

Development of Geotechnical Engineers as TSF Engineers of Record

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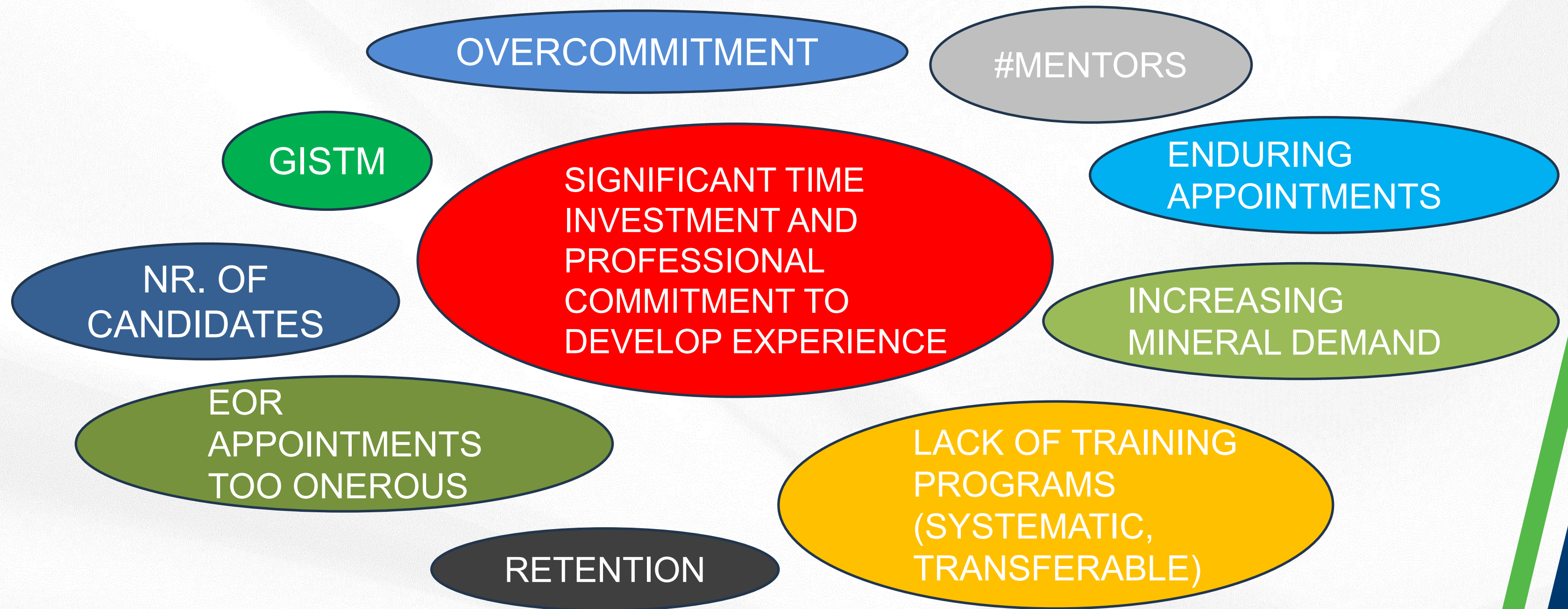


Objective

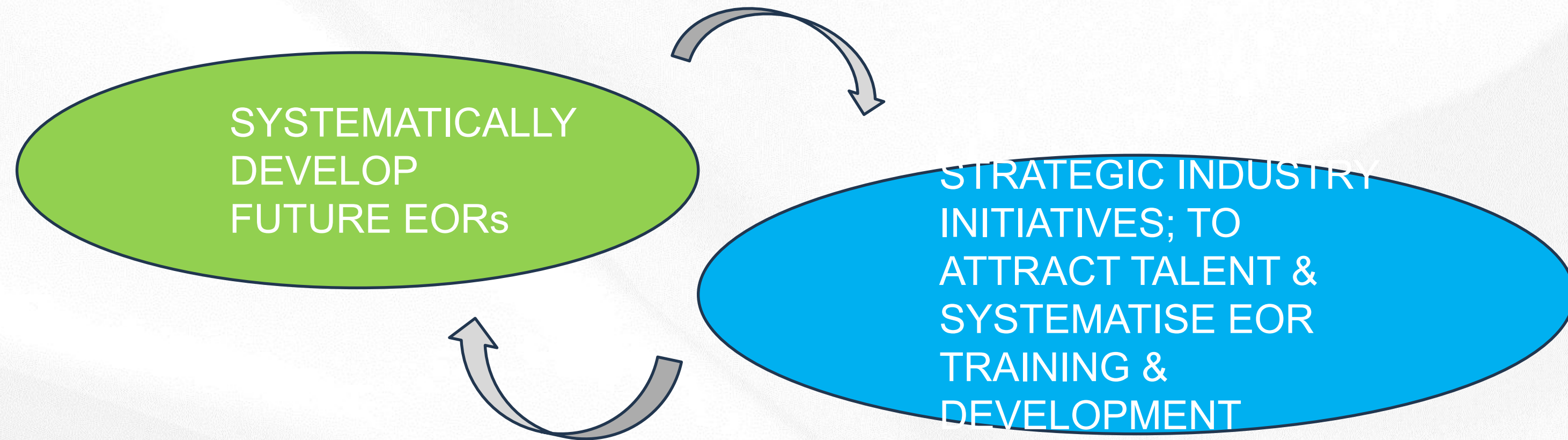
A framework to support the systematic and structured development of tailings storage facility EORs from a geotechnical engineering perspective, comprising;

