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Strategies for cultivating and sustaining a strong health and safety culture in the mining sector

Fleckson Magweregwede (Centre of Excellence Manager: Mine Health and Safety Research)

Coal Day of Learning: Practices and technologies to tackle falls of ground

Ukhozi Lodge, Secunda

5th of June 2025

Every mine worker returning from work unharmed every day. Striving for zero harm in our lifetime.

Presentation outline

- MHSC mandate, structure and research
- SAMI journey to zero harm
- Opportunities for breaking the plateau in mine health and safety (MHS) performance
- Health and safety (HS) culture
- Guidance on cultivating a strong HS culture
- Conclusions

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MHSC mandate



Vision: Zero Harm to Mine Employees and Communities Affected by Mining Activities.



Mining Employees

- ❖ Zero fatalities
- ❖ Elimination of injuries
- ❖ Elimination of occupational diseases
- ❖ Safety and security of women

Mining Communities

- ❖ Reduction in complaints
- ❖ Minimise negative impact on communities as a result of mining activities



Organised Labour

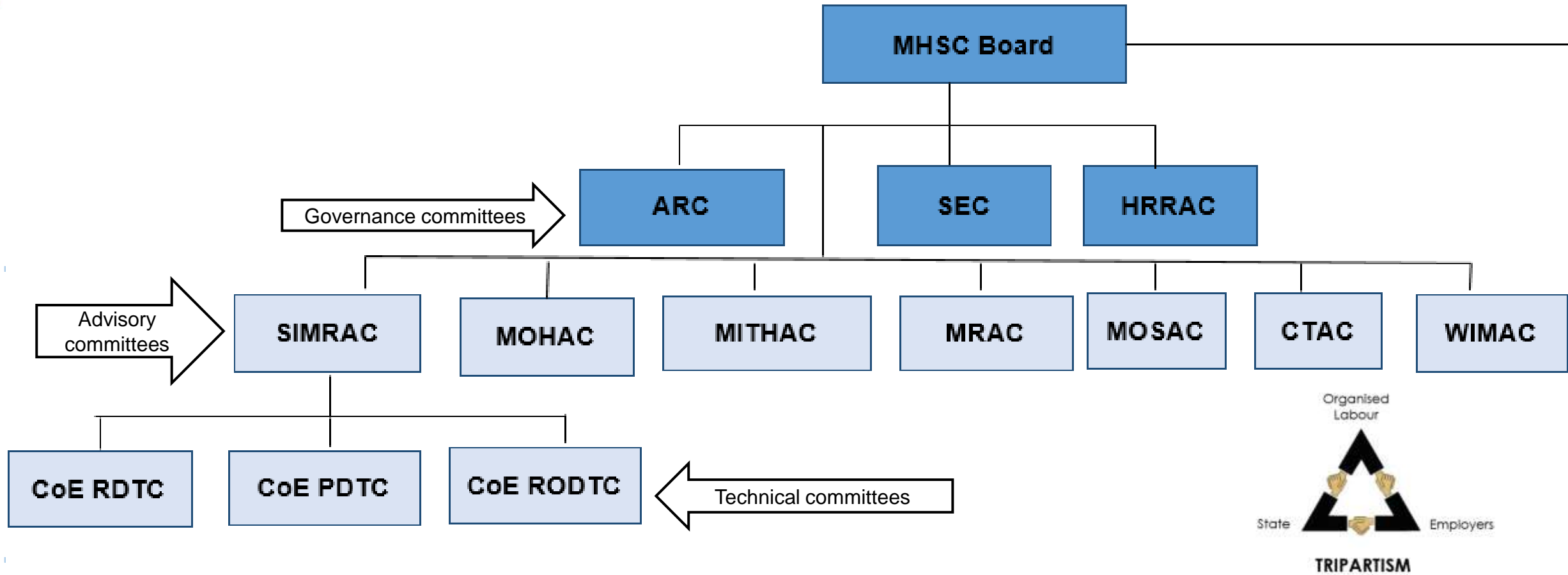
State

Employers

Biennial review of the state of health and safety in the SAMI through the Mine Health and Safety Tripartite Summit.

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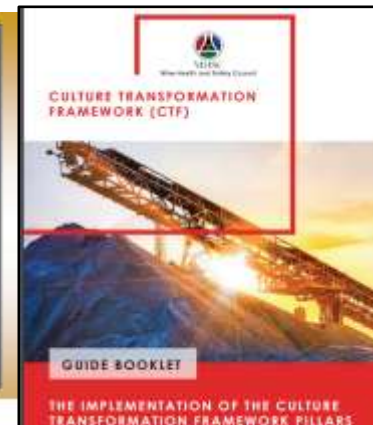
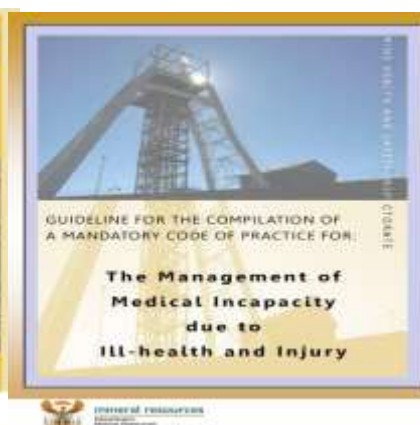
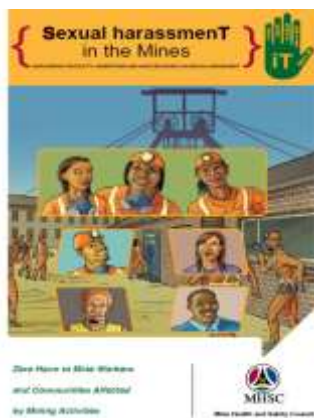
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MHSC research outcomes: Knowledge Generation

