MANDELA MINING PRECINCT
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Guideline

Assessment of upskilling and reskilling training innovations to drive modern mining skills development for Supervisors and Trainers in the South African mining sector

SATCAP 2024: WP 2.1 – SKILLS

science, technology & innovation
Department: Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR

MINERALS COUNCIL SOUTH AFRICA

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About the Mandela Mining Precinct

The Mandela Mining Precinct is a Public-Private Partnership between the Department of Science and Innovation and the Minerals Council South Africa. The Precinct is jointly hosted by the Council for Scientific and Industrial Research and the Minerals Council. The Mandela Mining Precinct is an initiative aimed at revitalising mining research, development and innovation in South Africa to ensure the sustainability of the industry. This is achieved through the South African Mining Extraction, Research, Development and Innovation (SAMERDI) strategy.
The strategy comprises six research programmes:

1. Longevity of Current Mining;
2. Mechanised Mining Systems;
3. Advanced Orebody Knowledge;
4. Real-Time Information Management Systems;
5. **Successful Application of Technologies Centred Around People**; and
6. Test Mine.

This guideline was developed under the Successful Application of Technologies Centred Around People (SATCAP) research programme. The programme is aimed at understanding the effects, impacts and challenges of mining modernisation on people in the minerals sector. As there is a demand for a balance between people, planet and profit, SATCAP further lends support to the environmental, social and governance (ESG) agenda, with focus on the social or 'benefits to people' aspect.

SATCAP2024 Modern skills development for Supervisors and Trainers

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Approved: A Saffy (SATCAP TSC Chairperson)

Executive Summary

The Successful Application of Technology Centred Around People (SATCAP) programme aims to understand the effects, impacts and challenges of mining modernisation on people in the minerals sector, and how people relate to each other and technology in the context of mining modernisation. The programme intends to support the mining industry's environmental, social and governance (ESG) agenda to enable a balance between people, the planet and profitability.

The objective of work package (WP) 2.1. of SATCAP's 2024/2025 projects was to develop a guideline for the South African mining industry through assessments of upskilling and reskilling modern training solutions to drive modern mining skills development impacts, with a focus on supervisors and trainers.

A literature review was conducted on upskilling and reskilling best practice criteria for the evaluation of modern mining skills. Important frameworks considered included the ISO Standard for Competence Management and People Development, with the Plan-Do-Check-Act (PDCA) cycle, the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model, and the Kirkpatrick and Phillips Model (Ashofteh and Orangian, 2021; Florida State University, 2024; International Organization for Standardization, 2019:v; Kirkpatrick and Kirkpatrick, 2013; Phillips, 1998). Based on the literature review, a draft evaluation matrix, which incorporated best-practice criteria for the assessment of training solutions, was developed. Input relating to the design and application of the best-practice criteria as an assessment tool was also obtained from an industry review panel. An evaluation matrix with 76 best-practice criteria for the assessment of training solutions was developed; which was later refined to a streamlined 48-criteria version.

The assessment instrument was applied to training curriculums for supervisors and trainers of two participant entities from the CSIR and a mining university. Data gathering included assessments of the training solutions, and a panel review process. Gap and strengths, weaknesses, opportunities and threat (SWOT) analyses were undertaken. The assessments provide an opportunity to rethink and redesign modern mining training offerings through following a thorough evaluation process.

Key insights were revealed for the respective training innovations evaluated towards meeting industry skills demands and modern mining training needs. Common and recurring themes across all the assessments were identified, to highlight and grade the major pain points and also the stand-out positive aspects that emerged. This culminated in a consolidated list of associated recommendations for training entities to consider, including:

- Maintaining what is in place but also building onto the existing strengths and do continuous review and improvement as the landscape changes for updates around training methodologies, content, facilitation, assessment and learner feedback approach, modernisation skills and training needs;
- Investigating initiatives to keep track of graduates or learners;
- A better alignment of assessment criteria with modernisation skills needs;
- A better alignment of curriculum with modernisation objectives and skills demands;
- Increased focus on risk assessment and control measures in line with the use of modern technologies;
- Lobbying of relevant professional bodies and key stakeholders to better align curricula with modernisation objectives and industry needs and feedback;
- Introducing more immersive learning experiences and afford opportunities for practice or practical exposure;
- Review of curriculum for relevance and continuous improvement based on learner feedback; and
- Taking advantage of opportunities created in the industry to stay on top of the latest modernisation strategies to continuously align and improve training interventions and methodologies.

What is key is that while sample training innovations were selected for evaluation (from a mining university and the CSIR), the recommendations remain relevant to training entities looking to align to their curriculum to mining modernisation skills needs and industry skills demands for modernisation.

The assessment of modern training solutions provides insights into strengths, weaknesses, opportunities, threats and gaps, so that training entities may adjust their curricula to meet industry and skills demands for modern mining, towards the drive for mining sustainability.

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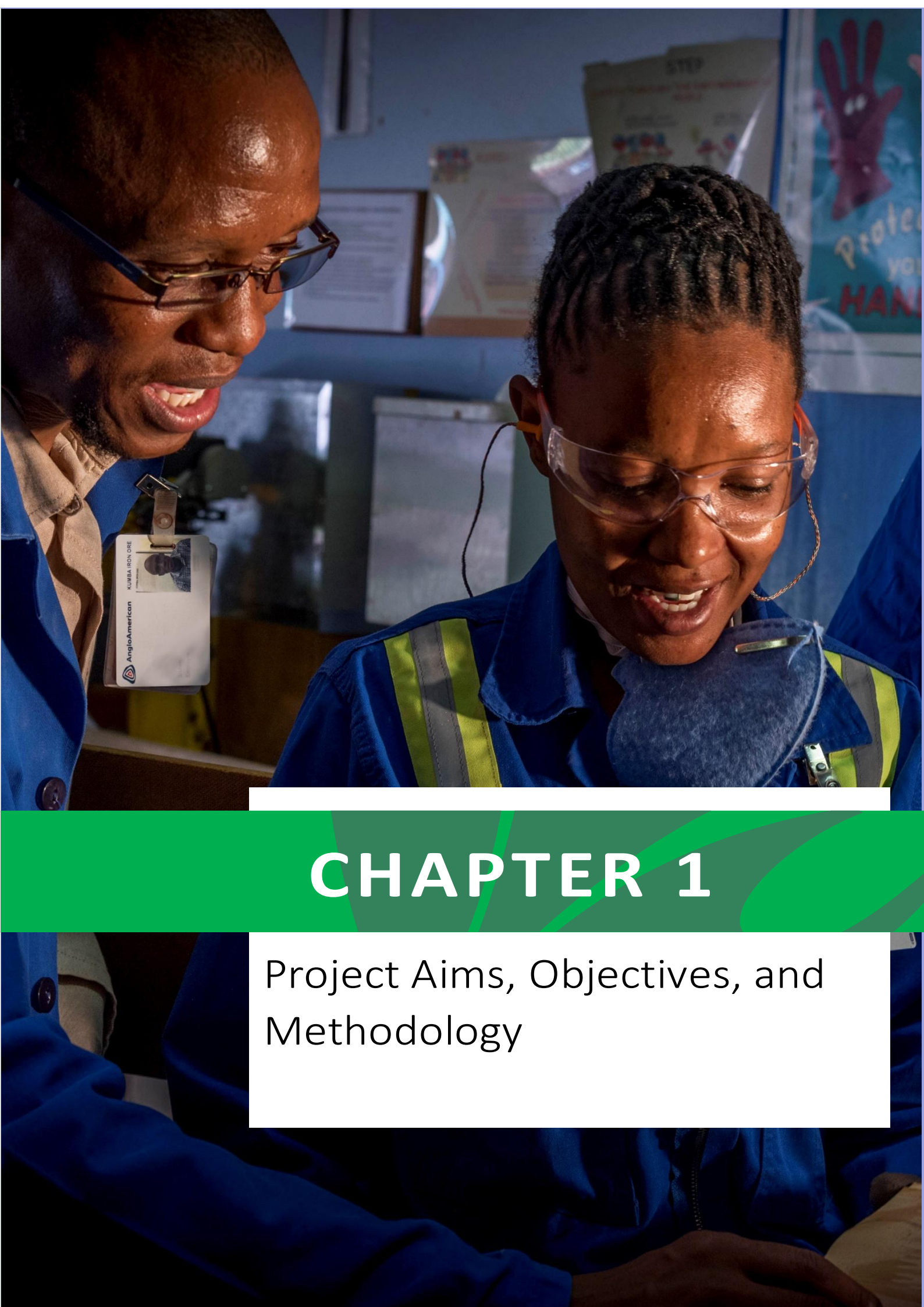


