Benchmarking the “Status of safety”: Safety Risks, Practices and Beliefs in Developing Countries

Researchers: Daniela Andrei, Mark Griffin, Lena Wang & Weng-Khong Choe
School/Centre: Accelerated Learning Laboratory
University/Institutions: The University of Western Australia

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Key countries: Mongolia, Zambia, Kenya, Gambia, Nigeria, Ivory Coast and Indonesia
Completion: February 2014

Research aims: The aim of this Action Research was to:
- Identify the risks, practices and beliefs in mining-related companies across developing countries
- Identify which areas require targeted training interventions and provide initial benchmarks that can be used by regulators and training agencies

For further information on this action research:
Contact person: Mark Griffin
mark.griffin@uwa.edu.au

IM4DC
Action Research Report

www.im4dc.org
Benchmarking the “Status of safety”: Safety risks, practices and beliefs in developing countries

The purpose of this research was to gather information about the risks, practices and beliefs in companies across developing countries engaged in mining or associated activities. This information can then be used to identify areas of safety that require targeted training interventions as well as providing initial benchmarks that can be used by regulators and training agencies.

National cultures vary greatly in their support for practices that improve safety and in their beliefs about the way individuals contribute to safety. The types of risks faced by workers in the mining industry also vary from country to country. These differences have implications for the type of training interventions that are likely to be effective in different cultural contexts.

Data was collected using the International Safety Survey, a survey that assesses 17 distinct factors contributing to safety at the individual, team and organisational level. Surveys were completed by 776 respondents from seven different countries: Mongolia, Zambia, Kenya, Gambia, Nigeria, Ivory Coast and Indonesia. Respondents came from various levels within organisations, with 51.2% of respondents being operational staff who worked onsite and 46.9% working in non-operational roles (e.g. supervisory, managerial or administrative positions).

The results from the survey showed respondents from all countries identified a large number of risks as being present in their worksite. Besides the most common risks present in the mining sector in Western countries, a number of risks specific to mining in developing countries were also identified, such as: hygiene and sanitation, poor working conditions and the adequacy of safety equipment and protocols.

At the individual level, participants tended to believe safety was important. However, individuals generally tended to comply with safety requirements more than they actively participated and promoted safety in the organisation. At the organisational level, highest rated subscales were related to perceptions of overall organisational vision and values oriented towards safety. Contrastingly, the lowest rated subscales were related to tangible safety outcomes, suggesting there is a disconnect between perceived attitudes toward safety and actual safety in the workplace.

Two broad sets of recommendations were outlined in this report and elaborated upon in the Executive Summary:

1. To investigate mechanisms for extending and embedding information about safety in developing countries so that the present database of information can be developed to provide more comprehensive, representative, and practical insights into country needs
2. To incorporate country-level insights about safety practices and beliefs into current training programs
Benchmarking the “Status of safety”: Safety risks, practices, and beliefs in developing countries

ALL@UWA Team Members Involved in This Report:
Dr Daniela Andrei
Prof. Mark Griffin
Dr Lena Wang
Weng-Khong Choe

International Collaborators Involved in this Report:
Prof. François Azoh
George Banda
Prof. Denis Dagou
Prof. Hazel Gachunga
Uvie Iginí
Alieu Jawo
Beza Mwanza
Nyamstend Nyandag
Modou Panneh
Revi Timora Salajar
Wasis Sriyadi

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1 EXECUTIVE SUMMARY

National cultures vary greatly in their support for practices that improve safety and in their beliefs about the way individuals contribute to safety. The types of risks faced by workers in the mining industry also vary from country to country. These differences will have implications for the type of training interventions that are likely to be effective in different cultural contexts.

The purpose of this research was to gather information about the risks, practices and beliefs in companies across developing countries engaged in mining or associated activities. This information can then be used to identify areas of safety that require targeted training interventions as well as providing initial benchmarks that can be used by regulators and training agencies.

Data was collected using the International Safety Survey – a survey that assesses 17 distinct factors contributing to safety at the individual, team and organisational level. Surveys were completed by 776 respondents from seven different countries: Mongolia, Zambia, Kenya, Gambia, Nigeria, Ivory Coast and Indonesia. Respondents came from various levels within organisations, with 51.2% of respondents being operational staff who worked onsite and 46.9% working in non-operational roles (e.g. supervisory, managerial or administrative positions).

The results from the survey showed respondents from all countries identified a large number of risks as being present in their worksite. Besides the most common risks present in the mining sector in Western countries, a number of risks specific to mining in developing countries were also identified such as: hygiene and sanitation, poor working conditions and the adequacy of safety equipment and protocols.

At the individual level, participants tended to believe safety was important. However, individuals generally tended to comply with safety requirements more than they actively participated and promoted safety in the organisation. At the organisational level, highest rated subscales were related to perceptions of overall organisational vision and values oriented towards safety. Contrastingly, the lowest rated subscales were related to tangible safety outcomes, suggesting there is a disconnect between perceived attitudes toward safety and actual safety in the workplace.

Two broad sets of recommendations were outlined in this report:

1. To investigate mechanisms for extending and embedding information about safety in developing countries so that the present database of information can be developed to provide more
comprehensive, representative, and practical insights into country needs.

2. To incorporate country-level insights about safety practices and beliefs into current training programs.

Elaborating on these two broad sets, recommendations for the overall safety content are:

- safety and its management should be top concerns and priorities for the development of sustainable mining in developing countries;
- future interventions around safety should focus less on the values level and more on how to build organisational systems and practices able to convey managerial values and mission and to support individual safety values;
- to support the IM4DC networks of alumni towards collecting or recording systematics data in their countries to create opportunities to better understand the main issues and offer adequate support within countries;

Concerning the Education and Training Program, our recommendations are:

- that IM4DC and/or training providers contracted by IM4DC actively investigate similarities and differences among participant countries as part of the development phase of the training programs;
- trainees can be taught how, each from their own position could disseminate knowledge and help instil those organisational practices that build a strong safety culture;
- we recommend the incorporation of the individual level into the training programs as change is accelerated when people are more aware of their own personal style or behaviours and how they relate to other outcomes;
- we recommend IM4DC educational programs to consider the scores discussed for each country as specific training needs in the area of health and safety management;

The main recommendations for the Action Research program were:

- to support further data collection to incorporate new countries and new areas of interest for IM4DC;
- to advocate and support cross cultural designs like the present one to reach to country representative samples;
- to support research that is attempting to extend common theories and practice to include factors specific to each country as well as research employing an in-depth approach to the topic of their interest;
2 Project background

In the final quarter of 2012, the Accelerated Learning Laboratory @ UWA (ALL@UWA) worked closely with IM4DC to develop, deliver, and evaluate an Occupational Safety and Health (OSH) training and development program for the International Mining for Development Centre (IM4DC). Participants in this training course came from 10 different priority countries, namely: Algeria, The Gambia, Ghana, Indonesia, Kenya, Mongolia, Nigeria, Peru, Uruguay, and Zambia.

During the training course the participants showed interest in safety issues and many reported the lack of safety data beyond incidents and accidents for their country. As some of the Return to Work Plans revolved around the need to obtain such data, the ALL@UWA team decided to start discussions around a possible cross-cultural survey on safety beliefs, practices and risks. The overall purpose for this action was to provide a tool that would be useful to all the countries involved, that trainees and others could easily use and that could provide an opportunity to analyse results and compare with other developing countries.

The design of the survey started before the OSH training course ended and trainees were able to provide feedback on the first draft. After the course ended, the application for an Action Research Grant was funded by IM4DC and efforts to finalize the survey were continued. The project team at the ALL@UWA who were involved in developing the research design included: Winthrop Professor Mark Griffin who was overseeing this action research and was heavily involved in the design of the research and data collection tool; Dr. Lena Wang who wrote the grant application and contributed to the overall design; PhD Student Andrew Chapman who was the contact person for all alumnae, kept the network active and helped finalizing the survey; PhD Student Zenobia Talati who also worked on the survey tool; Dr. Daniela Andrei who took over the project management of this grant starting February 2013, and supervised the data collection, data analysis and reporting; and MSc Student Weng-Khong Choe who was responsible for data-basis integration, data analysis and report writing as part of a placement requirement of his Master’s program in Industrial/Organisational Psychology.