- a structured development pathway, and
- a skills and competency matrix

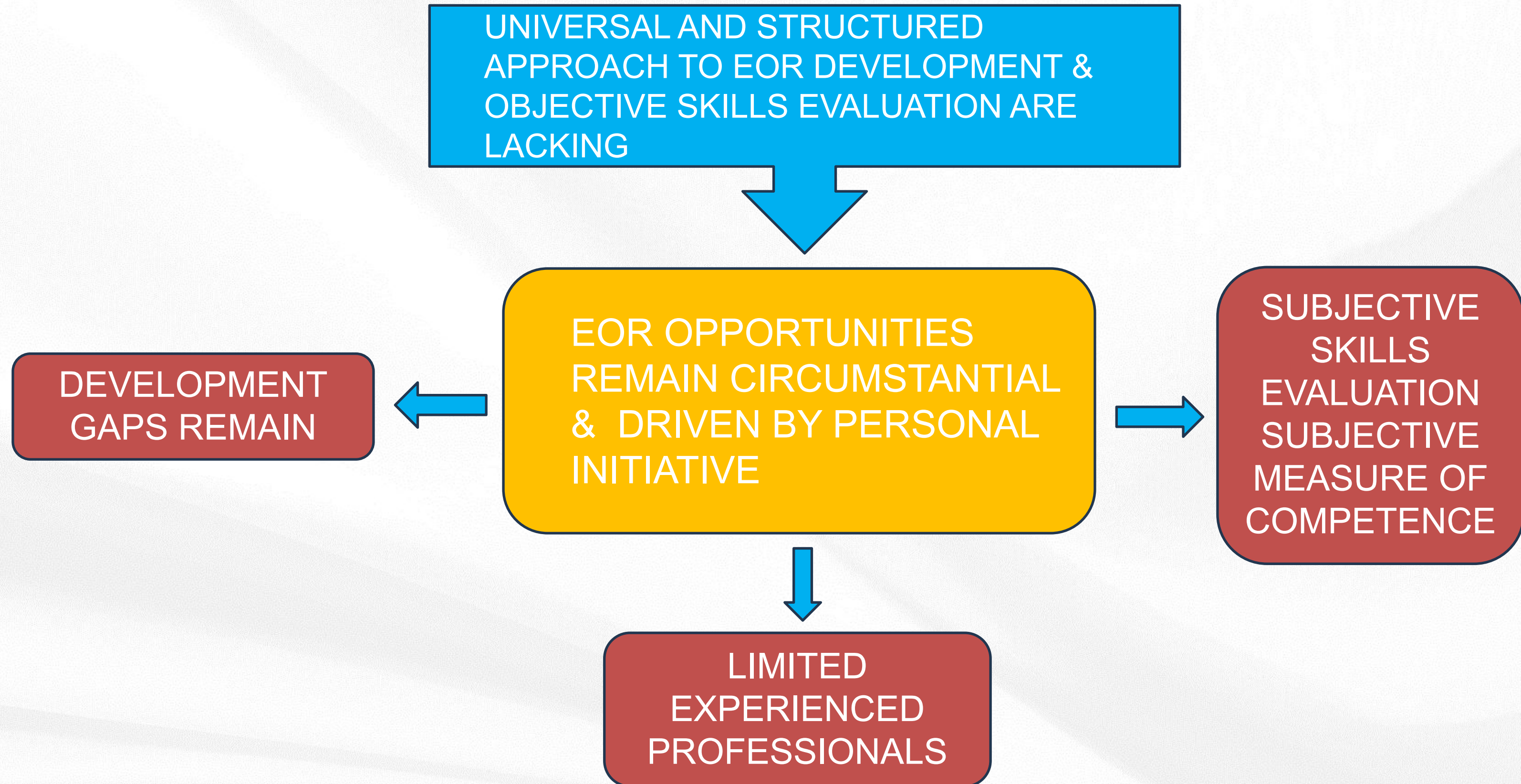
Causes of the EOR Shortage



Where Do We Go From Here?