CHAPTER 1

Project Aims, Objectives, and Methodology

1. PROJECT AIMS, OBJECTIVES, AND METHODOLOGY

The objective of SATCAP 2024 work package (WP) 2.1. was to develop a guideline for the South African mining industry through assessments of upskilling and reskilling modern training solutions to drive modern mining skills development impacts, with a focus on supervisors and trainers. As the mining industry continues to change and modernise, skills development needs to be a priority. The sector's future sustainability depends on this, as the role of supervisors is viewed as a missing link between strategy and implementation of innovative solutions. Relevant skills development will allow for developing employees with requisite skills for modern mining, and post-mining. Skills development will enable modernisation and many of the same skills, especially much-needed digital skills and the application thereof, are relevant for other sectors, including construction, manufacturing and agriculture, and may allow for job options, post mine closure.

A mixed methods approach was taken for this project to achieve the project objectives. Figure 1 shows the project process flow and activities

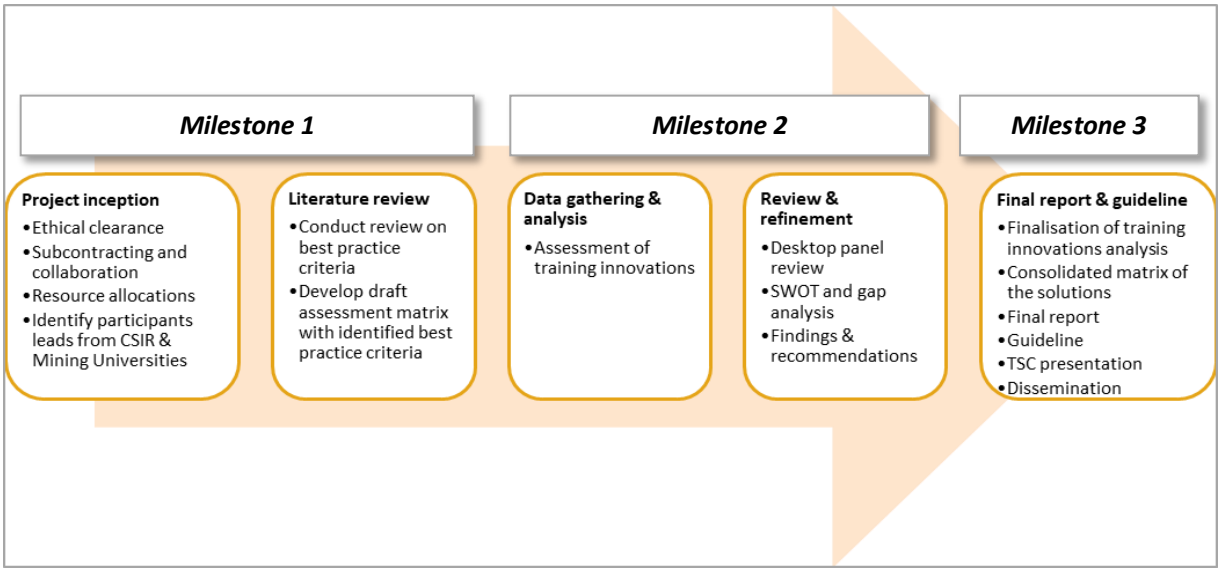


Figure 1: Process flow of activities

A draft evaluation matrix, which incorporated best-practice criteria for the assessment of training solutions, was developed based on findings from a literature review. Input relating to the design and application of the best-practice criteria as an assessment tool was also obtained from an industry review panel, providing credibility to the evaluation matrix and subsequent evaluation process. The review panel included members of the SATCAP Technical Steering Committee (TSC), the Minerals Council South Africa (MCSA), Mining Qualifications Authority (MQA), and mining companies.

The initial evaluation matrix developed had 76 best-practice criteria, but this was later refined to a streamlined 48-criteria version. The assessment instrument was applied to training curriculums for supervisors and trainers. Two training providers were identified for participation, and included the CSIR and a mining university. Purposive sampling was used to select the participating training providers, based on their knowledge and expertise in providing training to supervisors and/or trainers.

The data gathering was undertaken in an interview format, either virtually or in-person. The best practice criteria matrix was used to guide interviews with the training providers related to the selected training offerings. Further data gathering included an industry panel review process. The application of the evaluation matrix focused on a strengths, weaknesses, opportunities and threats (SWOT) analysis of the training solutions for supervisors and trainers, and with recommendations towards closing the gaps or taking advantage of opportunities. Ethics exemption was received for the project.

CHAPTER 2

Literature Review

2. LITERATURE REVIEW

A literature review was conducted to obtain a deeper understanding of the modern mining skills needs for supervisors and trainers, and towards establishing best-practice criteria to assess existing modern mining skills development training solutions. Figure 2 illustrates the core focus areas.

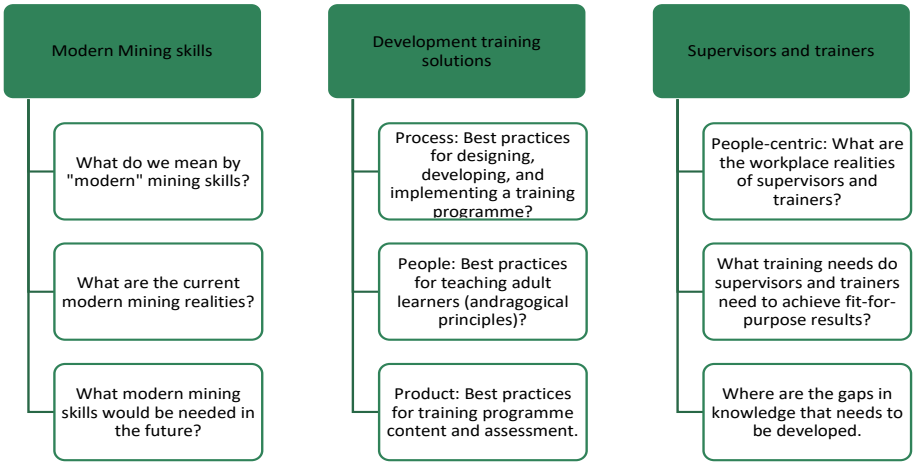


Figure 2: Literature review core focus areas

The modernisation of mines introduces new ways for mine supervisors and trainers to conduct activities. Reskilling and upskilling play an important role in the mining industry that is modernising its operations. It is critical that mine supervisors and trainers are given the relevant training for the diverse array of competencies necessary for the effective operation and management of advanced mining technologies and processes. According to the Minerals Council South Africa (2024), these skills include:

- Digital literacy and technology proficiency;
- Immersive learning and virtual reality (VR) training;
- Advanced technical skills;
- Health and safety management;
- Gamified and mobile micro-learning;
- Educational technology solutions;
- Cross-industry collaboration and innovation; and
- Adaptability and lifelong learning.

Modern training methods that were found to be effective (Haywood, 2022; Mape, 2020; Moodley, 2018) included:

- A blended learning approach;
- The implementation of a Learner Management System (LMS);
- The use of interactive methodologies;
- Adoption of modern training technologies and gamified learning;
- Internal training centres or seminars; and
- Bridging programmes.

Existing skills training in South Africa appear to emphasise management, leadership, and technical mining competencies, with less focus on modernisation technologies and their operational effects (MQA, 2024). Based on the literature review findings, key questions for evaluating training for supervisors and trainers in relation to modernisation were suggested (Table 1).