At the same time, we tried to remain in contact with our alumni throughout the entire process, as the research was designed entirely around their capabilities of data collection in their countries. Regular emails were sent to inform all alumni of the stages we were at in regards to the research design and survey development. When all approvals were obtained we reiterated
the invitation for all alumni to be involved in this research as collaborators. Some of the alumni were responsive and became involved in the research straight away; some remained unresponsive despite several follow-up emails. A collaboration agreement was signed with all collaborators and available funds for research assistance were sent into each collaborators account to facilitate data collection.

The OSH alumni group who became involved in the International Safety Research included: Prof. Hazel Gachunga from Kenya, who was also involved in the overall design of this research and was a strong supporter of our efforts within the alumni network; Mrs. Uvie Igini from Nigeria; Mr. Alieu Jawo and Mr. Modou Panneh from The Gambia; Mr. Beza Mwanza and Mr. George Banda from Zambia; Mr. Nyamstend Nyandag from Mongolia; Mr. Revi Timora Salajar and Mr. Wasis Sriyadi from Indonesia.

As less than eight countries were committed to this research, we also tried to look for possible collaborators inside our own academic networks. As a result, several professors from different developing countries which were of interest for IM4DC were contacted and explained the purpose of this research. Out of these, researchers from two countries indicated interest in taking part in this research: Professor François Azoh and Professor Denis Dagou from Ivory Coast and Professor Abdelkarim Belhaj from Morocco. Unfortunately, data collection in Morocco was not possible due to the fact that the mining companies did not allow access to our collaborators for data collection, and the companies who allowed data collection were outside the mining and associated industries. But we have developed a strong collaboration with Prof. François Azoh and Prof. Denis Dagou which led to the inclusion of Ivory Coast into this comparative research.

Overall, at this point the report is based on data coming from 7 development countries. As we were turned down in Morocco and had no news regarding the stage of data collection in Peru, we have made efforts to attract new collaborators from the 2014 OSH training course. We have already started to work with a team of researchers from the Philippines and we are confident we will collect more data from this country in the beginning of 2014. Also, the tool was presented to all trainees in the 2014 OSH course and all were offered assistance in data collection in exchange of sharing the resulting data. We hope that very soon more countries will take over this tool and we will be able to obtain more data about the status of safety in these countries.
3 AIMS OF ACTION RESEARCH

3.1 Research aims

National cultures vary greatly in their support for practices that improve safety and in their beliefs about the way individuals contribute to safety. For example, procedures for reporting near misses to supervisors might be easily integrated within a more collectivist culture but might meet resistance where there are strong beliefs about hierarchies and power. The risks also vary greatly in different mining environments. These differences have major implications for the type of training interventions that are likely to be effective in different cultural contexts.

Therefore, the aim of this action research was to gather information about risks, practices and beliefs in companies across developing countries engaged in mining or associated activities.

Data coming from this research will be used to deliver a “Status of Safety” that documents major risks, current practices used to manage safety and people’s beliefs about safety. This report provides excellent input for program delivery by IM4DC as well as valuable planning and regulatory information for, but not restricted to, participant countries.

It is important to learn more about differences in safety understanding across developing countries and about the variability in safety practices at the local level. The research is a unique opportunity to build on current links with IM4DC participants and develop systematic knowledge about the kinds of practices and beliefs that influence mine safety. Our main concerns were to identify areas of specific need in the participating countries and provide initial benchmarks that can be used by regulators and training agencies.

But at the same time, we are aware this research is just an initial step for a longer-term process that is needed in order to collect systematic data about safety practices. This initial step will provide an overall picture of the status of safety and, ideally, it will be followed by more in-depth research designs in each country that will be able to further contribute to our understanding of these issues in developing countries.

3.2 Research methods and measures

3.2.1 Participants

There were 776 total respondents from seven different countries: Mongolia, Zambia, Kenya, Gambia, Nigeria, Ivory Coast and Indonesia. The number of
respondents per country ranged from 80 to 164. Of the 776 respondents, 51.2% worked in operational roles, 22.4% in supervisory roles, 13% in managerial roles and 11.5% in administrative roles. Full demographic information about country and job-level of respondents can be found in Table 1 below.

<table>
<thead>
<tr>
<th>Country</th>
<th>Total</th>
<th>Operational (%)</th>
<th>Supervisory (%)</th>
<th>Managerial (%)</th>
<th>Administrative (%)</th>
<th>Not Specified (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>164</td>
<td>64.6% (106)</td>
<td>5.5% (9)</td>
<td>3% (5)</td>
<td>22% (36)</td>
<td>4.9% (8)</td>
</tr>
<tr>
<td>Zambia</td>
<td>106</td>
<td>33.0% (35)</td>
<td>36.8% (39)</td>
<td>28.3% (30)</td>
<td>0.9% (1)</td>
<td>0.9% (1)</td>
</tr>
<tr>
<td>Kenya</td>
<td>84</td>
<td>48.8% (41)</td>
<td>32.1% (27)</td>
<td>14.3% (12)</td>
<td>3.6% (3)</td>
<td>1.2% (1)</td>
</tr>
<tr>
<td>The Gambia</td>
<td>80</td>
<td>47.5% (38)</td>
<td>32.5% (26)</td>
<td>13.8% (11)</td>
<td>5.0% (4)</td>
<td>1.3% (1)</td>
</tr>
<tr>
<td>Nigeria</td>
<td>106</td>
<td>43.4% (46)</td>
<td>37.7% (40)</td>
<td>13.2% (14)</td>
<td>5.7% (6)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>136</td>
<td>64.7% (88)</td>
<td>5.1% (7)</td>
<td>7.4% (10)</td>
<td>19.9% (27)</td>
<td>2.9% (4)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>100</td>
<td>43% (43)</td>
<td>26% (26)</td>
<td>19% (19)</td>
<td>12% (12)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>Overall</td>
<td>776</td>
<td>51.2% (397)</td>
<td>22.4% (174)</td>
<td>13.0% (101)</td>
<td>11.5% (89)</td>
<td>1.9% (15)</td>
</tr>
</tbody>
</table>

A total of 84 different companies were included in the survey. The number of companies in each country ranged from 6 to 26. The number of respondents per company ranged from 1 to 50 (mean = 9.2).

Figure 1 below displays the industries represented in the total sample and the percentage of respondents working in that industry. Table 2 provides a detailed breakdown of industries represented in the sample for each country.
Benchmarking the “Status of Safety”

Figure 1

Industries Represented in the Total Survey Sample

Table 2

Breakdown of Industries Represented in Each Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Mining</th>
<th>Construction</th>
<th>Oil and Gas</th>
<th>Manufacturing</th>
<th>Power Utility</th>
<th>Not Specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>98.8% (162)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.2% (2)</td>
</tr>
<tr>
<td>Zambia</td>
<td>78.3% (83)</td>
<td>20.8% (22)</td>
<td></td>
<td></td>
<td></td>
<td>0.9% (1)</td>
</tr>
<tr>
<td>Kenya</td>
<td>71.4% (60)</td>
<td></td>
<td></td>
<td>11.9% (10)</td>
<td>15.5% (13)</td>
<td>1.2% (1)</td>
</tr>
<tr>
<td>The Gambia</td>
<td>67.5% (54)</td>
<td>16.3% (13)</td>
<td>15.0% (12)</td>
<td></td>
<td></td>
<td>1.3% (1)</td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
<td></td>
<td>58.5% (62)</td>
<td>41.5% (44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>47.8% (65)</td>
<td>50.7% (69)</td>
<td></td>
<td></td>
<td></td>
<td>1.5% (2)</td>
</tr>
<tr>
<td>Indonesia</td>
<td>93% (93)</td>
<td>1% (1)</td>
<td>6% (6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>66.6% (517)</td>
<td>21.5% (167)</td>
<td>8.0% (62)</td>
<td>1.3% (10)</td>
<td>1.7% (13)</td>
<td>0.9% (7)</td>
</tr>
</tbody>
</table>

All countries provided varied samples with surveys being filled in by employees of many different companies that vary in industry and in size. Although the proportions of small and large companies vary across countries, the trend in our sample was that there were fewer surveys from very small companies and most respondents were employed by medium to large companies. Figure 2 shows the percentage of respondents employed by companies of varying sizes. Table 3 provides a country-by-country breakdown of company size information.
This information suggests that the findings of this survey would be more representative of safety attitudes, beliefs and behaviours in larger companies, but not necessarily smaller companies.