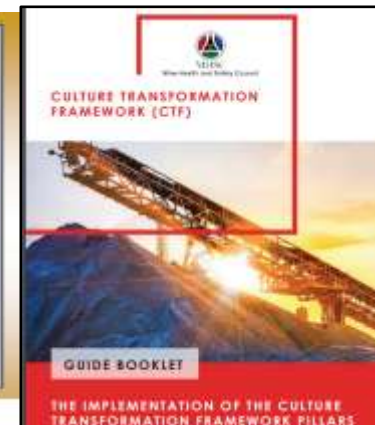
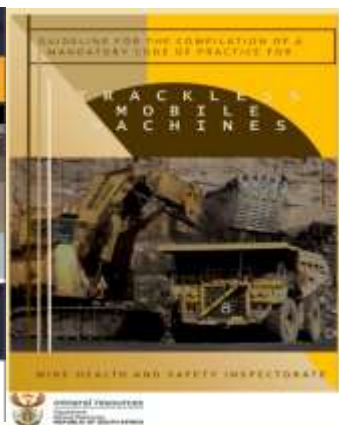
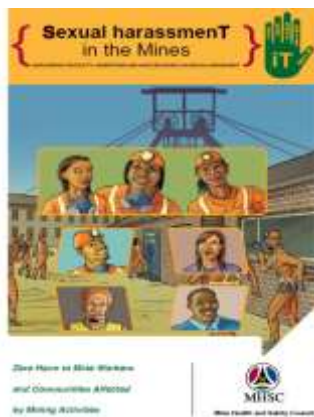
- MHSC research outcomes have assisted the mining sector to eliminate/reduce occupational fatalities, injuries and diseases resulting from agencies such as falls of ground, transport & machinery systems, explosions & fires and occupational exposures.
- MHSC research have generated some knowledge that have advanced MHS practice in South Africa and globally.
 - Books/handbooks in focus areas such as rock engineering, safety, ergonomics, occupational health and hygiene.
 - Culture transformation framework (CTF) - Promoting a culture of HS in the SAMI.
 - Training and awareness material (banners, pamphlets, posters, videos, etc).
 - Improving health, safety and security of WIM.



Research outcomes - Technology Development

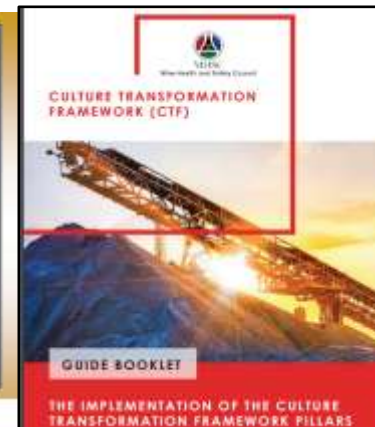
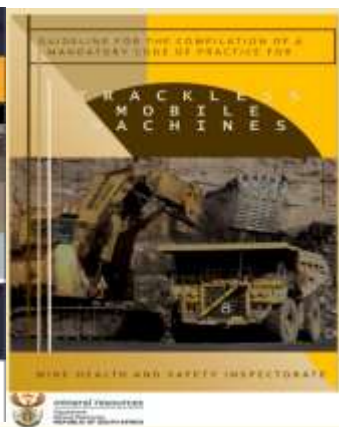
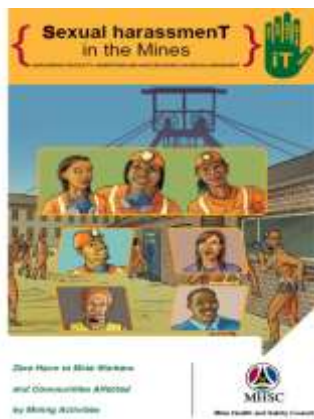
- **Innovations Triggered by Research include:**

- Development of support methodologies, design criteria, systems and technologies to mitigate rockbursts and falls of ground (nets with bolts, preconditioning, numerical modeling, etc.)
- Rock mass condition assessment tools [thermal imaging and acoustic device - Integrated Thermal Acoustic Device (ITAD)]
- Enhanced ventilation and dust suppression technologies.
- Bagged Stone Dust Barrier
- Missing person locator systems



Research outcomes: Regulations, Guidelines and Policy

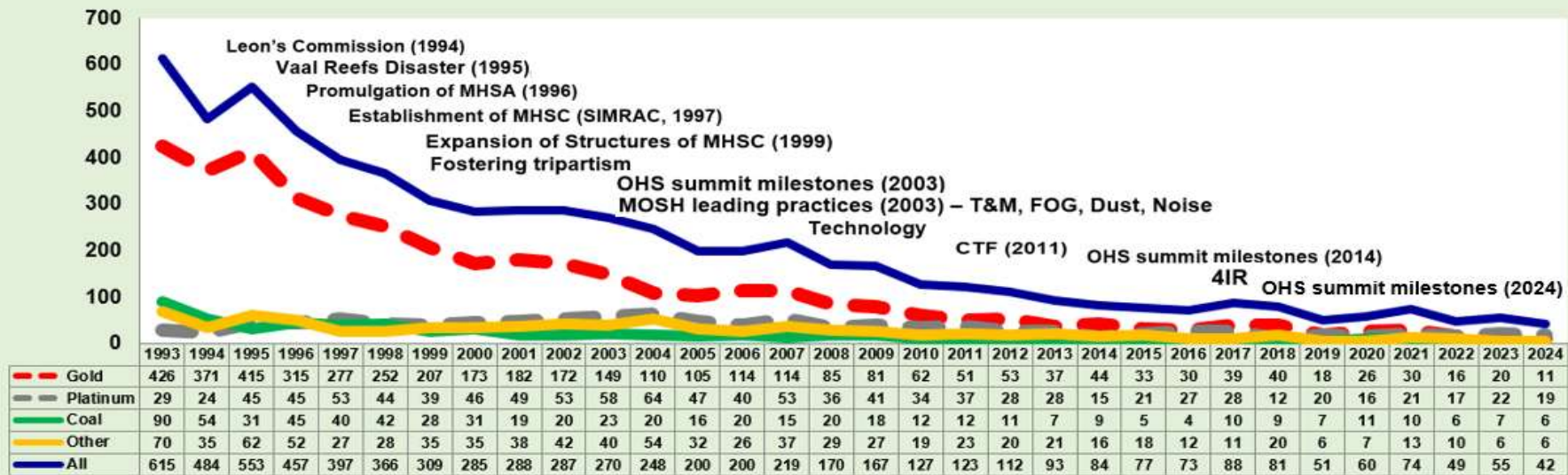
- MHSC research could recommend some improvements to the MHS legislative framework:
 - Reviewing existing legislation.
 - Developing new legislation.
- Examples of regulations include refuge bays, explosives, electrical, trackless mobile machines, etc.
- Examples of guidelines include cyanide management, PPE for WIM , Safety and security for WiM, underground rail-bound equipment, management of medical incapacity due to ill health and injury, etc.
- MHSC research could recommend regulatory changes to promote the adoption of technology that assist the mines to improve the management of MHS risks:
 - TMM regulations - CPS (Chapter 8) – promulgated.
 - Amendments to the Chapter 16 regulations: underground mine and surface mines with slope failure risk to implement missing person locator systems – promulgated
- Potential guidelines from ongoing MHSC research include Cannabis and Preconditioning



