taken together with the institutional analysis in [1], this paper provides a complete and actionable specification for developing a credible Pakistan Reporting Code.

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