Figure 2

Proportion of Responses from Different Sized Companies
Table 3

Breakdown of Company Size Demographics by Country

<table>
<thead>
<tr>
<th>Country</th>
<th>1-50</th>
<th>50-100</th>
<th>100-200</th>
<th>200-500</th>
<th>500-1000</th>
<th>&gt;1000</th>
<th>Don’t Know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>6.7%</td>
<td>12.2%</td>
<td>13.4%</td>
<td>30.5%</td>
<td>12.2%</td>
<td>20.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Zambia</td>
<td>8.5%</td>
<td>2.8%</td>
<td>4.7%</td>
<td>17.0%</td>
<td>17.9%</td>
<td>38.7%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Kenya</td>
<td>2.4%</td>
<td>15.5%</td>
<td>23.8%</td>
<td>15.5%</td>
<td>40.5%</td>
<td>2.4%</td>
<td>2.4%</td>
</tr>
<tr>
<td>The Gambia</td>
<td>2.5%</td>
<td>13.8%</td>
<td>70%</td>
<td>8.8%</td>
<td>2.5%</td>
<td>2.6%</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td>13.2%</td>
<td>51.9%</td>
<td>14.2%</td>
<td>20.8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>8.1%</td>
<td>3.7%</td>
<td>5.1%</td>
<td>28.7%</td>
<td>35.3%</td>
<td>0.7%</td>
<td>18.3%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>18%</td>
<td>3%</td>
<td>34%</td>
<td>6%</td>
<td>36%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>8.4%</td>
<td>5.7%</td>
<td>24.7%</td>
<td>18.0%</td>
<td>15.2%</td>
<td>21.9%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

3.2.2 Measures

Data was collected using a survey that measured factors contributing to safety at the individual, team and organisational level. The survey was divided into three major sections: Risks, Individual Factors and Organisational Factors.

3.2.2.1 Risk Factors

The Risk Factors section is comprised of three subscales: Risk likelihood, Risk severity and Risk assessment. The Risk likelihood and Risk severity subscales are derived from theories of risk perception. Both subjective expected utility theory (Edwards, 1954) and expectancy-value theory (Feather, 1959; Fishbein & Ajzen, 1975) propose that the likelihood of taking precautions against a risk is related to the perceived likelihood of that risk occurring and the perceived severity of that risk.
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Risk Likelihood

Two items assessed individuals’ perceptions of risk likelihood in their worksite. These items were “How likely is it that there will be a serious accident (such as a fatality or an irreversible disability/health effect) in your workplace” and “How likely is it that you will be personally affected by a serious accident in your workplace”. Individuals responded on a five-point scale ranging from “Not at all” (1) to “Extremely” (5).

Risk Severity

Four items sought to assess the perception of risk severity, if there was to be a serious accident in the workplace. Individuals were asked the severity of both short and long-term consequences for their workplace and also for them personally. Example items included “How severe would the short term consequences be for the workplace” and “How severe would the long term consequences be for you personally”. Individuals responded on a five-point scale ranging from “Not at all” (1) to “Extremely” (5).

Risk Assessment

The risk assessment subscale consisted of 13 hazards that had been identified as the most common industry hazards in the mining sector. Individuals were asked to answer “Yes” if the hazard was a risk of injury to themselves in the workplace, “No” if the hazard exists but does not provide a risk of injury to them personally and “N/A” if the hazard does not exist in their workplace. Some examples of hazards were “Working with vehicles”, “Falling objects” and “Ground failure, cave-ins, etc. (geo-technical)”. There were also 3 spaces for open-ended responses where respondents were able to list additional hazards that they believed were not covered.

3.2.2.2 Individual Factors

Four subscales were targeted at measuring safety factors on an individual level: Safety Beliefs, Work Attitudes, Work Responses and Safe Working. For each of these subscales, individuals responded on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Safety Beliefs

The safety beliefs subscale consisted of 5 items that assessed an individual’s beliefs about the importance of safety in their workplace. Items included items such as “Safety is more important than production”, “I have time to work safely” and “Safety is my responsibility”.

Work Attitudes

The work attitudes subscale consists of 12 items that are derived from the Work Motives Scale (Johnson, Chang, Meyer, Lanaj & Way, 2013). The Work
Motives Scale measures an individual’s approach and avoidance motivation in the workplace. Approach motivation guides behaviour toward positive objects and possibilities. In contrast, avoidance motivation guides behaviour away from negative objects and possibilities. Individuals with high approach motivation tend to focus more strongly on positive stimuli while individuals with high avoidance motivation tend to focus more strongly on negative information and stimuli.

Of the 12 items, 6 measured approach motivation. Examples of these items include “My goal at work is to fulfil my potential to the fullest in my job” and “In general, I tend to think about the positive aspects of my work”. The other 6 items measured avoidance motivation. Examples of these items include “I am focused on failure experiences that occur while working” and “I am fearful about failing to prevent negative outcomes at work”.

Work Responses

The work responses subscale consisted of 5 items taken from the Error Orientation Questionnaire by Rybowiak, Garst, Frese and Batinic (1999). The 5 items relate to how an individual tends to think about errors that occur in the workplace. Example items include “After I have made a mistake, I think about how it came about” and “After a mistake has happened, I think long and hard about how to correct it”.

Safe Working

The safe working subscale consists of 8 items from Neal, Griffin and Hart (2000). The first four items assessed individual compliance with safety procedures. Example items are “I carry out my work in a safe manner”, and “I ensure the highest level of safety when I carry out my job”. The second four items assessed the extent which individuals participated in safety related activities. Example items are “I voluntarily carry out tasks or activities that help to improve workplace safety”, and “I help my co-workers when they are working under risky or hazardous conditions”.

3.2.2.3 Organisational Factors

Ten subscales measured factors contributing to safety in the organisation itself: Safety Rewards, Safety Vision, Safety Learning, Safety Vigilance, Management Values, Communication, Training, Safety Systems, Physical Work Environment and High Performance Safety Systems. Responses to all the subscales, except for High Performance Safety Systems, were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Safety Climate Scales
Four subscales were derived from a study by Neal, Griffin and Hart (2000) into safety climate in organisations. Sixteen total items assessed perceptions of safety within the organisation, specifically: management values, communication, training, and safety systems. Example items include “Management is concerned for the safety of individuals”, “There is open communication about safety issues within this workplace”, “Safety issues are given high priority in training programs”, and “Safety procedures and practices are sufficient to prevent incidents occurring”. Responses were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

**Safety Rewards**

Four items measured the perception of how well safety was integrated and rewarded into the work systems of the organisation. Example items include “Safety is integrated effectively into all reward and feedback systems” and “All teams understand how they contribute to the safety process”. Responses were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

**Safety Vision**

The safety vision subscale consists of four items measuring attitudes to safety throughout the organisation. Example items include “Safety is an inspiring part of the work environment” and “Responsibility for safety is owned by all employees”. Responses were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

**Safety Learning**

The safety learning subscale consists of 4 items and is based on theories of error orientation (Rybowiak, Garst, Frese & Batinic, 1999) and seeks to measure the extent to which organisations are seeking to improve and update their safety systems based on past experiences, such as near misses. Example items include “Near misses are valued as an opportunity to learn” and “Information derived from monitoring is analysed and acted upon”. Responses were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

**Safety Vigilance**

The safety vigilance subscale consists of four items that measure how alert to risks people within the organisation are. Examples items include “People at all levels of the organisation are alert for risks to safety”, and “Monitoring for safety is comprehensive across all organisational role and functions”. Responses were recorded using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).
Physical Work Environment

Three items measured the perceived safety of the physical work environment in the organisation. Respondents rated the following statements on a 5-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree): “There are sufficient dangers inherent in the workplace”, “The physical work environment is safe”, and “Employees are frequently exposed to risky situations”.