SAMI journey to zero harm

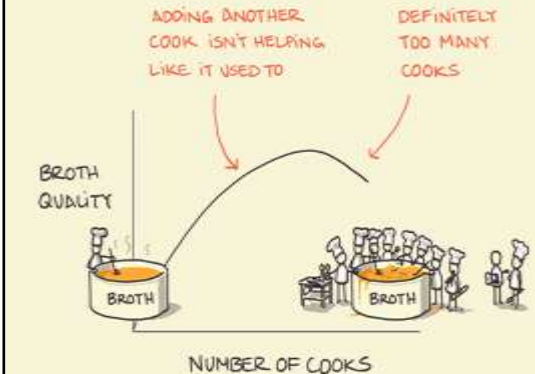
- Significant strides made in improving HS conditions in the SAMI.
- However, HS performance improvements have **plateaued** over the past decade **vs** the industry target of **Zero Harm**.
- **Law of diminishing returns** post implementation of interventions such as legislation, collaboration, HS summit milestones, research outcomes, leading practice, etc?
- A **paradigm shift** is required to initiate step changes in HS improvements.

Fatalities by Commodity



LAW OF DIMINISHING RETURNS

AT SOME POINT MORE OF THE SAME STOPS PAYING OFF



Sketchplanations

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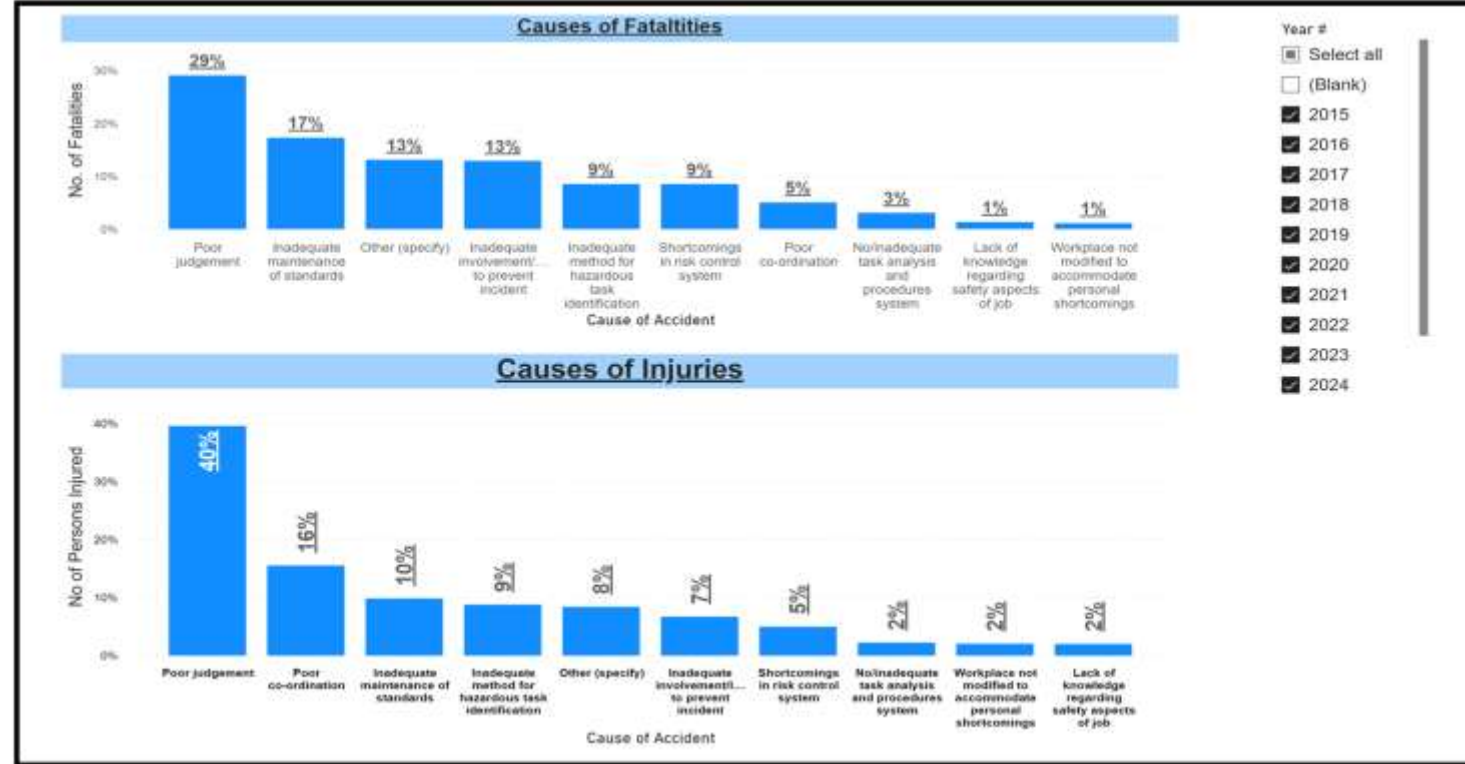
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Causes safety accidents in the SAMI