Where Are We?



EOR Development Pathway and Skills Matrix



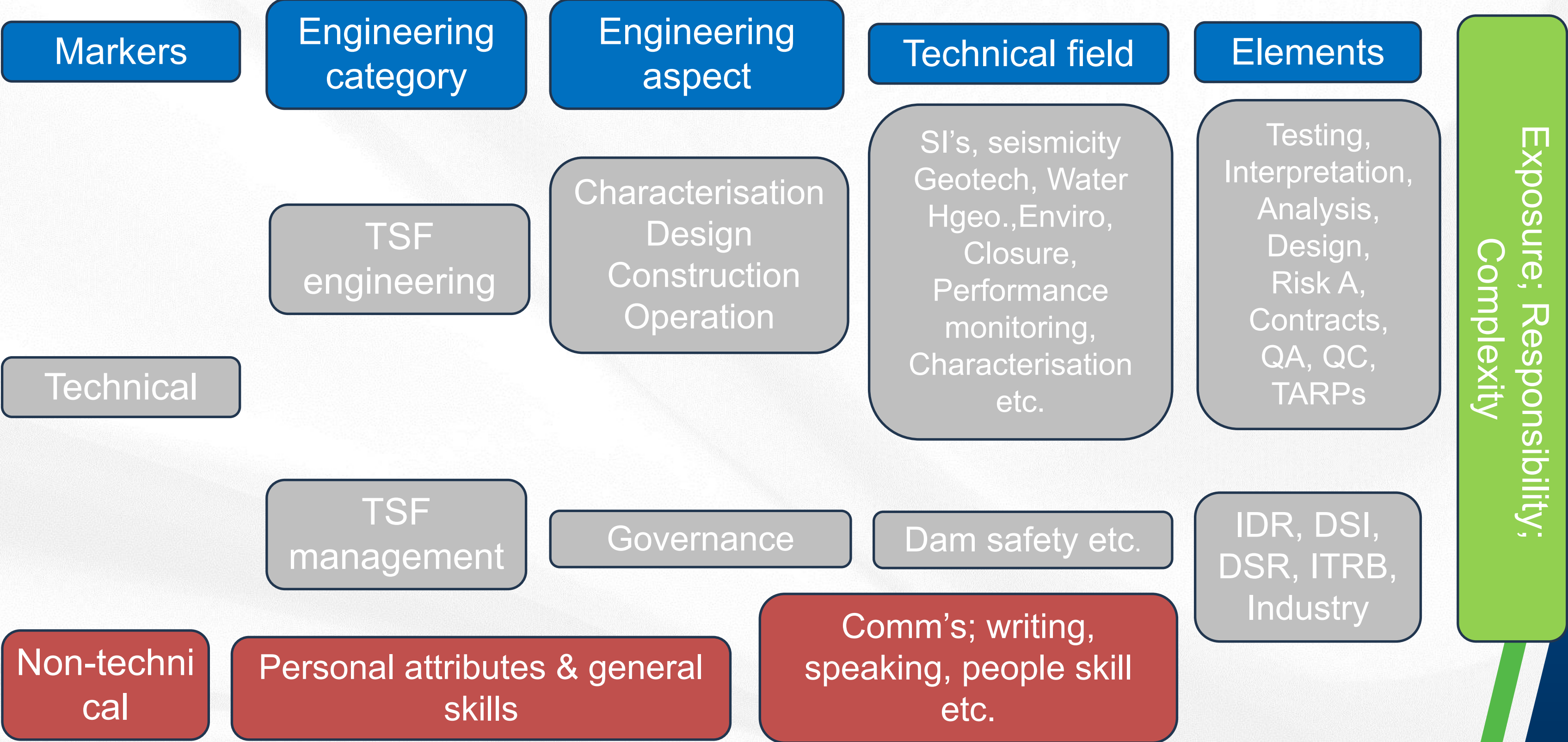
EOR Development Pathway

Level #	Status/ role	Technical responsibility	Practice level	Exposure/ experience (yrs)		EOR role	Responsibility (TSF CC)	Technical mentor
				Min	Cum			
1	Graduate civil engineer	General civil engineering design and construction monitoring.	Supervised	2	2	-	-	DEOR 1
2	TSF design engineer in training	Singular TSF design/ assessment tasks. Construction monitoring. TSF performance monitoring.	Supervised	1–2	3–4	-	-	DEOR 2
3	TSF design engineer	Complex, singular TSF design/ assessment tasks. Design criteria and, construction and performance monitoring specifications.	Supervised complex tasks	1–2	5–6	EOR TR	Significant/ High	EOR 1
4	Senior TSF engineer	Multiple TSF design/ assessment tasks. Design criteria and, construction and performance monitoring specifications.	Unsupervised	1–2	7–8	DEOR 1	Significant/ High	EOR 2
5	Senior TSF engineer	Complex, multiple TSF design/ assessment tasks and internal review. Dam safety audits and reviews. Holds ultimate responsibility for the design, construction and safety of TD.	Unsupervised	1–2	9–10	DEOR 2	High/ Extreme	EOR 3

EOR Development Pathway

Level #	Status/ role	Technical responsibility	Practice level	Exposure/ experience (yrs)		EOR role	Responsibility (TSF CC)	Technical mentor
				Min	Cum			
6	Lead TSF engineer	Complex, multiple TSF design/ assessment tasks and internal review. Dam safety audits and reviews. Holds ultimate responsibility for the design, construction and safety of TSF.	Unsupervised	2–3	12–13	EOR 1	Significant	Principal
7	Principal/ equivalent TSF engineer	Singular TSF project development and internal review. Dam safety audits, reviews and ITRB. <i>Holds ultimate responsibility for the design, construction and safety of TSF.</i>	Unsupervised	2	14–15	EOR 2	High	Principal
8	Principal/ equivalent TSF engineer	Multiple TSF project development and internal review. Dam safety reviews and ITRBs. <i>Holds ultimate responsibility for the design, construction and safety of TSF.</i>	Unsupervised	2	16–17	EOR 3	Extreme	Principal