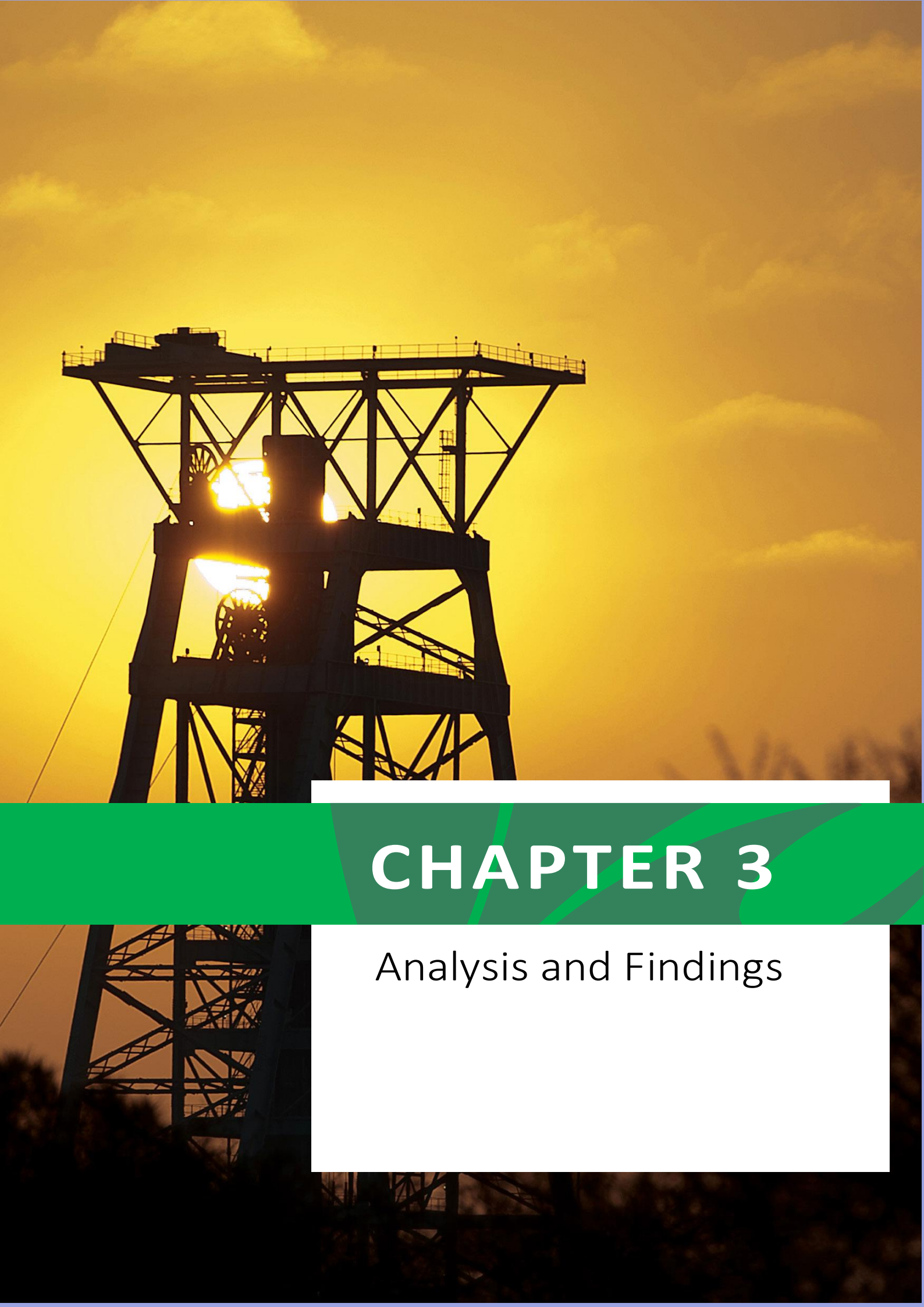
Table 1: Evaluation questions

Focus area	Evaluation Question
Compliance with regulation	Is the training for the modernisation technology aligned with applicable legislation and standards?
Alignment with business strategic goals	Is the training aligned with the modernisation/digitalisation/technology journey map?
Alignment with skills audit	Is the training aligned with the training needs identified through a skills audit?
Safety and health	Does the training equip trainees with hazard, risk assessment and control measure information of the modernisation technology?
Alignment with technology provider or OEM	Is the training aligned with the new technology manuals provided by original equipment manufacturers (OEMs)?
Training structure and content	Does the training afford the trainee (especially mine supervisors who have busy schedules) a work-study balance? Is the training face-to-face, online or blended? Is the training accredited?

In summary, literature has indicated that any curriculum changes or enhancements, to enable modernisation, should consider, amongst other factors:

- Legal requirements/compliance changes;
- New or updated manuals, operating procedures;
- New safety, health and environmental hazards and mitigation measures;
- Reviews of performance measures and on-job assessments;
- Leadership development and coaching;
- Effective ways of communication and engagement;
- Changes in equipment/machinery/hardware maintenance processes;
- Changes in logistics (transport of materials needed for daily shift activities);
- Changes and advancements in technologies;
- Training and skills development (digital, technical, safety and health, technology proficiency);
- Modern training methodologies; and
- Change management.

Further, important frameworks with which to create best-practice criteria, to evaluate training, were also identified in the literature. The main framework used is the ISO Standard for Competence Management and People Development (cf. International Organization for Standardization, 2019:v). The ISO standard, with the Plan-Do-Check-Act (PDCA) cycle, serves as a recognised guideline for good quality management. The ISO PDCA Cycle was also enhanced using an instructional design framework called the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model (Florida State University, 2024), to provide extra depth to what is needed when developing a training programme. A Training Needs Analysis (TNA) forms part of the first step of the PDCA cycle and ADDIE. The third framework used to enhance the PDCA cycle is the Kirkpatrick and Phillips Model. It consists of five levels of evaluation: Reaction, Learning, Behaviour, Results, and Return on Investment (ROI) for an increased business or institutional perspective (Ashofteh and Orangian, 2021; Kirkpatrick and Kirkpatrick, 2013; Phillips, 1998). The importance of following a systems approach was identified when developing the best practice evaluation matrix.



CHAPTER 3

Analysis and Findings

3. ANALYSIS AND FINDINGS

Based on insights from the literature review, an assessment tool in the form of an evaluation matrix was developed to evaluate the training programmes for supervisors and trainers. The best practice criteria included a planning and delivery approach, work integrated learning, instructional design principles, and the integration of learning (process, people, and product). The assessment matrix initially contained a total of 76 questions but was later streamlined to 48 questions following the industry panel review. The evaluation of the training solutions, in terms of PDCA methodology, considers:

- **Plan:** Industry needs and skills gaps, and curriculum design;
- **Do:** Curriculum relevance, and curriculum delivery;
- **Check:** Evaluation/review; and
- **Act:** Continuous improvement, and future foresight.

The evaluation matrix developed has key focus areas with associated criteria for assessments, assessment questions, and assessment ratings have also been identified. The following is noted:

- The PDCA cycle serves as the base for the criteria;
- Supporting models and approaches are included in each step of the PDCA cycle, to enhance the validity of the criteria and ensure that it is comprehensive and covers all necessary fields in terms of the process, people, and product of training interventions; and
- The evaluation matrix is informed by the skills needed and the best approach to develop the requisite modern knowledge, skills and application for the mining industry.

A snapshot of the best practice criteria evaluation matrix is shown in Table 2, while a summary of the refined best practice criteria is shown in Figure 3.

Table 2: Snapshot of the training assessment best practice criteria evaluation matrix

ISO PDCA Phase:		**PLAN**				
ADDIE Step(s):		**ANALYSIS**				
Best-Practice Criteria		**Evaluation Questions:**	**Assessment:**			**Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:**
Identify industry needs & skills gaps			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	**Evidence-based Training Needs Analysis**	Has an evidence-based Training Needs Analysis been conducted to identify the training requirements for mine supervisors and trainers?	No TNA done.	Yes, a TNA was done but subjective or not focussing on supervisors & trainers.	Yes, an evidence-based TNA was done for supervisors & trainers.	
	Multiple source data collection	Has comprehensive data been collected from multiple sources (e.g., surveys, interviews, performance reviews) to identify training needs?	No data was collected.	Yes, data was collected but not from multiple sources.	Yes, data was sourced from multiple sources.	