Causes of causality accidents: 2019 - 2024



Causes of fatalities and injuries : 2015 - 2024

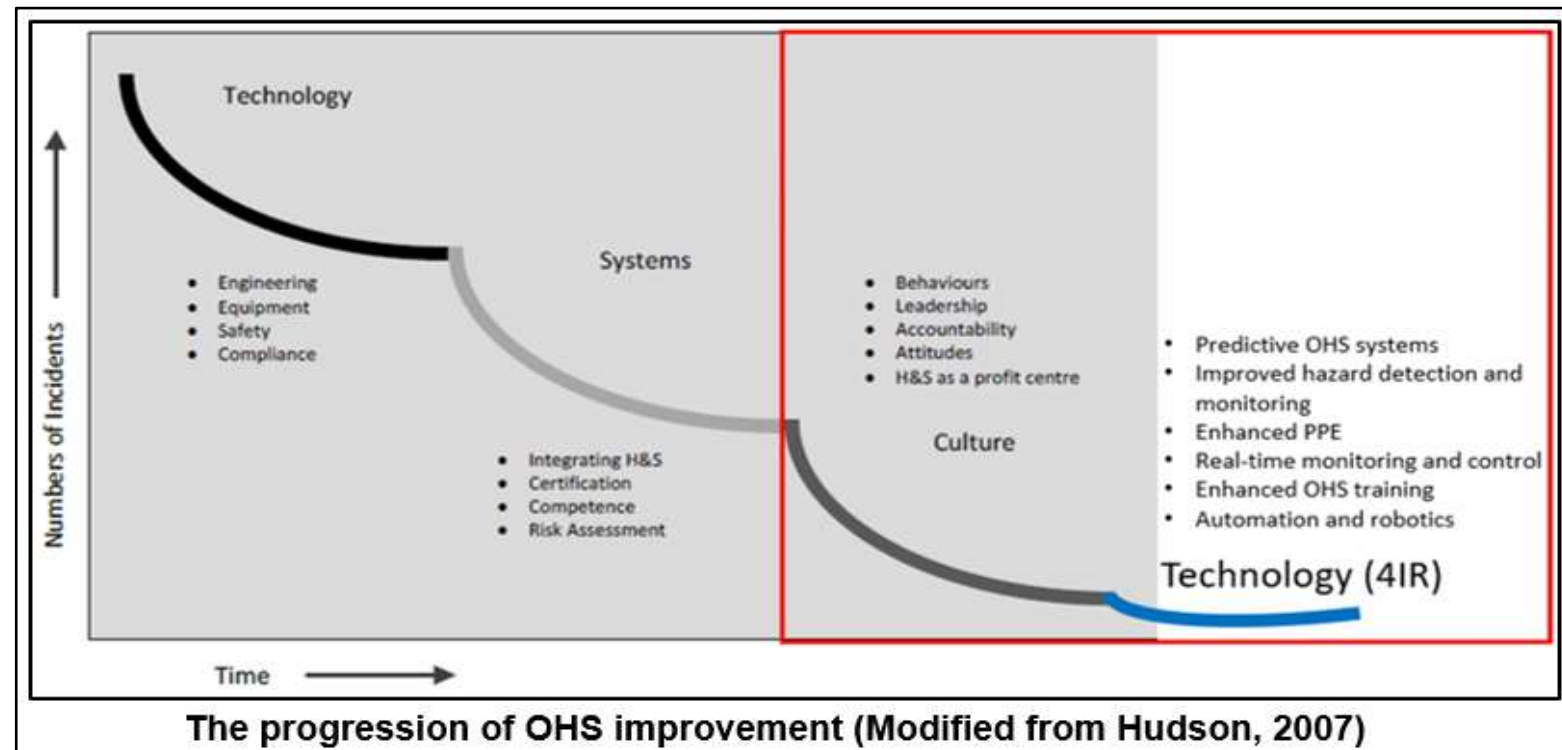


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Breaking the plateau

- Opportunities to break the plateau in MHS performance include the **adoption of technology (including 4IR technologies)** and the cultivation and sustaining of a strong HS culture.
- Technology and 4IR technologies will assist the SAMI across the entire HS risk management value chain including identifying, assessing and controlling the risks.



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Breaking the plateau: systematic HS management

- Human factors can be defined as “a range of issues including the perceptual, physical and mental capabilities of people and the interactions of individuals with their jobs and working environments, the influence of equipment and system design on human performance and those organisational characteristics which influence safety-related behaviour at work” (Stranks, 2007).
- Human factors are the leading cause of most HS incidents, contributing between 70% and 95% (Rimington, 1989; Ikin, 2015; Simpson & Widdas, 1992 and Barnes, 1993).
- Effective HS management should holistically consider interactions between the working environment, OHSMS, and the organisation and its people.