High Performance Safety Systems

Based on past research into high performance work systems and occupational safety, 15 high performance safety systems were identified that are theoretically and empirically associated with occupational safety. These items asked the respondent whether their organisation had a particular system in place. Respondents were required to tick a box to indicate that their organisation had those systems in place. Items in this scale included “Employing a safety officer”, “Prioritise safety over productivity”, “Conduct regular safety assessments”, and “Have a system through which you can report safety related concerns”.

3.2.3 Procedure

After the survey tool was developed, it was sent to each collaborator for data collection.

Three countries needed translated versions: Ivory Coast, Mongolia, and Indonesia. The French translation for Ivory Coast was managed by the ALL@UWA team and we went through the usual procedure of: independent translation, comparison, back-translation of the final version into English, comparison and finalization. The translation in Mongolian and Indonesian was managed by our collaborators in these two countries. The collaborators were instructed regarding the necessary translation procedures but due to unfamiliarity with the language we were not able to assist in this process. In the remaining countries data collection was done using the English version of the survey.

In order to collect data, each collaborator contacted several companies coming from mining and associated industries. The initial target was that in each country, at least 10 surveys in at least 10 companies should be collected. But due to difficulties in reaching this number of companies and the insufficient funding to cover trips to all companies in all countries, the number of companies included varied depending on the country and the costs associated to travelling to the mine sites. Collaborators were
instructed to collect more data in the companies they visited so as to compensate for the reduced number of companies.

The collaborators managed data collection independently. All the surveys were collected in paper and pencil format due to lack of resources for online data collection. Before filling in the survey, each participant was provided with an information sheet describing the aims of this research and the overall procedures and all gave informed consent to participate in this research. No identification data beyond country, company, location and level of job was collected from any of the participants, protecting their anonymity.

Collaborators were instructed to distribute surveys at all hierarchical levels in the company, where possible, and to comply with the Australian ethical guidelines for research data collection.

After completed surveys were collected, they were sent to ALL@UWA via mail. Some of the collaborators also managed data entry before sending the surveys; other surveys were entered in the data base by ALL@UWA team. The accuracy of data-entry was tested by the ALL@UWA team using a random sample of surveys from each country.

3.2.4 Data analysis and reporting approach

Before presenting the main results of this research, we must draw attention on some of its limits and the way they impact on our data analysis and reporting approach.

All samples in this research are convenience samples and are not representative for the entire countries that they come from, or for the mining and related industry in these countries. Our research collaborators worked with limited resources and each used pre-existent relationship with industries to collect data. As a result, the samples coming from these countries are very different in terms of number of companies and participants in each company, company type, and hierarchical levels represented and so forth. Also, some of our research collaborators are involved in mine inspections as part of their usual jobs and this might have induced an increased desirability effect on the collected data resulting in inflated means. Therefore, at this stage our ability to generalize data to the country level or to analyse the differences in means across countries is seriously limited.

As a consequence, throughout this report we de-emphasized the importance of mean differences among countries and whenever possible, we focused our report on the different rankings or patterns the variables we
measured take in each country. However, we could not completely avoid presenting means for the samples in each country, so whenever they are presented, please interpret them with caution and be remembered that they are not generalizable to the whole country and are only illustrative for the convenience sample that we used in the respective country.

All limits considered, we do believe that this research is an important step for starting to gain a more thorough understanding of safety issues related to mining in developing countries. And such an initial step is more so needed as safety data from these countries rarely, if ever, goes beyond incident and accident reports. It is our hope that this research will be followed up by more systematic data collection in these countries, but also in other developing countries, so that a comprehensive picture of safety and the factors that contribute to it can be created. Besides the great practical implications this could have for policy, interventions and training, it could also provide an opportunity for refining and extending the existing theory and knowledge in this area to more thoroughly address characteristics particular to such countries.

4 FINDINGS

4.1 Main risks faced by people working in mining and associated industries in each country

4.1.1 Pre-defined risks

The pre-defined risks section of the survey required participants to answer whether a hazard was present in their workplace and whether or not they were personally at risk from that hazard. From this section, the percentage of respondents identifying each risk as a hazard in their workplace was calculated. Figure 3 below shows the percentage of the total sample that identified each pre-defined risk as a hazard in their workplace. Of the 13 pre-defined risks, 9 exceeded 80% prevalence.

A country-by-country breakdown of risk prevalence can be found in the Appendix. The countries vary in terms of the frequencies and types of risks – this is to be expected due to different samples and different industry profiles. But it can be observed that the percentages are high for a lot of these risks for almost all of the countries (most of percentages exceed 75%) which could indicate a very risky working environment.
4.1.2 Risk Likelihood and Severity

The risk likelihood and risk severity subscales measured the perceived likelihood of a serious accident (such as a fatality, or an irreversible disability/health effect) occurring in the workplace and perceived severity of the risk on the respondent personally, and for the company. Participants rated items on a 5-point scale ranging from 1 (Not At All) to 5 (Extremely).

Mean scores for each subscale can be found in Table 4 below. The overall mean for Risk Likelihood was 2.985 while the mean for Risk Severity was 3.316. On an item-level, in the Risk Severity scale, there was no significant difference in reported severity of consequence to the individual (M = 3.30, SD = 1.18) and to the workplace (M = 3.34, SD = 1.16) if there were to be a serious accident.

The data on the prevalence of risks suggests that respondents can identify many hazards and risks inherent in the workplace. Overall, there is a perception that there is a moderate likelihood of serious accidents occurring in the workplace. Additionally, if a serious accident were to occur in the workplace, the consequences are perceived to be equally severe not only for the company, but also personally for the employees themselves.
Table 4

Mean ratings of Risk Likelihood and Risk Severity

<table>
<thead>
<tr>
<th>Country</th>
<th>Risk Likelihood</th>
<th>Risk Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mongolia</td>
<td>2.997</td>
<td>3.136</td>
</tr>
<tr>
<td>Zambia</td>
<td>2.788</td>
<td>3.460</td>
</tr>
<tr>
<td>Kenya</td>
<td>3.298</td>
<td>3.781</td>
</tr>
<tr>
<td>The Gambia</td>
<td>2.850</td>
<td>3.141</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2.875</td>
<td>3.327</td>
</tr>
<tr>
<td>Ivory Coast</td>
<td>2.901</td>
<td>3.289</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.245</td>
<td>3.228</td>
</tr>
<tr>
<td>Overall</td>
<td>2.985</td>
<td>3.316</td>
</tr>
</tbody>
</table>

4.1.3 Open ended questions

A total of 50 different risks were entered in the open-ended risks section by respondents. The frequency and types of risks reported in each country greatly differed but some risks were shared across multiple countries. Analysis of responses was conducted qualitatively using inductive content analysis (Elo & Kyngas, 2007).