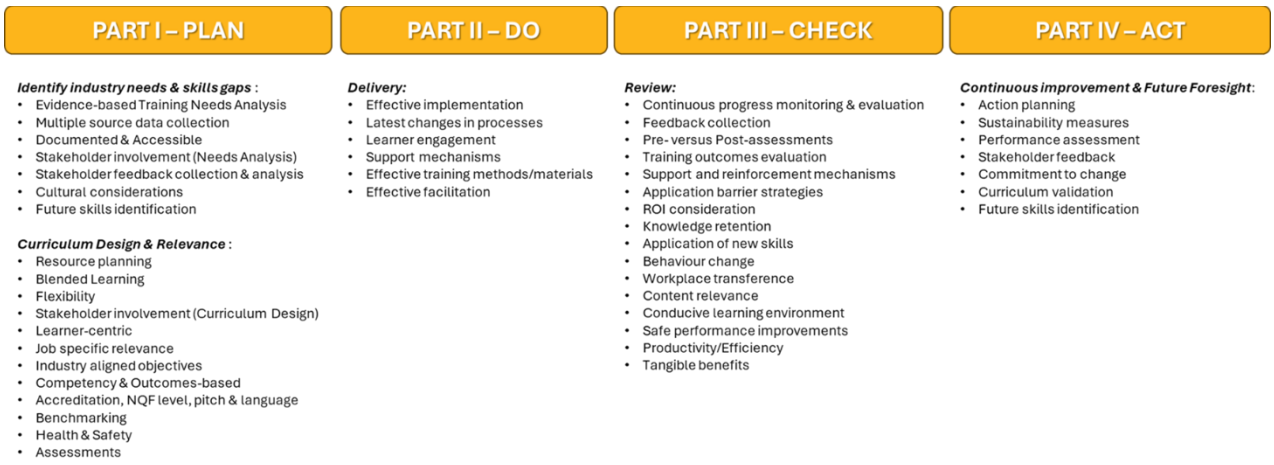
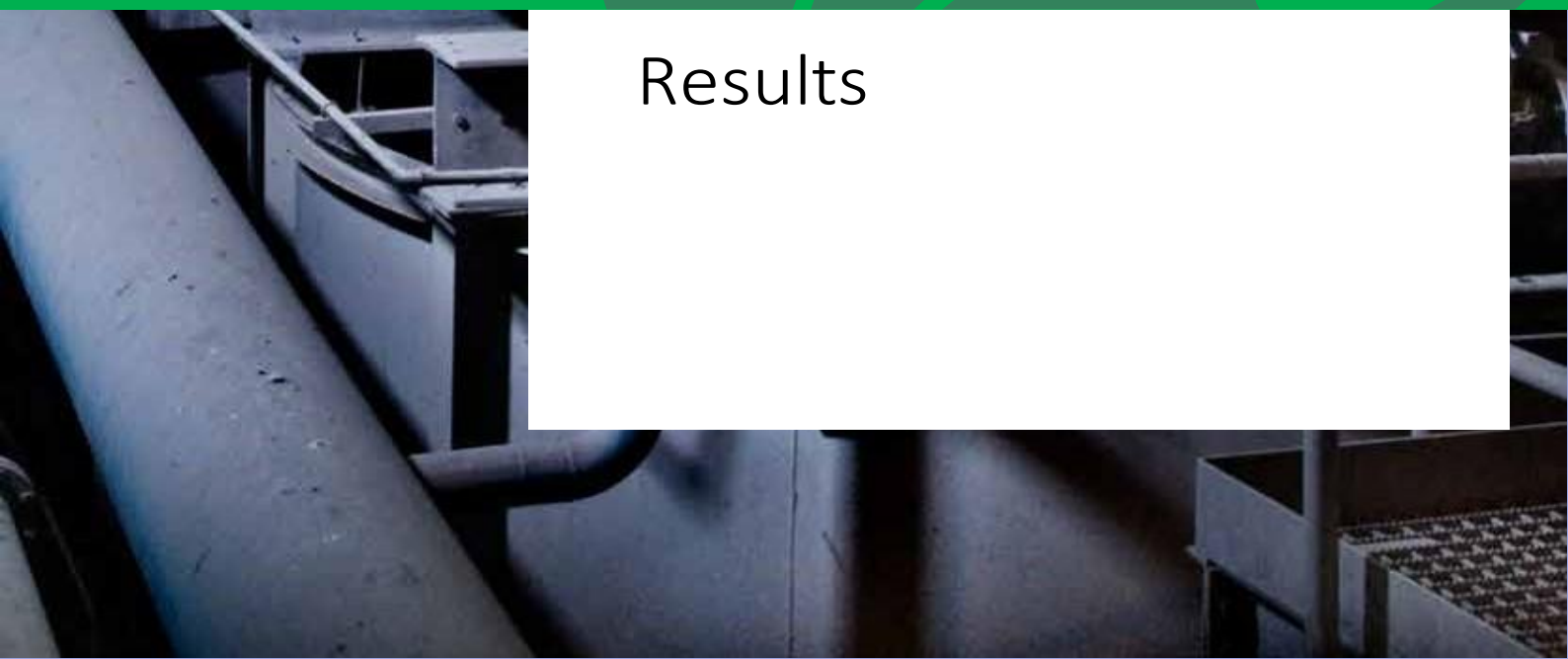


Figure 3: Summary of the refined best practice criteria used for the training assessment

This guideline is available on the Mandela Mining Precinct website, with the evaluation matrix included as Appendix A, for use by industry training entities.

CHAPTER 4

Results



4. RESULTS

Assessments were done with two training providers, and for two training solutions offered by each. A summary of the training courses that were assessed is shown in Table 3. The identities of the training providers are confidential, and are therefore referred to as Trainer A and Trainer B.

Table 3: Training assessments conducted

Trainer A	Trainer B
Training innovation A1 is an NQF level 8 Bachelor of Engineering (BEng) semester course aimed at undergraduates. The module is presented in English in a classroom-based setting and comprises three lectures and two tutorials per week. **Training innovation A2** is a short course that is open to mining industry representatives and provides the learner with a theoretical background on the topic of Geotechnical Engineering. The course is presented over five days and allows interaction between the facilitator and the students.	**Training innovation B1** is a Safety Awareness Training short course aimed at new and returning industry employees. The module is presented in English in a classroom-based setting and comprises eight hours (1 day) of instruction. **Training innovation B2** is also a 1-day / 8-hour Emergency Response short course that is open to mining industry representatives – preferably candidates with basic literacy and numeracy knowledge and a minimum of two years underground experience (advised).

Data collection was conducted by applying the developed best practice evaluation matrix, and these findings were used to conduct a SWOT analysis for each of the assessed training innovations. Key insights were revealed for the respective training innovations towards meeting the industry skills demands and training needs for trainers and supervisors. The process of assessment and the analysis of data enabled areas of strengths and areas for potential improvement to be highlighted. Review by the industry panel also contributed to findings and recommendations. The primary objective of the panel review was to gain an understanding, from an industry perspective, if the training solutions that were considered were meeting and addressing the skills and training demands for a modernising landscape.

A direct comparison of individual offerings was not advised but was considered insightful to identify common and recurring themes across all the assessments that were done, to highlight and even grade the major pain points (weaknesses and threats) and also the stand-out positive aspects (strengths and opportunities) that emerge. To this end, a semi-quantitative and partly subjective scoring system was applied to a consolidated matrix of the assessment results. For each positive response ('Yes'), a score of +2 was assigned. 'Partial weakness' responses were assigned a score of -1, while strong negative responses ('No') were assigned a score of -2. The scores were tallied to yield a cumulative score for the complete list of the 48 best-practice criteria. The grading approach that was applied based on the cumulative scores is shown in Table 4. The consolidated matrix (heatmap) of results is shown in Figure 4.