9	Manager – TSFs	Oversee and provide strategic management of multiple dam projects/portfolios.	-	-	16+	EOR 3	Extreme	-

Tailings Engineer and EOR Skills Matrix



Technical experience competency evaluation rating guide: 'Exposure level'

Numerical rating	Descriptive rating	Description
1	Very low	No to little experience with parts of this task or concept; limited in how to integrate information with other components of a project
2	Low	Performed tasks and applied related theory under supervision; demonstrates fair understanding of how to integrate information with other components of the project
3	Moderate	Repeated experience of task or applied related concepts to other projects; demonstrates understanding of how to generate and apply information
4	High	Consolidated experience with task and/or concept and has applied it to several projects; understands how to generate and use this information; started reviewing work by others
5	Very high	In-depth experience with this task and/or concepts; lead discussions on the topic

Technical experience competency rating guide: 'Responsibility'

Numerical rating	Descriptive rating	Description
1	Very low	General exposure to rudimentary tasks; little to no responsibility
2	Low	Assisting; limited responsibility for work output
3	Moderate	Participating; full responsibility for supervised work
4	High	Contributing; full responsibility to supervisor for immediate work quality
5	Very high	Performing and leading; responsible with no support required but not accountable

Technical experience competency rating guide: 'Complexity'

Numerical rating	Descriptive rating	Description
1	Very low	Routine tasks; well defined; minimal risk
2	Low	Known procedures; applying general technical knowledge; low risk
3	Moderate	Tasks with some uncertainty; required to solve problems; undertake analysis using appropriate tools; moderate risk and impact
4	High	Significant levels of uncertainty; requiring advanced skills; high risk
5	Very high	High levels of uncertainty (ill-defined problems); requiring expert knowledge and innovation (derive solutions from 1 st principles); multi disciplinary problems; lead with/ develop new technology; very high risk