A number of respondents cited severe climatic conditions such as high temperatures, heavy rain and flooding as hazards that affected those in their workplace. Noise and working in loud environments was also mentioned as a hazard by respondents from a number of countries. A review of occupational health hazards in mining (Donoghue, 2004) noted that noise is ubiquitous in mining and is generated by many mining-related activities such as drilling, blasting, conveying and oil processing. Donoghue notes that noise-related hearing loss is a common problem facing mine workers and the identification of this risk by respondents suggests that it is a problem faced by mine workers in a number of developing countries.

Thematically, there were issues raised about the adequacy of safety equipment and protocols. A respondent from Kenya stated that his worksite had a lack of emergency exits. One respondent from Zambia stated they worked with defective tools and equipment. Another response from Nigeria stated that workers often did not use their PPEs (personal protective equipment). This suggests that the risks, in terms of adequacy of equipment and whether or not workers tend to use that equipment are hazards that
are perhaps not adequately considered in some worksites in developing countries.

A number of respondents cited poor sanitation, consumption of unhygienic water and lack of food hygiene as hazards. This highlights that in developing countries, the risks that workers face are not only related to the nature of the job itself, but also may arise from the overall country sanitary conditions. This suggests that companies need to incorporate sanitation and hygiene into their safety strategy, in addition to industry-specific risks.

A number of respondents also cited risks related to their general work conditions. Risks such as long working hours, stress, pressure from bosses and ill pay conditions illustrate that there may be hazards present in workplaces that are not adequately captured by ‘traditional’ measures of safety. While the risk assessment subscale consisted of 13 of the most commonly identified risks, the open-ended responses elicited 50 different hazards that were not covered. This suggests that we need a more in-depth approach to really understand the issues of safety and the hazards present in working in each of these countries.

**Summary of findings**
The key findings are as follows:

- All of the countries identified a large number of risks as being present in their worksite
- The likelihood and severity of risks was also high in all countries, which indicates a highly risky working environment
- Besides the most common risks present in the mining sector in Western countries, a number of risks specific to mining in developing countries were identified, such as:
  - Hygiene and sanitation
  - Poor working conditions
  - Adequacy of safety equipment and protocols
- Traditional safety approaches do not incorporate many of the specific risks which are mentioned
- We need a more in-depth approach to identify and understand risks in the context of developing countries.

**4.2 Individual Factors**
The individual factors measured were Safety Beliefs – which measures an individual’s perception on the importance of safety, Work Responses – which measures an individual’s responses to errors, Safe Working – which
measures the extent to which individual comply with safety procedures and the extent to which individuals participate in safety related activities, and Work Attitudes – which measures an individual’s approach and avoidance motivation at work. The results from each sub-scale will be presented individually.

### 4.2.1 Safety beliefs

Safety beliefs measured an individual’s perception on the importance of safety and was measured using a 5-point scaling ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Figure 4 below graphically represents the mean ratings of each statement for the overall combined sample, operational staff and non-operational staff (e.g. administrative, supervisory and managerial staff).

Figure 4

*Means of Safety Belief subscale items*

<table>
<thead>
<tr>
<th></th>
<th>Non-Operational</th>
<th>Overall Sample</th>
<th>Operational</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have time to work safely</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is more important than production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is a waste of time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is my responsibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety is important</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It can be seen that non-operational staff tend to have more positive responses to safety beliefs items than operational staff. The difference between these two groups were found to be statistically significant for all items other than *Safety is more important than production* in which both groups had very similar means. Table 5 provides detailed descriptive statistics for the Safety Beliefs subscale.
Table 5
*Means (S.D.) of Safety Beliefs subscale items*

<table>
<thead>
<tr>
<th>Item</th>
<th>Overall Sample</th>
<th>Operational</th>
<th>Non-Operational</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety is important</strong></td>
<td>4.78 (.62)</td>
<td>4.73 (.75)</td>
<td>4.85 (.45)</td>
</tr>
<tr>
<td><strong>Safety is my responsibility</strong></td>
<td>4.58 (.86)</td>
<td>4.50 (.95)</td>
<td>4.68 (.76)</td>
</tr>
<tr>
<td><strong>Safety is a waste of time</strong></td>
<td>1.55 (1.19)</td>
<td>1.64 (1.25)</td>
<td>1.44 (1.09)</td>
</tr>
<tr>
<td><strong>Safety is more important than production</strong></td>
<td>4.12 (1.22)</td>
<td>4.11 (1.22)</td>
<td>4.135 (1.21)</td>
</tr>
<tr>
<td><strong>I have time to work safely</strong></td>
<td>4.28 (.99)</td>
<td>4.15 (1.10)</td>
<td>4.4215 (.86)</td>
</tr>
</tbody>
</table>

The means show that, overall, in our samples, individual beliefs about safety are positive. People generally value safety at an individual level and consider it to be their responsibility. There was found to be a higher amount of variability in responses to the items *Safety is a waste of time* and *Safety is more important than production*. This suggests that the prevalence of these two beliefs may be very different in different countries, companies or industries.

Additionally, non-operational staff appeared to have more positive perceptions of the importance of safety than operational staff. The greatest differences between the two groups were for the items *Safety is a waste of time* and *I have time to work safely*. This suggests that non-operational staff who are not faced with as many risks and hazards as operational staff feel they have time to work safely, however operational staff may be under pressure to meet production targets and thus may feel they do not have sufficient time to work safely.

### 4.2.2 Work Attitudes

The work attitudes subscale measured whether individuals’ approach and avoidance motivation at work, or whether they tend to think and focus on positive or negative stimuli and occurrences whilst at work. Figure 5 below shows means of both types of motivation. Overall, it can be seen that individuals in our sample tend to have a higher approach motivation score than avoidance motivation; however the average for avoidance motivation is also fairly high. This trend appears to be consistent in all the countries surveyed.

The items with the highest means in the Avoidance motivation subscale were: “I am fearful about failing to prevent negative outcomes at work”, “I am focussed on failure experiences that occur while working”, and “I feel
anxious when I cannot meet my responsibilities at work”. Linking these findings back to safety, it suggests that, on an individual level, workers are actively thinking about potential failures and issues that may arise in the work place.

Figure 5

Mean ratings of Approach and Avoidance Motivation

4.2.3 Work responses

The work responses subscale measures error orientation, which is the extent to which individuals analyse and try to improve from mistakes. Overall, the means from each country range from 4.15 to 4.71 (Overall M = 4.41) which indicates that individuals report that they do tend to analyse mistakes, think about how they came about and how to prevent them in the future. This is a positive result as research has shown that high levels of error orientation can be beneficial to innovation and the improvement of systems.

The safety learning subscale can be viewed as a being very similar to the work responses scale, but applied to an organisational context and specifically focussed on safety outcomes, rather than general job-related errors. The mean of safety learning ranged from 3.39 to 4.04 (Overall M = 3.74). The difference between these two means suggests that on an individual level, employees tend to think about mistakes that occur and how processes can be improved upon. However, on an organisational level, specifically in relation to safety, they don’t perceive that there is a strong culture of iterative development and improvement from past mistakes. Figure 6 below contrasts the means of Work Responses and Safety Learning.
subscales. It can be seen that the trend of work responses being higher on average than safety learning is common across all countries.

Figure 6

*Mean ratings of Work Responses and Safety Learning*

![Bar chart showing mean ratings of Work Responses and Safety Learning across different countries.](image-url)
4.2.4 Safe working

The safe working scale was comprised of two subscales: compliance and participation. Compliance measured the extent to which individuals complied with safe working protocols whilst participation measured the extent to which individuals actively participated and promoted safety behaviours and safe working. Figure 7 below displays the means of each safe working subscale.

Figure 7

Means of Participation and Compliance Subscales

Due to the limitations of our overall sample characteristics, it would not be meaningful to look at differences in means across countries. It is more meaningful to compare the relationship between participation and compliance across countries. Means for both participation and compliance are high, which is a positive sign given that safety culture in mining is still in its infancy in many of these developing countries.