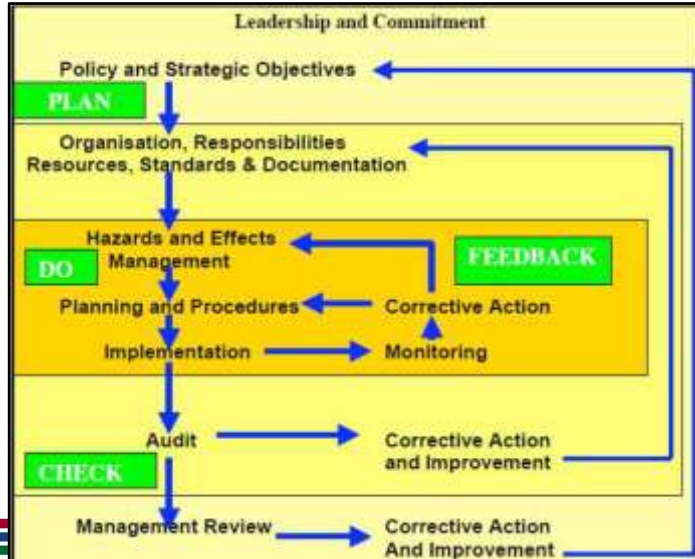
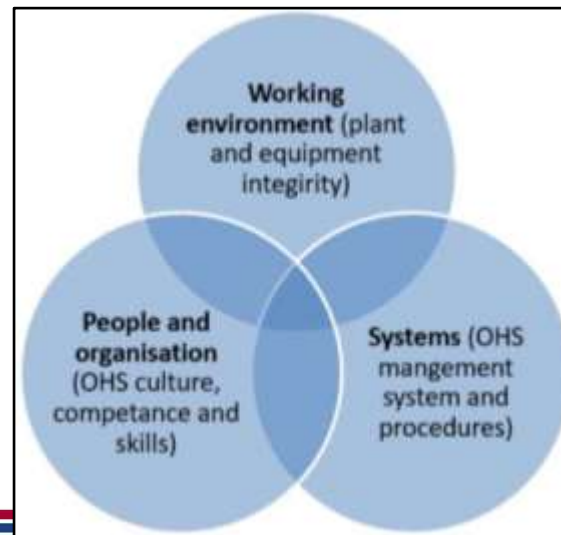
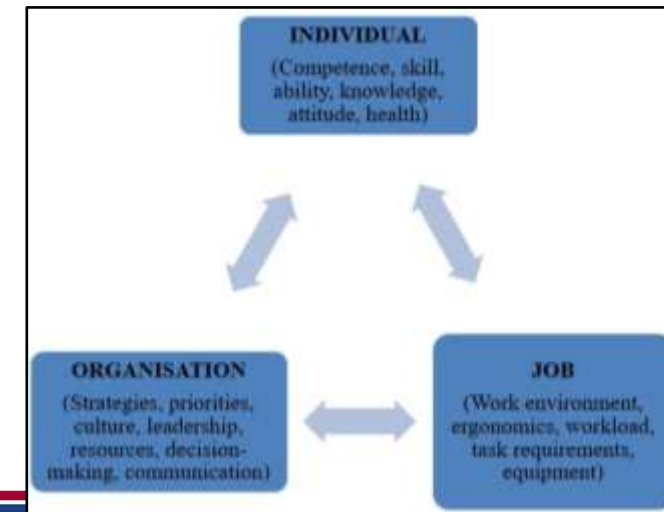


Illustration of generic OHSMS (Hudson, n.d.)



Systematic approach in HS management (IOSH, 2015)



Holistic consideration of human factors elements (Ikin, 2015)

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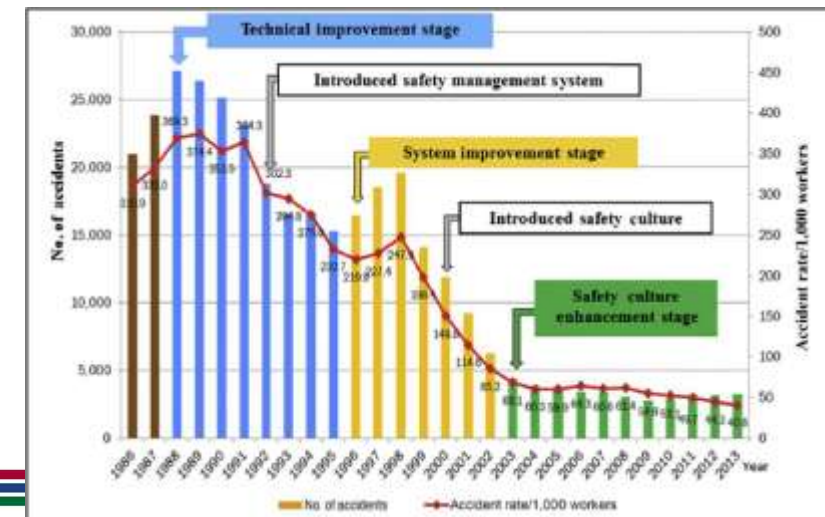
Breaking the plateau: Cultivating strong HS culture

HS culture definitions:

- Culture in which in which HS is valued in the concerns of all people at all levels within an organisation (Hudson, 1999).
- Companies' atmosphere in which HS is understood to be the number one priority (Mohammadfam et al. (2013).
- The 'engine' that drives the organisation towards the goal of sustaining the maximum resistance towards HS hazards Reason (1998)
- Combination of shared values, beliefs, feelings, attitudes and perceptions that determine the approach and commitment to HS management (IOSH, 2015; ICS, 2013; MHSC, 2005; HSC, 1993; Stranks, 2007).
- An emphasis on HS culture is particularly important when HS performance improvements have plateaued – eg the introduction and enhancement of HS culture in the employers, workforce and at community level in Hong Kong markedly improved HS performance in the construction industry (Kim et al., 2016).



Features of a positive HS culture (Reason, 1997)



Accident statistics of the construction industry in Hong Kong (Kim et al., 2016)

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The growing significance of cultivating a strong HS culture

- There is increasing recognition of the role of HS culture as a key enabler of sound HS management:
 - The MHSA aims to promote a culture of HS in the mining industry.
 - One of the MHSC mandates is to promote a culture of HS in the mining sector.
 - One of the 2024 Mine Health and Safety Summit milestones aims to promote cultivation of a strong HS culture through the implementation of the HS culture transformation framework.



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The value proposition for cultivating and sustaining a strong HS culture

- The prevailing HS culture determines the company's approach to HS management, HS values, attitude towards HS, HS risk appetite and HS risk tolerance.
- Research evidence: sustainable management of HS requires a combination of appropriate technical interventions, sound OHSMS and a positive HS culture.
- Sound management of HS is a shared value and matter of enlightened self-interest for all stakeholders: all the individuals will benefit from improved HS and wellbeing, whilst the business in its totality benefits from improved sustainability and viability.
- Research evidence: companies with positive HS culture and high-performance work ethic have better HS performance, low labour turnover, low absenteeism, high productivity and more profitability.
- Additional benefits of effective HS management include reduced production disruptions, increased revenue, increased shareholder value, improved social corporate responsibility and reduced insurance costs, worker's compensation costs and emergency response costs.
- Poor HS culture could result in poor HS performance and associated negative consequences such as bad corporate image, poor productivity, production stoppages, wastage of time and resources, and negative socio-economic impacts on employees and families.