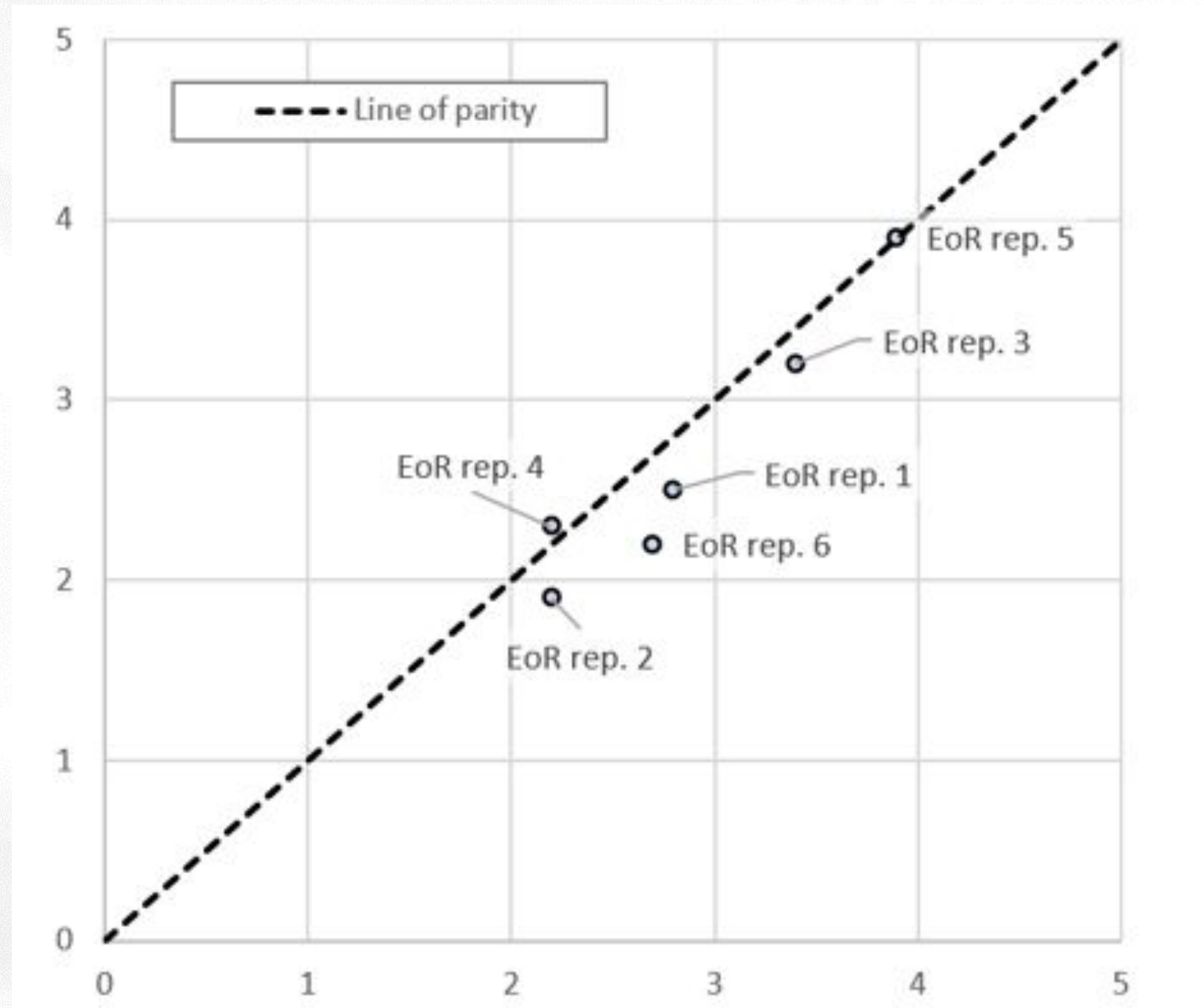
EOR Skills Matrix...ctd.

Example of non-technical competency scale

Numerical rating	Descriptive rating
1	Poor
2	Average
3	Good
4	Very Good
5	Advanced

EOR Skill Evaluation

EOR firm
assessment



Self-assessment

Example: EOR Technical execution/ responsibility matrix for a TSF project

Career stage	EOR role	Functional domain					
		Site Inv.	Design		Procurement and construction	Operation and monitoring	Governance
			Geotechnical	Water			
Principal geotechnical engineer	EOR	A	P	A	A	P	P
Senior geotechnical engineer	DEOR	P	A	A	P	A	A
Senior engineering geologist	EOR TR	P	A	-	-	-	-
Senior geotechnical engineer	EOR TR	A	P	-	-	P	A
Geotechnical engineer	EOR TR	-	A	-	-	-	P
Senior water engineer	DEOR	-	-	P	-	A	P
Senior resident engineer	DEOR	A	-	-	P	-	-

Key: EOR = Engineer of Record; DEOR = Deputy EOR; EOR TR = EOR-in-training; P = primary responsibility; A – assisting.

Summary

1. Systematising EOR development provides a foundation for:
 - Building EOR capability and capacity across the industry.
 - Maintaining continuity of knowledge.
 - Aligning responsibility with experience.
 - Maintaining accountability over a TSF life cycle.
2. EOR development is optimal within a team-based EOR execution structure.
3. Evaluation matrix guides skill assessment fairly/ sensibly – not absolute measure.
4. The framework has been developed from a geotechnical perspective – not exclusive.

Thank
You!