In most of the countries, compliance is higher than participation. Only one country in our sample – The Gambia – reported participation as being slightly higher than compliance. A strong safety culture accentuates the importance of safety participation and promotion, and not only compliance with regulations. This suggests that safety management in these countries should focus on interventions targeted at increasing participation in safety.

In the overall sample, there was found to be significant difference between operational and non-operational staff in ratings of compliance. The mean for non-operational staff was 4.46. The mean for operational staff was 4.28. As with safety beliefs, it suggests that interventions to improve safety need to
adequately cater to operational staff, in order to improve their compliance and participation in safe working.

**Summary of findings**
The key findings are as follows:

- Individuals believe safety is important and feel it is their personal responsibility to ensure safety
- The individuals surveyed tended to have a higher approach motivation than avoidance motivation, suggesting they tend to focus more on positive stimuli at work than on negative stimuli, though avoidance motivation was also high.
- Individuals report that they do tend to analyse mistakes at work and how to prevent them in the future. This is a positive result as high levels of error orientation are beneficial to the improvement of systems.
  - However, they don’t perceive that the organisations, overall, do the same which indicates a possible lack of systematic procedures dedicated to error analysis and prevention
- On an individual level, respondents generally complied with safety protocols and took an active role in promoting safety
- Safety compliance was generally higher than safety participation which suggests that improving safety participation should be a focus of interventions to improve safety management
4.3 Organisational factors

The organisational factors section was comprised of 9 subscales: Safety Rewards; Safety Vision; Safety Learning; Safety Vigilance; Management Values; Communication; Training; Physical Work Environment; and Safety Systems. In analysing this information, we opted to compare analyse the ranks each subscale takes in different countries, instead of interpreting each subscale individually. A comprehensive table showing means for each country on each subscale can be found in the appendix.

Figure 8 below shows the overall mean of the sample for each subscale as well as the means for Operational and Non-Operational level staff. There were found to be statistically significant differences between the two groups in all organisational factors subscales other than Safety Vision and Physical Working Environment.

The data shows that operational staff tends to have lower ratings than non-operational staff, consistently across a number of subscales. This is a similar pattern of response to the Safety Beliefs subscale in which non-operational staff tended to rate items more positively than operational staff. It suggests that the perceptions of organisational safety held by non-operational staff are generally more positive than those held by operational staff.

Figure 8

Means of Organisational Factors for Non-Operational and Operational staff

Figure 9 below shows the top and bottom 3 subscales for the overall sample.
All countries surveyed had Safety Vision and Management Values as two of their top three high scoring subscales. This suggests that most respondents had a perception of management placing high priority on safety and this vision of safety is shared throughout the organisation.

The overall lowest three subscales were Physical Work Environment, Safety Rewards and Training. In contrast to the highest scoring subscales which relate to safety attitudes, all three of the lowest subscales relate to tangible aspects of safety. This suggests there is a disconnect between the perceived attitudes toward safety and actual safety in the workplace. While management is perceived to see safety as being important, safety does not appear to be as well promoted throughout the organisation. Safety also appears to be poorly integrated into the reward system.

While some countries scored highly on safety training, it was in the bottom three scores for the majority of countries. This suggests that in some countries safety training does not appear to be comprehensive or widely available.

The top and bottom 3 organisational factors were also calculated for each country and contrasted with the overall sample mean for those factors. This was done in order to gain an understanding of differences in organisational safety in different countries.

*Mongolia*

While training was generally a weakness across the countries sampled, it was one of the top 3 factors among Mongolian respondents. Additionally,
scores in all subscales were higher than average. This suggests organisational safety culture in the Mongolian sample is generally perceived as more positive.

**Mongolia Top and Bottom 3**

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Overall Sample</th>
<th>Mongolia</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Management Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Safety Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Safety Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Safety Rewards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Physical Work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Zambia**

Zambia performed slightly better than average on the safety systems subscale which suggests respondents feel there are sufficient systems in place to prevent incidents. The scores for safety vision, training and safety rewards are below average. Safety interventions in Zambia should focus on improving these areas in order to create a better safety culture where employees are rewarded for safe behaviours and share a vision of safety.

**Zambia Top and Bottom 3**

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Overall Sample</th>
<th>Zambia</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Management Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Safety Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Safety Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Safety Rewards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Physical Work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Kenya**
While training was a weakness in other countries, Kenya had training as one of the highest rated organisational factors. Additionally, the perceptions of management’s attitudes toward safety were high. However safety vigilance was lower than average which could be a potential area for improvement.

**Kenya Top and Bottom 3**

- 5. Management Values
- 2. Safety Vision
- 7. Training
- 4. Safety Vigilance
- 1. Safety Rewards
- 8. Physical Work Environment

**The Gambia**

The Gambia performed far below average in the training subscale which suggests that there is a lack of safety-related training and education. Additionally, communication was also below average. This suggests that safety is something that is perhaps not talked about or discussed within organisations. Both of communication and training can be seen as areas that are definitely in need of improvement.

**Gambia Top and Bottom 3**

- 5. Management Values
- 2. Safety Vision
- 4. Safety Vigilance
- 6. Communication
- 7. Training
- 8. Physical Work Environment

Overall Sample

Gambia


**Nigeria**

Nigeria scored higher than the overall sample on communication which suggests that there is a culture of open communication between management and employees about safety issues in the workplace. The three weakest areas of organisational safety culture in the Nigerian sample were consistent with the overall sample, with training, safety rewards and physical work environment being areas that could be improved.

**Ivory Coast**

The top and bottom 3 organisational safety factors for the Ivory Coast were the same as those for the overall sample. Training and Safety rewards were significantly below the average of the overall cohort and these represent areas where initiatives to improve safety culture should be focused.
Indonesia

Indonesia performed slightly above average on most organisational subscales. Notably, Indonesian respondents averaged 3.86 on the Safety Rewards subscale which is above average and suggests that safety is integrated into reward and feedback systems. Additionally, while safety training was in the bottom 3 subscales, the score was above average suggesting that employees are provided with safety training. However, despite this, Indonesia performed poorly when compared to the overall sample in the physical work environment subscale, suggesting that the work environment is relatively hazardous. Continuing to promote a culture of safety may help to minimize the risk of incidents occurring in such a hazardous work environment.

### Indonesia Top and Bottom 3

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Overall Sample</th>
<th>Indonesia</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. Management Values</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Safety Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Safety Vigilance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Safety Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Physical Work Environment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 4.3.1 High performance safety systems

The high performance safety system scale consisted of 15 safety systems that are theoretically and empirically associated with occupational safety. These items asked the respondent whether their organisation had a particular system in place. Respondents were required to tick a box to indicate that their organisation had those systems in place.

Table 6 below shows the percentage of respondents from the overall sample that stated their organisation had a particular high performance safety system in place. The table shows the percentage for the overall sample, as well as comparing with the responses of operational and non-operational
respondents. Consistent with previous subscales, non-operational staff had more favourable ratings than operational staff.