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HS culture assessment

- HS culture is a critical driver of HS performance that should continuously be monitored, evaluated and improved.
- HS culture is assessed using techniques such as focus group discussions (FGDs), in-depth interviews (IDIs) and HS culture surveys with representative participants drawn from all levels of the organisation.
- HS culture evolution models such as DuPont Bradley Curve, Westrum's model, Hudson's model and Keil Centre Safety Culture Maturity Model (SCMM) are used to determine the prevailing HS culture.
- The effectiveness of the HS culture surveys could be enhanced by publicising the purpose and providing anonymity assurance and timeous feedback on the outcomes of the surveys to all people within the organisation.
- A holistic understanding of the prevailing HS culture provides insights into the gaps within the OHSMS and the effectiveness of the HS culture improvement programmes, thus facilitating the preparation of an informed HS culture improvement strategy.
- The outcome from the HS culture survey could be compared against HS culture evolution models to determine the prevailing HS culture.

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HS culture evolution stages

Item	HS culture evolution stage	Key characteristics
1	Reactive HS culture	<ul style="list-style-type: none"> Lack of management support Inadequate OHSMS, HS processes and programs Changes are usually made after HS incidents
2	Dependent HS culture	<ul style="list-style-type: none"> Culture of command and control Management commitment and ownership to HS Compliance is driven by the fear of punishment Comprehensive and adequate OHSMS, HS rules and procedures All people are held accountable for HS performance Availability of programmes to continuously improve OHS competency and behaviour
3	Independent HS culture	<ul style="list-style-type: none"> Ownership and commitment to HS by all people HS is valued at personal level and employees consistently care for their own HS
4	Interdependent HS culture	<ul style="list-style-type: none"> There is no hierarchy on HS matters There is mutual ownership and accountability on HS by all stakeholders All the people walk the extra mile from caring about their personal HS to caring about other people's HS There is a culture of care and teamwork, going beyond behaviour-based HS



DuPont Bradley Curve (adapted from DuPont, 2020)

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Guidance on cultivating a strong HS culture

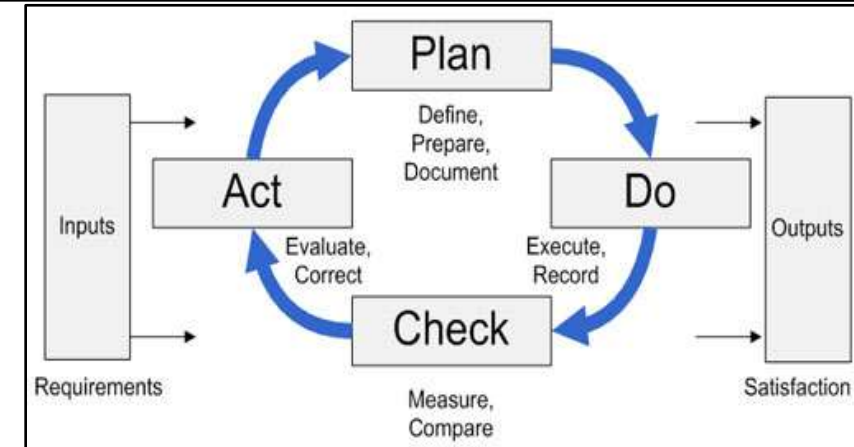
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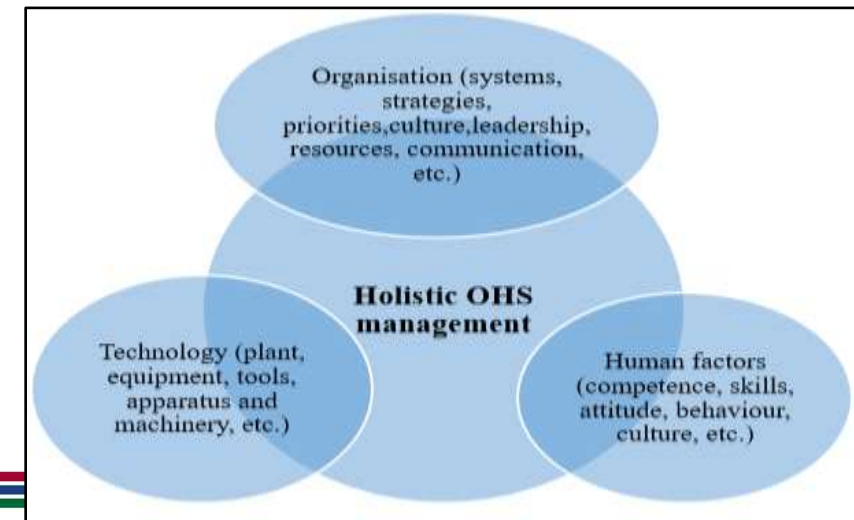
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Establishing occupational health and safety management systems (OHSMS)

- Establishment and implementation of an appropriate and adequate OHSMS is the departure point of sound HS management and subsequent cultivation of positive HS behaviour and culture.
- An OSHMS is an effective tool for meeting the organisation's SH goals, ensuring compliance with relevant HS regulations, constantly improving HS performance, proactively and effectively managing HS risks and learning from HS incidents.
- OHSMS are based on different international standards such as ISO 45001, OHSAS 18001, HSG65 and ILO-OSH 2001.
- Most of these OHSMS guidelines are aligned to the PDCA systematic management and continuous improvement model.
- The effectiveness of the OHSMS could be enhanced by adopting a holistic approach to HS management.
- The effectiveness of the OHSMS could be improved by factors such as robust HS risk management, collaborative approach on HS matters, adequate technical measures, state-of-the-art maintenance practices, good housekeeping, providing adequate resources, creating a conducive working environment, availability of user-friendly standard operating procedures and embracing culture of compliance.