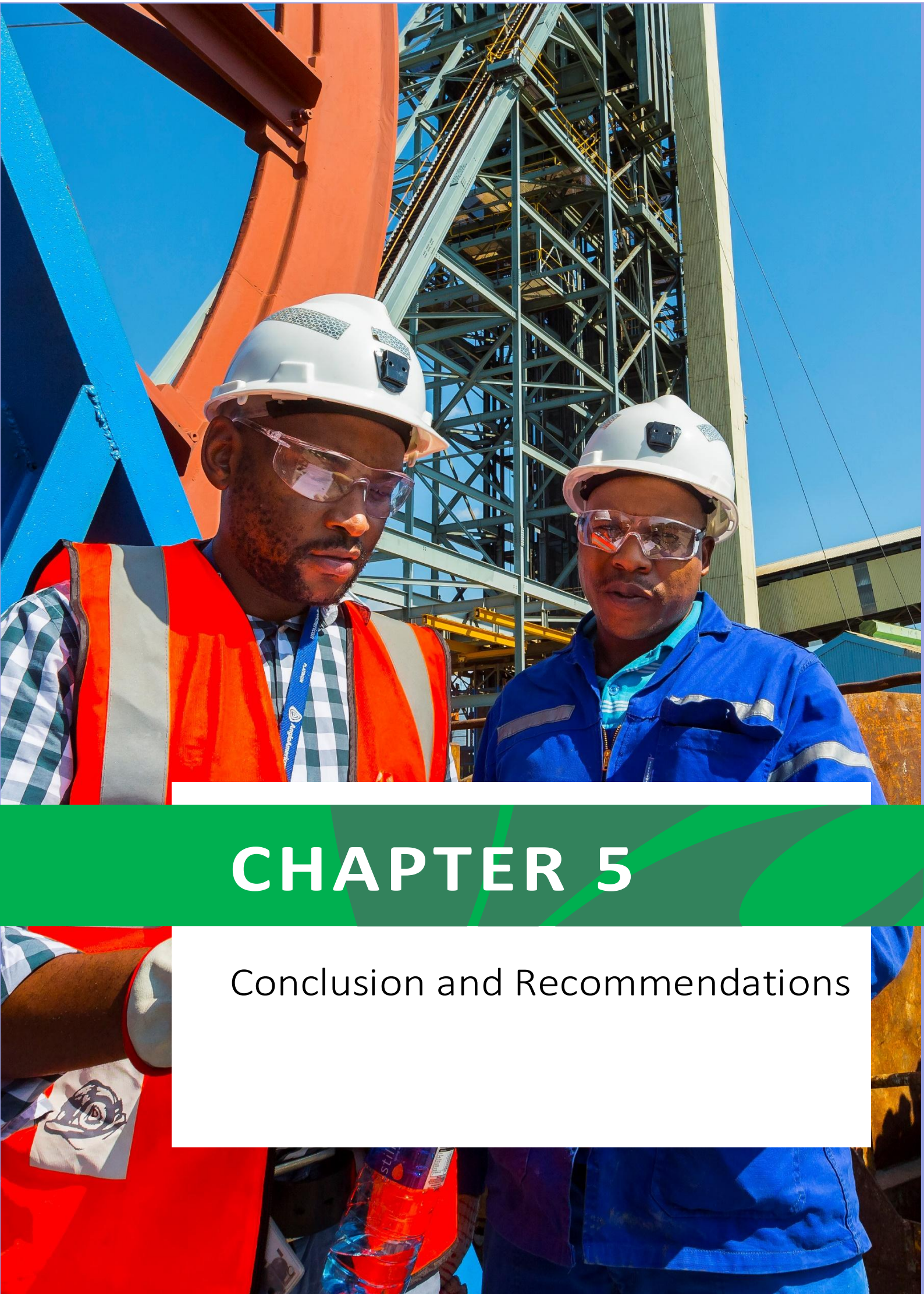
The results may be of significance to the participant entities to remediate or enhance their curriculum, and hence is not discussed in detail in this section; but to note, the results have relevance to training entities in need of aligning their curriculum towards modernisation skills development efforts.

Table 4: Grading approach

MIN	MAX	RATING COLOUR	
-8	-3		A cummulative score of between -8 and -3 indicates the most concerning weaknesses
-2	0		A cummulative score of between -2 and 0 indicates less concerning, but arguably still important weaknesses
1	3		Cummulative scores of between 1 and 3 can be considered as neutral
4	8		Cummulative scores of between 4 and 8 can be viewed as prominent strengths

	Best-Practice Criteria	Assessment (A1):			Assessment (A2):			Assessment (B1):			Assessment (B2):			Score	Rating colour
PART I - PLAN	*Identify industry needs & skills gaps*	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS Evidence-based Training Needs Analysis			2		-1							2	3	
	PROCESS Multiple Source Data Collection			2		-1							2	3	
	PROCESS Documented & Accessible			2		-1					-2			-1	
	PEOPLE Stakeholder Involvement (Needs Analysis)			2		-1							2	3	
	PEOPLE Stakeholder Feedback Collection & Analysis			2			2	-2					2	4	
	PEOPLE Cultural Considerations			2			2			2			2	8	
	PRODUCT / OUTPUT Future Skills Identification			2			2	-2					2	4	
	Curriculum Design & Relevance	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS Resource Planning			2			2			2			2	8	
	PROCESS Blended Learning			2	-2				-1				2	1	
	PROCESS Flexibility	-2				-1				2			2	1	
	PEOPLE Stakeholder Involvement (Curriculum Design)			2			2			2		-1		5	
	PEOPLE Learner-Centric		-1			-1		-2					2	-2	
	PEOPLE Job Specific Relevance			2			2		-1				2	5	
	PRODUCT / OUTPUT Industry Aligned Objectives			2			2	-2				-1		1	
	PRODUCT / OUTPUT Competency & Outcomes-based			2		-1			-1				2	2	
	PRODUCT / OUTPUT Level & Language			2		-1				2			2	5	
	PRODUCT / OUTPUT Benchmarking			2			2			2			2	8	
	PRODUCT / OUTPUT Health & Safety		-1			-1								-2	
	PRODUCT / OUTPUT Assessments		-1			-1							2	0	
PART II - DO	Best-Practice Criteria	Assessment:			Assessment:			Assessment:			Assessment:				
	Delivery	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS Effective Implementation			2			2	-2				-1		1	
	PROCESS Latest Changes in Processes			2			2		-1					3	
	PEOPLE Learner Engagement			2		-1			-1				2	2	
	PEOPLE Support Mechanisms			2			2			2			2	8	
	PRODUCT / OUTPUT Effective Training Methods/Materials			2		-1			-1				2	2	
	PRODUCT / OUTPUT Effective Facilitation			2		-1				2			2	5	
														0	
PART III - CHECK	Best-Practice Criteria	Assessment:			Assessment:			Assessment:			Assessment:			0	
	Review	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS Continuous Progress Monitoring & Evaluation			2		-1				2				3	
	PROCESS Feedback Collection			2			2		-1			-1		2	
	PROCESS Pre- versus Post-Assessments		-1		-2				-1			-1		-5	
	PROCESS Training Outcomes Evaluation			2			2						2	6	
	PROCESS Support and Reinforcement Mechanisms		-1				2	-2			-2			-3	
	PROCESS Application Barrier Strategies		-1			-1				2		-1		-1	
	PROCESS ROI Consideration	-2			-2			-2			-2			-8	
	PEOPLE Knowledge Retention			2		-1			-1				2	2	
	PEOPLE Application of New Skills			2			2			2			2	8	
	PEOPLE Behaviour Change			2			2			2		-1		5	
	PEOPLE Workplace Transference	-2					2			2			2	4	
	PRODUCT / OUTPUT Content Relevance	-2					2			2			2	4	
	PRODUCT / OUTPUT Conducive Learning Environment			2		-1			-1			-1		-1	
	PRODUCT / OUTPUT Safe Performance Improvements			2			2			2			2	8	
	PRODUCT / OUTPUT Productivity/Efficiency			2			2			2				6	
	PRODUCT / OUTPUT Tangible Benefits			2			2			2				6	
PART IV - ACT	Best-Practice Criteria	Assessment:			Assessment:			Assessment:			Assessment:				
	Continuous Improvement & Future Foresight	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)	NO (Strong Weakness)	Partially (Weakness)	YES (Strength)		
	PROCESS Action Planning			2	-2					2	-2			0	
	PROCESS Sustainability Measures			2			2	-2						2	
	PEOPLE Performance Assessment			2			2			2			2	8	
	PEOPLE Stakeholder Feedback			2		-1			-1				2	2	
	PEOPLE Commitment to Change			2			2			2			2	8	
	PRODUCT / OUTPUT Curriculum Validation			2			2			2			2	8	
	PRODUCT / OUTPUT Future Skills Identification			2		-1				2			2	5	

Figure 4: Consolidated matrix of assessment results



CHAPTER 5

Conclusion and Recommendations

5. CONCLUSION AND RECOMMENDATIONS

Conclusions based on the assessment results are shown in Table 5.