Table 6

**Percentage Prevalence of High Performance Safety Systems**

<table>
<thead>
<tr>
<th>High Performance Safety Systems</th>
<th>Overall Sample</th>
<th>Operational</th>
<th>Non-Operational</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Offer Quality of Work Life programs, Quality Circles and/or labour-management participation teams</td>
<td>45.5%</td>
<td>44.6%</td>
<td>46.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>6. Provide rewards and incentives for safe behaviour</td>
<td>45.7%</td>
<td>43.6%</td>
<td>47.2%</td>
<td>3.7%</td>
</tr>
<tr>
<td>15. Provide sufficient training to employees</td>
<td>62.0%</td>
<td>59.5%</td>
<td>64.6%</td>
<td>5.2%</td>
</tr>
<tr>
<td>8. Prioritise safety over productivity</td>
<td>65.6%</td>
<td>63.7%</td>
<td>67.6%</td>
<td>3.9%</td>
</tr>
<tr>
<td>4. Provide safety training to all employees</td>
<td>70.5%</td>
<td>67.0%</td>
<td>73.8%</td>
<td>6.8%</td>
</tr>
<tr>
<td>1. Conduct regular safety assessments</td>
<td>72.1%</td>
<td>70.0%</td>
<td>73.5%</td>
<td>3.5%</td>
</tr>
<tr>
<td>2. Hold Regular Safety meetings</td>
<td>72.4%</td>
<td>67.3%</td>
<td>78.2%</td>
<td>10.9%</td>
</tr>
<tr>
<td>10. Listen to suggestions about how to improve safety in the workplace</td>
<td>75.5%</td>
<td>71.3%</td>
<td>79.6%</td>
<td>8.3%</td>
</tr>
<tr>
<td>13. Regularly assess equipment to ensure it is safe to operate</td>
<td>76.7%</td>
<td>73.8%</td>
<td>79.5%</td>
<td>5.7%</td>
</tr>
<tr>
<td>9. Encourage open discussion about safety among employees</td>
<td>77.7%</td>
<td>74.8%</td>
<td>80.9%</td>
<td>6.1%</td>
</tr>
<tr>
<td>5. Have a system through which you can report safety related concerns</td>
<td>79.1%</td>
<td>76.6%</td>
<td>81.5%</td>
<td>4.9%</td>
</tr>
<tr>
<td>7. Conduct investigations to determine the cause of an accident</td>
<td>79.7%</td>
<td>76.3%</td>
<td>83.2%</td>
<td>6.8%</td>
</tr>
<tr>
<td>11. Provide you with sufficient protective equipment</td>
<td>82.0%</td>
<td>78.6%</td>
<td>86.2%</td>
<td>7.6%</td>
</tr>
<tr>
<td>3. Employ a safety officer</td>
<td>82.4%</td>
<td>78.6%</td>
<td>86.4%</td>
<td>7.8%</td>
</tr>
<tr>
<td>12. Try to learn from accidents</td>
<td>83.4%</td>
<td>83.3%</td>
<td>84.3%</td>
<td>0.9%</td>
</tr>
</tbody>
</table>
Over 80% of respondents stated that they were provided with sufficient protective equipment, employ a safety officer and try to learn from accidents. However, only 62% of respondents stated that their company provided sufficient training to employees. This is consistent with findings we have discussed in the previous sections.

Only 65.6% of respondents stated that the company prioritised safety over productivity. This response contrasts with the safety beliefs section item: Safety is more important than production. Most individual respondents tended to hold that belief and agreed with that item (M = 4.12), however only 65.6% of respondents felt their company prioritised safety over productivity. Only 45.7% of respondents stated that there were rewards and incentives for safe behaviour. The low percentage of companies providing rewards and incentives for safe behaviour is consistent with the data from the Safety Rewards subscale which found rewarding safety to be an area that required improvement.

This suggests that while there are safety measures in place in order to comply with regulations, it may not always be the primary concern. The lack of incentivizing or rewarding safe behaviour also suggests there could be improvements made in reward structures in order to promote safe behaviours.

The low percentage of companies offering quality of work life programs, quality circles and labour-management participation teams can be seen as additional evidence to support the findings from the open-ended risk responses that companies in developing nations may have poor work conditions. It suggests that there is currently not a strong focus on employee wellbeing and quality of life.

Both “Quality of Work Life programs” and “Provide rewards and incentives for safe behaviour” were in the bottom three least frequent high performance safety systems in every country. This suggests a widespread deficiency in this area across multiple countries. The three most and least prevalent high performance safety systems in each country will be discussed below.

Mongolia

It can be seen in the figure below that Mongolia had a significantly higher percentage of respondents stating that their company provided safety training to all employees. While the overall average of the overall sample was 70.5%, 90.9% of Mongolian respondents stated their company had that system in place. Interestingly, only 76.2% of Mongolian respondents stated their company “Provided sufficient training to employees” and only 75% stated their company “Provided sufficient protective equipment”. This could
suggest that while training is provided to all employees, it is currently perceived as being insufficient. Alternatively, it may suggest that safety training is perceived to be offered, but overall training (in other areas) is perceived as being insufficient.

Zambia

The percentage of respondents that stated their company Conduct investigations to determine the cause of an accident was 93.4%, higher than the average of 79.7%. This contrasts with the Zambian responses in the Safety Learning subscale (M = 3.625) which was below average. This potentially suggests that while investigations into accidents occur, they may not necessarily be learned or actioned upon. The high performance safety systems identified as least common are consistent with the findings of we have discussed in previous sections with weaknesses in training and rewarding safety behaviours.
**Kenya**

Only 66.7% of respondents stated that the company prioritized safety over productivity and it was one of the bottom three safety systems in the Kenya sample. Additionally, providing rewards and incentives for safety was also an area of weakness. In such a company, it would be difficult to create a culture focused on safety. Interestingly, the highest rated subscales are all focused on compliance with safety rather than encouraging participation and promotion with safety.
The Gambia

The Gambian sample had a lower prevalence of all safety systems in comparison to the overall sample. Only 22.5% of respondents stated that their company prioritised safety over productivity which may indicate a major absence of safety culture. *Encouraging open discussions about safety among employees* was one of the top three safety systems. This procedure is beneficial in fostering a culture of participative safety. However, the discussions about safety may not be beneficial in an environment where productivity is prioritized and safety is almost not at all rewarded.

Nigeria

Similar to the Gambian sample, Nigeria had a number of more participative safety systems and procedures in place such as holding safety meetings and trying to learn from accidents. However, they also have similar weaknesses in prioritising safety over productivity and rewarding safety in the workplace. This suggests that these procedures may be employed more to “tick the boxes” and comply with safety. Encouraging safety participation and rewarding safety behaviours would be beneficial in improving safety culture.
Ivory Coast

Only 42.7% of Ivory Coast respondents stated that their company conducted regular safety meetings. This is significantly below the overall sample average of 72.1%. The trend of ‘compliance’ related safety behaviours being more prevalent than behaviours encouraging participation in creating a safety culture is also present.
Indonesia

Overall, Indonesia had one of the highest prevalence of high performance safety systems than the overall sample. While training and rewarding safety behaviours were still among the lowest items in the Indonesian sample, it can be seen that they were still higher than the overall sample average.

Summary of findings

The key findings are as follows:

- The highest rated subscales were related to perceptions of safety and safety attitudes
- Conversely, the lowest rated subscales were related to tangible safety outcomes
- This suggests there is a disconnect between the perceived attitudes toward safety and actual safety in the workplace.
- While safety is seen as important, safety does not appear to be as well promoted and integrated throughout organisations
- The High Performance Safety Systems data suggests that there are safety measures in place in order to comply with regulations
- However, it is not currently incentivized or rewarded safe behaviour and safety is not perceived to be a priority over production.
- Improvement could be made in reward structures and priorities in order to promote safe behaviours
5 RECOMMENDATIONS

In this section we outline some practical recommendations for different stakeholders. We focus on implications for the IM4DC strategic area – Health and Safety of Workforces and Resources Communities - in developing countries.

The report identifies common concerns about safety in developing countries as well as potential differences across the countries in the way safety is managed and experienced. The results provide the foundation for better understanding of safety needs within countries and support the design of future training programs.

We make two broad sets of recommendations. The first concerns the way systematic information about safety might continue to be collected and used by participating individuals and countries in IM4DC programs. The report demonstrates that participants are keen to engage in information gathering and see value in the opportunity to gain insights about safety beliefs and practices in their country. Therefore the first broad recommendation concerns the development of this initial effort.

1. Investigate mechanisms for extending and embedding information about safety in developing countries so that the present database of information can be developed to provide more comprehensive, representative, and practical insights into country needs.