PDCA management model (adapted from IOSH 2014)



Holistic approach to HS management (adapted from IOSH, 2015 and Kim, 2015)

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Effective HS risk management

- The main objective of OHSMS is to effectively manage HS risks to protect the workforce from injuries, fatalities, and occupational diseases.
- HS risk management is a key component of the OHSMS and includes identifying, assessing, and mitigating risks.
- HS risk management is foundational for a successful OHSMS and drives continuous improvement in HS culture and performance.
- To enhance the effectiveness of risk management, it is essential to empower all stakeholders to effectively manage HS risks through interventions such as high-impact training and coaching.
- Additional strategies include conducting mandatory pre-task risk assessments, involving all stakeholders, and holistic consideration of socio-economic factors like fatigue and diversity.
- The Mining Industry Occupational Safety and Health (MOSH)'s Triggered Action Response Plan (TARP) is an effective tool for risk management (risk identification and subsequent triggering of a remedial action).
- TARP ensures that each HS risk is escalated to the level of responsibility that is required to deal with that risk in terms of the definition of the process [Green (minor risk) , Yellow (moderate risk), Red (high risk)]
- Section 23: The Right to Refuse Dangerous Work (RRDW) and Right to Leave Dangerous Working Place (RLDWP) is an integral part of the effective HS risk management.
- Shared understanding of the level of risk = no contention on Sections 23, 54, 55, etc.= **If it is not safe to mine, we will not mine**

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Learning from HS incidents

- Lessons learnt from internal and industry-wide HS incidents, could assist organisations to put in place mitigation measures to prevent recurrences of similar incidents.
- It is important to create a conducive environment and approaches to encourage all people to freely report all HS incidents (including near misses).
- The establishment of a comprehensive HS database could assist companies to draw some insights from the data and develop evidence-based strategies to progressively improve HS performance.
- The reporting of HS incidents could be improved by approaches such as educating all employees, popularising the significance of reporting all HS incidents and adopting a just culture on apportionment of blame.
- The reporting of HS incidents could also be improved by the use of performance indicators and incentive systems that encourage the reporting of HS incidents (e.g. measure process accomplishments such as percentage of positive behaviour observations and number of risk assessments conducted, rather than outcomes such as number of fatalities and injuries).
- Striking a balance in the apportionment of blame is critical: a culture of blame could hinder HS incident reporting, whilst an absolutely blameless culture could promote a culture of non-compliance and at-risk behaviour.
- Prompt and impartial investigation of all HS incidents, and implementation of corrective measures from HS audits and incident investigation could result in continuous improvement of HS performance and culture.
- The use of independent and experienced HS incident investigation teams could improve the effectiveness and credibility of the HS incident investigation system.

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HS leadership

- All levels of HS leadership should play a critical role in cultivating and sustaining positive HS culture within all stakeholders.
- Securing commitment, buy-in and support from all levels of leadership on HS matters is essential for continuous improvement of HS.
- Leadership buy-in and commitment could be secured by publicising HS vision, goals, values and strategy, and outcomes of the cost-benefit analysis of maintaining and sustaining zero harm.

HS leadership category	Examples of roles for different levels of HS leadership
Top leadership	<ul style="list-style-type: none"> • Defining HS values, vision, strategy, goals and desired HS culture • Creating an environment where HS is regarded as a first priority that should never compete with other performance indicators such as productivity and costs • Incorporating HS activities in all operational aspects of the business • Providing adequate resources (time, budget, and expertise) • Developing incentive systems and performance metrics that drive zero harm and good HS behaviour • Providing adequate, competent and credible HS leadership at all levels • Making HS management a line management responsibility and outlining clear HS roles and responsibilities at all levels • Mandating all levels leadership to walk the zero harm talk, and fostering a culture of trust, open communication and collaboration on HS issues • Making all levels of leadership accountable for HS performance and nurturing the desired HS behaviour and culture • Making all people accountable for HS performance. This could be enhanced by incorporating HS performance into KRAs of all people • Aligning the organisational structure to HS management strategy
Top HS leadership committee	This should comprise representation from the individual mines and will be responsible for championing the development and implementation of HS policy and strategy
All levels of leadership	<ul style="list-style-type: none"> • Active participation in HS matters • Walking the zero harm talk • Cultivating a culture of compliance and enforcing compliance to HS provisions • Nurturing the desired HS behaviour and culture in all stakeholders • Providing timeous and clear communication on HS issues
HS practitioners	<ul style="list-style-type: none"> • Offering technical advice about sound HS management practices • Identifying opportunities for continuous HS improvement
HS representatives	<ul style="list-style-type: none"> • Identifying, investigating, resolving and escalating HS concerns • Assisting the front line workforce to effectively manage HS risks • Assisting with identification of opportunities for continuous improvement of HS
Zero harm committee	<p>The committee is responsible for championing continuous HS improvement initiatives and proactive HS risk management. The composition of the committee could be as follows:</p> <ul style="list-style-type: none"> • Chaired by a senior manager in order to expedite decision making and enhance buy-in from senior management • A dedicated HS practitioner should be appointed to provide secretarial and technical advice to the committee • Comprise representation from front line supervisors and workforce. This could boost a sense of ownership on the HS improvement initiatives from all levels and also foster effective collaboration on HS management

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Fostering effective collaboration on HS matters

Cultivating and sustaining a positive HS culture requires a collaborative approach, embracing adequate consultation, engagement and active participation of all stakeholders on all HS matters. Advantages include:

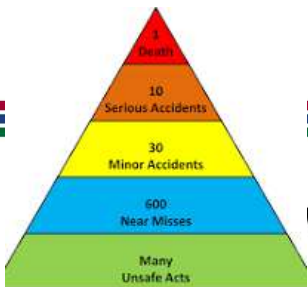
- Improving buy-in and commitment of all stakeholders on HS matters.
- Enhancing holistic understanding of the HS challenges faced at the workplace at different levels within the organisation.
- Enhancing HS culture, work ethic and communication with the crews, resulting in improved HS risk management and HS performance.