Table 5: Summary of assessment results

Most concerning weaknesses	Other perceived weaknesses
• ***Pre- versus Post-Assessments:*** generally, learners' skills were not assessed before and after the training to determine new skills/upskilling and reskilling needs; it is mostly done only at the end of the training. • ***Support and Reinforcement Mechanisms:*** it appears that there were often no mechanisms in place to support effective application on the job. • ***ROI Consideration:*** the concept of return-on-investment (ROI) does not generally feature for the training programmes that were assessed.	• ***Documented & Accessible:*** competence gap analysis results were not usually documented. • ***Learner-centric:*** training programmes are generally not tailored to meet the specific modernisation skills needs. • ***Health & Safety:*** the training offerings do not necessarily equip supervisors and trainers with hazard, risk assessment and control measure information of the modernisation technology. • ***Application Barrier Strategies:*** remedial/reinforcement strategies are not offered post upskilling/reskilling/new skills development. • ***Conducive Learning Environment:*** the training environment is not always considered to be conducive to learning (e.g., comfortable, well-equipped, with modern machines/technologies for learning). • ***Action Planning:*** it emerged that specific actions were not always planned or implemented to address gaps or areas for improvement.
Most prominent strengths	**Most prominent strengths**
• ***Cultural Considerations:*** cultural factors and diversity aspects were generally considered; sometimes part of accreditation visits, advisory board meetings or part of professional body's requirements and demands. • ***Resource Planning:*** the necessary internal, competent resources (e.g., budget, materials, faculty) were allocated for the training programmes. • ***Benchmarking:*** curriculums were mostly aligned with OEMs standards and operating manuals, best-practices as well as future skills requirements. • ***Support Mechanisms:*** support mechanisms were put in place to guide learners to relearn new behaviours and unlearn old behaviours during the training. • ***Training Outcomes Evaluation:*** training outcomes were evaluated against the predefined modernisation/technology use and upskilling/reskilling objectives. • ***Application of New Skills:*** learners were enabled to apply the skills gained from the training in their job or in the training of workers/communities.	• ***Productivity/Efficiency:*** the training contributed to increased efficiency due to improved skills to deliver training/ supervise in the modern mining landscape. • ***Tangible Benefits:*** the training offerings considered seem to yield benefits, such as improved safe production, a better skilled workforce, upskilled supervisors and trainers as a result of the training. • ***Stakeholder Involvement:*** key stakeholders (e.g., industry experts, trainers, supervisors) were mostly involved in setting the learning criteria for the training programme and its assessments; learning criteria were also sometimes aligned with company values. • ***Job specific Relevance:*** the curriculums were generally considered relevant to the job roles and responsibilities of supervisors and trainers to support and enable modernization; for example, where fundamentals of mine safety is taught. • ***Level and Language:*** training was pitched at an appropriate level considering the educational level of participants and their language. • ***Effective Facilitation:*** the trainers generally had the necessary capacity, capability, qualifications and competence to deliver the modernisation content and address learner new skills needs; however, it should be noted that in some cases, technical roll-out and capacity constraints were observed. • ***Behaviour Change:*** *it was mostly agreed that the reskilling/upskilling and new skills development allowed for observable behaviour changes of supervisor and trainers; it was commented however that it was difficult to observe change in behaviour in the workplace and that employers should be better positioned to observe this.* • ***Future Skills Identification:*** the faculty skills and competence requirements were generally assessed, to give faculty the required capacity development to support future skills demands; for example, allowing for additional lecturing staff for delivery.

Considering the consolidated analysis presented above and recommendations that were made based on individual SWOT analyses, the following consolidated recommendations can be made for training providers that either want to improve an existing training offering (in the broad context of mining modernisation), or for those wanting to develop a new offering:

- Maintain and build on existing or identified strengths, and do continuous review and improvement as the landscape changes for updates around training methodologies, content, facilitation, assessment and learner feedback approach, modernisation skills and training needs;
- Better align curriculum with modernisation objectives to meet industry skills demands;
- Investigate initiatives to keep track of graduates to perform post-study validations;
- Better align the assessment criteria with modernisation skills needs;
- Better align the curriculum with modernisation objectives and stakeholder needs; to this end, professional bodies should be lobbied for input;
- Include more focus on risk assessment/control measures in line with the use of modern technologies;
- Introduce more immersive learning experiences and afford opportunities for practice or practical exposure;
- Continual improvement based on learner feedback;
- Take advantage of opportunities created in the industry to stay on top of the latest modernisation strategies to continuously align and improve training interventions;
- Investigate how linkages with industry and the Department of Mineral Resources and the Environment (DMRE), can be leveraged to secure additional funding to support and sustain and even expand current offerings;
- A key to continual improvement is through learner feedback;
- Investigate post-training opportunities in collaboration with industry - for example, behaviour change feedback, on the job application and remedial/reinforcement strategies;
- Investigate how the concept of ROI can be better quantified, introduced to learners, and related to training offerings; and
- Ensure that continuous improvement and future foresight measures are put in place; for example, through faculty skills and competence assessment and development.

A key consideration is that while sample training innovations were selected for evaluation, the findings and recommendations are relevant to training entities looking to align to their curriculum to mining modernisation skills demands and training needs.

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APPENDIX

APPENDIX A: Evaluation matrix

SATCAP WP2.1 Training Solution Assessment Guide on assessing upskilling and reskilling modern training-innovations for supervisors and trainers	
Overview	
Training Solution Title	
Training Provider	
Field / Description	
Type / Level of Offering	
NQF Level	
Duration	
Contact Time	
Topics Covered	
Prerequisites / Eligibility Criteria	
Are participants receiving a certificate upon successful completion?	
How long has the traning provider delivered this solution?	
When was the curriculum last reviewed and/or updated?	