Objective	Examples of best practices of enhancing collaboration on HS
Stakeholder commitment, buy-in and ownership on HS matters	<ul style="list-style-type: none"> • Defining the collaboration criteria and creating time for engagement • Effective communication on HS matters such as HS values, goals, improvement initiatives, and individual HS roles and responsibilities. It is critical to ensure that the executors and agents for change (workforce) have a comprehensive understanding of all HS matters • Having clearly defined HS responsibilities for all people • Empowering all people to take charge of their personal and other people's health and safety, both at work and community levels • Strengthening stakeholder alignment on HS issues • Effective consultation and engagement of all stakeholders on HS matters • Fostering team work, high performance work ethic and culture of compliance to all HS provisions • Creating a favourable environment to encourage all the stakeholders to voluntarily, freely and openly participate in HS matters • Appointing influential members within the workforce into the zero harm committee • Making HS matters a standing agenda item for all meetings and having regular HS meetings
Creating a favourable environment for effective participation on HS matters	<ul style="list-style-type: none"> • Embracing core values of respect, care, dignity, confidence, trust and equality at all levels • Establishing innovative ways to deal with undesirable sector legacies such as autocratic leadership styles, trust deficit, poor labour relations, racism, illiteracy and language barriers • Providing decent and conducive work environment • Use of incentive systems and performance metrics that drive the right HS behaviour and culture
Empowering all people to effectively manage HS	<ul style="list-style-type: none"> • High impact training and refresher courses • Visible felt leadership (VFL) and coaching • Dissemination of HS information through platforms such as workshops, HS meetings and HS talks could strengthen the workforce's vigilance and awareness on HS matters
Effective communication on HS matters	<ul style="list-style-type: none"> • Develop and implement an effective communication strategy that ensures all stakeholders timeously receive accurate and tailored HS information and feedback • Embrace two-way communication, thus affording an opportunity for all people to raise HS concerns and suggest recommendations for continuous improvement of HS. This could enhance the collaborative culture, and keep all stakeholders motivated and updated on HS issues • Promote sharing of HS information and best practices at industry level through platforms such as regional tripartite forums, MOSH process, workshops, seminars and field visits

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Cultivating the desired HS behaviour

- The prevailing HS culture within a particular organisation is the product of individual HS cultures.
- To cultivate the desired HS culture, it is critical to nurture the required HS behaviour and culture within individuals.
- Cultivating the desired HS behaviour at all levels within the organisation could reduce the prevalence of unsafe acts and non-compliance to HS requirements, resulting in continuous improvement of HS performance and establishment of a strong HS culture.
- Practices that could assist to cultivate and sustain the required HS behaviour include:
 - Making use of incentives that drive positive HS behaviour such as HS prizes, HS awards and timeous celebration of HS accomplishments.
 - Making use of performance metrics that drive positive HS behaviour such as inclusion of a significant HS component into performance contracts of all the people.
 - Implementation of programmes designed to continuously monitor and cultivate the right HS behaviour such as behaviour based safety (BBS) observations, visible felt leadership (VFL), and regular coaching and mentoring.
 - Introducing mandatory HS risk tolerance and HS behaviour screening, and intensive HS induction for all new entrants into the mining sector could assist to maintain the desired HS behaviour.



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Improving HS through technological innovation

Adoption of technology will result in improved HS, productivity, and efficiencies, reduced operating costs, creation of alternative economies and employment opportunities, and development of new skills for mine employees. Opportunities for improving HS include:

- **Predictive HS systems** – mining companies can use 4IR technologies such as big data analytics, ML, AI, smart sensors, cloud computing, location positioning devices and IoT to predict the likelihood of occurrence of potential HS incidents. This will assist the mines to timeously implement the necessary corrective actions to prevent the occurrence of HS accidents.
- **Improved hazard detection and monitoring** - technological developments have enabled the development of hazard detection and monitoring systems that can quickly identify potential HS risks in the workplace. This will enable the mines to address these issues before they escalate and pose a threat to the HS of mineworkers.
- **Enhanced personal protective equipment (PPE)** – recent technological innovations have significantly improved the effectiveness of PPE. Smart PPE, such as connected hard hats, safety glasses, and gloves, can monitor worker fatigue, and stress levels, providing real-time data that can help employers address potential HS concerns before they result in accidents or injuries.
- **Remote monitoring and communication** – the use of technology such as drones, global positioning system (GPS) tracking, and two-way radios have enabled mining companies to remotely monitor employee HS and HS conditions in hazardous or hard-to-reach locations.
- **Automation and robotics** will significantly improve HS by reducing the need for the workforce to perform dangerous tasks in hazardous environments.
- **Enhanced HS training methods** – technologies such as VR and AR have revolutionised workplace HS training, allowing employees to experience realistic simulations of potentially hazardous situations without putting themselves at risk. Immersive training methodology can help workers develop a better understanding of the HS risks they may encounter and the appropriate safety measures they should take.

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Internal and external factors that could obstruct the establishment of a positive HS culture

- Comprehensive HS management, including cultivating and sustaining a positive HS culture, should holistically consider both internal and external factors that could obstruct the establishment of a strong HS culture.
- The cultivation of a positive HS culture could be negatively impacted by factors such as prevailing national HS culture and socio-economic issues.
- The socio-economic factors include fatigue, stress, nepotism, genderism, racism, tribalism, corruption, factionalism, favouritism, abuse of powers and other forms of discrimination.
- Adverse socio-economic conditions could predispose the employees to psychological distress and HS incidents.
- To cultivate and sustain a strong HS culture, it is important to cultivate a positive HS culture at a societal level.
- If the majority of people in the society practice risky HS behaviours such as not following the road traffic rules, it could be difficult for these people to sustainably practice good HS behaviour at workplaces.
- Thus, sustainable HS management could be enhanced if HS is embraced by all people as a value at societal level.

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Conclusions

- Attaining zero harm is a journey which is long, windy and bumpy.
- Through interventions such as tripartism (collaboration), legislation, and implementation of research outcomes, technology, best/leading practices and CTF, huge progress has been made in reducing fatalities in the SAMI: about **615 in 1993 vs 42 fatalities in 2024**.
- Systematic HS management, cultivating and sustaining a strong HS culture, and adoption of technology offer an opportunity to break the plateau and initiate step-change improvements in HS.
- The process of cultivating positive HS culture is gradual, demanding, and complex: The process requires proper planning, nurturing, change management strategy and holistic approach.



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