SATCAP WP2.1 Training Solution Assessment Guide on assessing upskilling and reskilling modern training-innovations for supervisors and trainers

Assessment PART I

ISO PDCA Phase:		**PLAN**				
ADDIE Step(s):		**ANALYSIS**				
Best-Practice Criteria		**Evaluation Questions:**	**Assessment:**			**Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:**
Identify industry needs & skills gaps			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	Evidence-based Training Needs Analysis	Has an evidence-based Training Needs Analysis been conducted to identify the training requirements for mine supervisors and trainers?	No TNA done.	Yes, a TNA was done but subjective or not focussing on supervisors & trainers.	Yes, an evidence-based TNA was done for supervisors & trainers.	
PROCESS	Multiple Source Data Collection	Has comprehensive data been collected from multiple sources (e.g., surveys, interviews, performance reviews) to identify training needs?	No data was collected.	Yes, data was collected but not from multiple sources.	Yes, data was sourced from multiple sources.	
PROCESS	Documented & Accessible	Are the results for a competence gap analysis documented and accessible?	No competence gap analysis results documented.	Yes, the competence gap analysis results are documented, but not accessible.	Yes, the competence gap analysis results are documented and accessible.	
PEOPLE	Stakeholder Involvement (Needs Analysis)	Have key stakeholders, including managers, employees as well as supervisors and trainers, been involved in the needs-determination process?	No stakeholders have been involved.	Yes, but not all stakeholders were involved.	Yes, all key stakeholders were involved.	
PEOPLE	Stakeholder Feedback Collection & Analysis	Has employee feedback been systematically collected and analysed as part of the needs analysis?	No employee feedback has been collected.	Yes, but only limited employee feedback was collected.	Yes, employee feedback has been collected and analysed.	
PEOPLE	Cultural Considerations	Have cultural factors and diversity been considered in the needs analysis?	No, cultural factors were considered.	Yes, but only some factors were considered.	Yes, all cultural factors and diversity aspects were considered.	
PRODUCT / OUTPUT	Future Skills Identification	Have future skills and technological requirements for supervisors and trainers been identified based on industry trends and demands?	No future skills or technological requirements have been identified.	Yes, but only general future skills were identified, not for supervisors/trainers or based on industry demands.	Yes, future skills and technological requirements were identified for supervisors/trainers based on industry demands.	
Curriculum Design & Relevance			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	Resource Planning	Are the necessary internal, competent resources (e.g., budget, materials, faculty) allocated for the training programme to upskill supervisors and trainers?	No or very limited resources planned for the training programme.	Yes, but for the most part only budget was allocated with no detailed resource planning.	Yes, detailed resource planning was done and allocated.	
PROCESS	Blended Learning	Is the training offering a blended learning approach including face-to-face as well as on-line and on-job components?	No it does not offer a blended learning approach.	Yes, but the majority of training is still face-to-face with very limited on-line/on-the-job components.	Yes, the training offering incorporates a blended learning approach fully.	
PROCESS	Flexibility	Does the training afford the supervisors and trainers a work-study balance due to busy schedules within the mining environment?	No, the training does not take work-study balance into consideration.	Yes, but only limited consideration is given to work-study balance. Individuals should still try and manage/balance their schedules/work load.	Yes, the training is flexible and was designed with work-study balance in mind.	
PEOPLE	Stakeholder Involvement (Curriculum Design)	Have key stakeholders (e.g., industry experts, trainers, supervisors) been involved in setting the learning criteria for the training programme and its assessments?	No, key stakeholders were not involved in setting the learning criteria.	Yes, but only some stakeholders were involved.	Yes, all key stakeholders were involved in the process of setting the learning criteria.	
PEOPLE	Learner-Centric	Is the programme tailored to meet the specific modernisation skills needs of mine supervisors and trainers?	No, the programme is not tailored to meet the specific modernisation skills needs.	The programme is tailored but only to meet some specific modernisation skills needs.	Yes, the programme is tailored to meet the specific modernisation skills needs.	
PEOPLE	Job Specific Relevance	Is the curriculum relevant to the job roles and responsibilities of supervisors and trainers to support and enable modernisation?	No, the curriculum is not relevant to the job roles and responsibilities of supervisors/trainers.	Only parts of the curriculum is relevant.	Yes, the curriculum is relevant to the job roles and responsibilities of supervisors/trainers.	
PRODUCT/OUTPUT	Industry Aligned Objectives	Are training objectives aligned with the industry's modernisation journey and set to enable basic operating acumen for the use of, training of or supervision of new technology?	No, objectives were not set at all.	Objectives were set, but not to enable basic operating acumen for the use of modern technology.	Yes, training objectives were set to enable basic operating acumen for the use of modern technology.	
PRODUCT/OUTPUT	Competency & Outcomes-based	Are the training objectives competency and outcomes-based focusing on the skills and knowledge requirements for effective job performance and skilling of supervisors and trainers?	No, the objectives are not competency or outcomes-based.	Yes, but it is competency based but not outcomes-based (or visa versa).	Yes, the objectives are both competency and outcomes-based.	
PRODUCT/OUTPUT	Level & Language	Is the training pitched at an appropriate level considering the educational level of participants and their language?	No, the training is not pitched at an appropriate level.	The training is mostly pitched on an appropriate level, but there are some areas for improvement.	Yes, the training programme is pitched on an appropriate level and considers participants' educational levels and language.	
PRODUCT/OUTPUT	Benchmarking	Is the curriculum aligned with OEMs standards and operating manuals, best-practices as well as future skills requirements?	No benchmarking was done.	Yes, but only some standards are aligned and/or aligned to OEM standards, but no best-practices.	Yes, aligned with both OEM standards, best-practices and future skills requirements.	
PRODUCT/OUTPUT	Health & Safety	Does the training equip supervisors and trainers with hazard, risk assessment and control measure information of the modernisation technology?	No, the training does not.	Yes, but only in part. Various hazard/risk assessment/control measure information not covered.	Yes, the training equips supervisors/trainers with all hazard, risk assessment and control measure information necessary.	
PRODUCT/OUTPUT	Assessments	Are assessments criteria aligned to modernisation skills needs and industry demands for supervisors and trainers?	No, assessment criteria is not aligned to modernisation skills needs or industry demands.	Yes, but very limited and/or aligned to modernisation skills needs but not industry demands.	Yes, assessment criteria is fully aligned.	

Assessment PART II

ISO PDCA Phase:		DO				
ADDIE Step(s):		DESIGN, DEVELOPMENT & IMPLEMENTATION				
Best-Practice Criteria		**Evaluation Questions:**	**Assessment:**			**Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:**
Delivery			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	Effective Implementation	Is the training delivery implemented with effective upskilling/reskilling/new skills development for supervisors and trainers to enable mining modernisation?	No, the training delivery does not provide effective upskilling, reskilling or new skills development.	The training delivery does provide some upskilling, reskilling or new skills development.	Yes, the training delivery does provide effective upskilling, reskilling and new skills development.	
	Latest Changes in Processes	Does the curriculum include latest changes in equipment/machinery/hardware maintenance processes?	No, the curriculum does not include the latest changes in equipment or machinery or hardware maintenance processes.	The curriculum includes some changes in equipment or machinery or hardware maintenance processes, but its not the latest.	Yes, the curriculum includes the latest changes in equipment and machinery and hardware maintenance processes.	
PEOPLE	Learner Engagement	Are learners actively engaged in interactive (practical and theory) training sessions?	No, learners are not engaged in interactive training.	Learners are only engaged in parts of the training.	Yes, learners are engaged in interactive training.	
	Support Mechanisms	Are there support mechanisms in place to guide learners to relearn new behaviours/unlearn old behaviours during the training?	No support mechanisms are in place to guide learners.	Very few support mechanisms are in place to guide learners.	Yes, support mechanisms are in place to guide learners.	
PRODUCT/OUTPUT	Effective Training Methods/Materials	Is the training delivered as planned, using appropriate blended methods, modalities and relevant modernisation materials/equipment?	No, the training was delivered, but not as planned.	The training was delivered as planned for the most part, but there is still some aspects that needs improvement..	Yes, the training was delivered as planned.	
	Effective Facilitation	Does the faculty have the necessary capacity, capability, qualifications and competence to deliver the modernisation content and address learner new skills needs?	No, the faculty does not have the necessary capacity or capability to deliver.	The faculty does have some of the necessary capacity or capability to deliver.	Yes, the faculty does have the necessary capacity and capability to deliver.	

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Assessment PART III

ISO PDCA Phase:	CHECK
ADDIE Step(s):	EVALUATION

Best-Practice Criteria		Evaluation Questions:	Assessment:			Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:
Review			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	Continuous Progress Monitoring & Evaluation	Is the training regularly monitored and evaluated to ensure they are meeting the identified skills demands and industry needs as well as to update the training?	No system in place to continuously monitor, update and review the training.	There is only a manual system in place to monitor, update and review the training.	Yes, there is a system in place to continuously monitor, update and review the training.	
	Feedback Collection	Is feedback from learners and stakeholders systematically collected during the training - to review the curriculum to address modernisation skills needs?	No feedback from learners and stakeholders is collected during the training.	Limited feedback from learners and/or stakeholders is collected during the training.	Yes, feedback from learners and stakeholders is systematically collected during the training.	
	Pre- versus Post-Assessments	Are learners' skills assessed before and after the training to determine new skills/upskilling and reskilling needs?	No, learners' skills are not assessed before and after the training to determine new skills/upskilling and reskilling needs.	Learners' skills are assessed before and after the training, but not to determine new skills/upskilling and reskilling needs.	Yes, learners' skills are assessed before and after the training to determine new skills/upskilling and reskilling needs.	
	Training Outcomes Evaluation	Are the training outcomes evaluated against the predefined modernisation/technology use/ upskilling/reskilling objectives?	No, the training outcomes are not evaluated against the predefined modernisation/technology use/ upskilling/reskilling objectives.	The training outcomes are evaluated, but not against the predefined modernisation/technology use/ upskilling/reskilling objectives.	Yes, the training outcomes are evaluated against the predefined modernisation/technology use/ upskilling/reskilling objectives.	
	Support and Reinforcement Mechanisms	Post upskilling/reskilling/new skills development, are there mechanisms in place to support effective application on the job?	No, there are no mechanisms in place to support effective application on the job.	There are very few mechanisms in place to support effective application on the job.	Yes, there are mechanisms in place to support effective application on the job.	
	Application Barrier Strategies	Post upskilling/reskilling/new skills development, are there remedial/reinforcement strategies offered?	No, there are no remedial/reinforcement strategies offered.	There are very few remedial/reinforcement strategies offered.	Yes, there are remedial/reinforcement strategies offered.	
	ROI Consideration	Was a ROI percentage considered for the modernisation training programme - towards reskilling/upskilling/new skills development of supervisors and trainers to benefit mine modernisation?	No, a ROI percentage was not considered for the modernisation training programme.	An outcome was desired/considered for the modernisation training programme, but no ROI percentage specifically.	Yes, a ROI percentage was considered for the modernisation training programme.	
PEOPLE	Knowledge Retention	Does the curriculum allow for the learners ability to retain and deploy the skills acquired over time (e.g. after 5 months)?	No, the curriculum does not allow for the learners ability to retain and deploy the skills acquired over time.	The curriculum allows for limited ability by the learners to retain and deploy the skills acquired over time.	Yes, the curriculum does allow for the learners ability to retain and deploy the skills acquired over time.	
	Application of New Skills	Are the learners enabled to apply the skills gained from the training on job or in the training of workers/communities?	No, the learners are not enabled to apply the skills gained from the training on job or in the training of workers/communities.	The learners are able to apply some of the skills gained from the training on job or in the training of workers/communities.	Yes, the learners are enabled to apply the skills gained from the training on job or in the training of workers/communities.	
	Behaviour Change	Would the reskilling/upskilling and new skills development allow for observable behaviour changes of supervisor and trainers?	No, the reskilling/upskilling and new skills development does not allow for observable behaviour changes.	The reskilling/upskilling and new skills development allows for limited behaviour changes.	Yes, the reskilling/upskilling and new skills development does allow for observable behaviour changes.	
	Workplace Transference	Is the training transferred to the workplace setting effectively to skill them to deliver modern training/ supervise in the modern mining landscape?	No, the training was not transferred to the workplace setting effectively.	The training is transferred to the workplace setting, but not to skill them to deliver training/supervise in the modern mining landscape.	Yes, the training is transferred to the workplace setting effectively.	
PRODUCT/OUTPUT	Content Relevance	Does the learner evaluation allow for learners to evaluate the training content with relevance to their job roles and responsibilities, and skills needed to deliver training/ supervise in the modern mining landscape?	No, the learner evaluation does not allow for learners to evaluate the training content with relevance to their job roles and responsibilities.	The learner evaluation allows for learners to evaluate the training content, but not with relevance to their job roles and responsibilities.	Yes, the learner evaluation does allow for learners to evaluate the training content with relevance to their job roles and responsibilities.	
	Conducive Learning Environment	Is the training environment conducive to learning (e.g., comfortable, well-equipped, with modern machines technologies availed for learning)?	No, the training environment is not conducive to learning.	The training environment is somewhat conducive to learning, but not with modern machine technologies.	Yes, the training environment is conducive to learning.	
	Safe Performance Improvements	Does the training lead to improvements in the individual's skill to deliver training/ supervise in the modern mining landscape to support organisational safe performance?	No, the training does not lead to improvements to support organisational safe performance.	The training lead to improvements, but not specifically to support organisational safe performance.	Yes, the training does lead to improvements to support organisational safe performance.	
	Productivity/Efficiency	Does the training contribute to increased efficiency due to improved skills to deliver training/ supervise in the modern mining landscape?	No, the training does not contribute to increased efficiency.	The training only contributes somewhat to increased efficiency.	Yes, the training does contribute to increased efficiency.	
	Tangible Benefits	Does the training yield tangible benefits, such as improved safe production, a better skilled workforce, upskilled supervisors and trainers as a result of the training?	No, the training does not yield tangible benefits.	The training does yield benefits, but not tangible.	Yes, the training does yield tangible benefits.	

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Assessment PART IV

ISO PDCA Phase:		**ACT**				
ADDIE Step(s):		**EVALUATION**				
Best-Practice Criteria		**Evaluation Questions:**	**Assessment:**			**Recommended action to close the identified gap or change a weakness into a strength or take advantage of an opportunity to improve:**
Continuous Improvement & Future Foresight			**NO** (Strong Weakness)	**Partially** (Weakness)	**YES** (Strength)	
PROCESS	Action Planning	Are specific actions planned or implemented to address gaps or areas for improvement?	No specific actions planned or implemented to address gaps or areas for improvement.	Specific actions planned and implemented, but not to address gaps or areas for improvement.	Yes, specific actions are planned and implemented to address gaps or areas for improvement.	
	Sustainability Measures	Are measures in place to ensure future foresight in the training/ curriculum to support mining industry sustainability and its modernisation imperative?	No measures in place to ensure future foresight in the training/ curriculum.	Some/limited measures in place to ensure future foresight in the training/ curriculum.	Yes, measures are in place to ensure future foresight in the training/ curriculum.	
PEOPLE	Performance Assessment	Will the performance of the faculty be assessed to identify further gaps and areas for improvement (modernisation skills/ competence/ qualifications)?	No, the performance of the faculty will not be assessed to identify further gaps and areas for improvement.	The performance of the faculty will be assessed, but not to identify further gaps and areas for improvement.	Yes, the performance of the faculty will be assessed to identify further gaps and areas for improvement.	
	Stakeholder Feedback	Will the feedback from learners and stakeholders be integrated into the enhancement of the training/ curriculum to reskill/ upskill/ provide new skills to supervisors and trainers?	No, feedback from learners and stakeholders are not integrated into the enhancement of the training/ curriculum.	Feedback from learners and stakeholders are measured, but not integrated into the enhancement of the training/ curriculum.	Yes, feedback from learners and stakeholders are integrated into the enhancement of the training/ curriculum.	
	Commitment to Change	Are faculty willing and committed to continuously deliver a modern mining curriculum focused on reskilling/ upskilling and new skills development?	No, the faculty is not willing and committed to delivery of a modern mining curriculum.	The faculty is somewhat willing and committed to delivery of a modern mining curriculum.	Yes, the faculty is willing and committed to delivery of a modern mining curriculum.	
PRODUCT/OUTPUT	Curriculum Validation	Will the curriculum be validated by cross-referencing with the latest industry performance data, best practices, industry trends and stakeholder feedback?	No, the curriculum review will not be validated.	The curriculum review will be validated, but not by cross-referencing.	Yes, the curriculum review will be validated by cross-referencing.	
	Future Skills Identification	Will the faculty skills and competence requirements be assessed, and faculty given capacity development to support future skills demands?	No, the faculty skills and competence requirements will not be assessed.	The faculty skills and competence requirements will be assessed, but the faculty will not be given capacity development.	Yes, the faculty skills and competence requirements will be assessed, and faculty given capacity development to support future skills demands.	