The second general recommendation concerns implications for the design of safety information in IM4DC training programs. The report provides initial insights into some key similarities and differences across countries that can guide the structure and content of IM4DC learning and communication activities.

2. Incorporate country-level insights about safety practices and beliefs into current training programs.

We next explore the implications of these recommendations in more detail.

The first implication applies generally across IM4DC programs. The second and third sets refer more specifically to two of the IM4DC program activities – Education and Training and Action Research.

Overall safety content

Overall, our data indicates that mining still represents a highly risky work environment in developing countries. All typical risks are encountered and other specific risks and hazards are identified. Moreover, the likelihood and
severity of accidents and incidents is perceived to be above average, and physical environment is scored the poorest of organisational variables in all the surveyed countries. **Combined, all this data points to the fact that safety and its management should be top concerns and priorities for the development of sustainable mining in developing countries.**

There were significant similarities across countries with respect to participants’ individual beliefs about safety, with all of them valuing safety and considering it as a personal responsibility. In addition, participants in all countries identified certain weak points at the level of organisational systems put in place to manage safety. Participants across countries perceived a great deal of emphasis on safety at the level of organisational and managerial vision and values, but these weak points lie in the way the mission and values fail to be reflected into the rewards and training systems. Therefore, **future interventions around safety should focus less on the values level and more on how to build organisational systems and practices able to convey managerial values and mission and to support individual safety values.**

The results also identified some differences across countries with implications for country-specific programs that might be developed in the future. Tentative examples of such specific programs at the organisational level for each country are:

- Mongolia: safety systems and safety reward practices
- Zambia: improving training for employees and safety reward practices
- Kenya: improving safety vigilance and safety reward practices
- The Gambia: improving training for employees and safety communication practices
- Nigeria: improving training for employees and safety reward practices
- Ivory Coast: improving training for employees and safety reward practices
- Indonesia: improving training for employees and safety systems around organisations

More generally we recommend IM4DC to support their networks of alumni towards collecting or recording systematics data in their countries to create opportunities to better understand the main issues and offer adequate support within countries.
Education and training program

The results show that while some countries are similar to each other in many respects, at the same time there can be critical differences. Furthermore, while there are some tendencies for countries to cluster together based on regions, this is not always the case. For example, regarding Safety Beliefs, our analysis of differences across countries showed that overall countries in South Asia tended to cluster together, as did countries from Africa. But also, there were countries such as Ivory Coast and The Gambia that differed significantly from the other African countries in their overall safety beliefs scores. We have not gone in-depth with the analysis and presentation of these results due to the design limitations that we have already highlighted but it is an indication that particular characteristics of each country should be actively considered (even when regional programs are concerned).

Therefore, we recommend that IM4DC actively investigates similarities and differences among participant countries as part of the development phase of the training programs. Such knowledge would allow trainings to be better directed at issues that are specific to the participants’ countries. It would also enhance the collaborations between participants from different countries during and after the IM4DC trainings by facilitating awareness of one’s own situation but also of the resources that can be used to overcome difficulties.

As we have already seen, individuals we surveyed across countries value safety at an individual level. However, some of the values that are more permeable to organisational practices were lower and had more variability. Within the educational programs run by IM4DC, trainees can be taught how, each from their own position could disseminate knowledge and help instil those organisational practices that build a strong safety culture.

At the individual level, we highlighted results regarding individual safety beliefs, work attitudes, safety learning and safe working. Some interesting implications could be derived from these results for the educational programs. First of all we recommend IM4DC to incorporate this level into the training programs as change is accelerated when people are more aware of their own personal style or behaviours and how they relate to other outcomes. Second, the high scores for compliance, together with above average avoidance tendencies in our samples suggest that the main focus in the area of safety in these countries is still on compliance. Future trainings in the area of safety should actively target safety participation and the way participants could help build a healthy safety culture.

Within the sections dedicated to Organisational Factors and High Performance Safety Practices, we have highlighted the strong and weak
points within the overall sample and within each country with respect to several organisational variables that are linked with safety outcomes. **We recommend that IM4DC educational programs consider these as specific training needs in the area of health and safety management for the countries investigated.** Among these, training, both general and safety specific, seems to be a common issue. **While large scale training is outside the IM4DC scope, some “Train the trainer” elements could be incorporated in the longer courses to further facilitate training at lower levels.** Another common element is the lack of variables related to safety culture at the top end of scored organisational variables and practices. Together with previous data, this suggests that **all of the countries still have important work to do in order to build such cultures in the mining related industry in their home countries. IM4DC training could focus even more on supporting trainees in this endeavour.**

**Action research program**

Most of the recommendations for this section are derived from type of design we employed in the present research but some are also derived from the actual results at different levels.

Our first recommendation for future action research grants refers to our overall research design. Although there are difficulties inherent to any cross-cultural research, we believe it to be a necessity for any further interventions or programs targeted at these countries, especially given the fact that creating cross-cultural networks of professionals is one mechanism that IM4DC is actively trying to create. Therefore, we recommend that **conducting cross-cultural research on issues of special interest for mining in development countries should be an explicit focus of the IM4DC Action Research program.**

Another strong point of this research is related to the high diversity of the samples investigated with a good mixture of countries, type of companies and job levels represented. This diversity could be even more so enhanced in the future as some of the focus geographical areas of IM4DC are yet not represented, and some are underrepresented. **We recommend IM4DC to support further data collection to incorporate new countries and new areas of interest for IM4DC.** At the same time, due to the limits highlighted in the first part of this report, **we also recommend IM4DC to advocate and support cross cultural designs like the present one to reach to country representative samples so that inferences based on obtained data could be generalized at the country level and comparisons between countries could be more robust.**
Last but not least, we will focus on recommendations derived based on the actual findings of the present research. Our first section of findings, focusing on risks, highlighted the importance of understanding the risks and hazards which are specific to each country, and of extending existent theory and practice to address these specific factors. Therefore, the IM4DC should support research that is attempting to extend common theories and practice to include factors specific to each country as well as research employing an in-depth approach to the topic of their interest.

Our findings related to risks and hazards also point to the need of a more in-depth understanding of what constitutes risks and hazards in this countries and how they relate to a series of outcomes at the organisational level but also at personal level and quality work-life of people working in the mining industry.

At the level of individual factors contributing to safety, our results show that the scores of people working at the operational level are constantly lower than those of the non-operational (supervisors, managers, administrative). We recommend further action research to look deeper into this divide and investigate its antecedents and facilitators as well as its outcomes.

At the level of organisational variables and high performance practices we focused on highlighting the prevalence of each variable and practices overall and in each country to identify possible organisational needs. Further research might be conducted to investigate how the levels of these variables or combinations of them link to specific safety related outcomes at all levels.

6 References


7 APPENDIX

7.1 International safety survey

A copy of the survey used for this research is available from the authors as a Power Point file.
### 7.2 Overview of data

*Individual Factors Means Table*

<table>
<thead>
<tr>
<th></th>
<th>Mongolia</th>
<th>Zambia</th>
<th>Kenya</th>
<th>The Gambia</th>
<th>Nigeria</th>
<th>Ivory Coast</th>
<th>Indonesia</th>
<th>Overall Sample</th>
</tr>
</thead>
</table>
### Organisational Factors Means Table

Top 3 and Bottom 3 factors in each sample group highlighted in green and red respectively

<table>
<thead>
<tr>
<th>Factor</th>
<th>Mongolia</th>
<th>Zambia</th>
<th>Kenya</th>
<th>Gambia</th>
<th>Nigeria</th>
<th>Ivory Coast</th>
<th>Indonesia</th>
<th>Overall Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Risk Prevalence Means Table

<table>
<thead>
<tr>
<th>Country</th>
<th>Mongolia</th>
<th>Zambia</th>
<th>Kenya</th>
<th>The Gambia</th>
<th>Nigeria</th>
<th>Ivory Coast</th>
<th>Indonesia</th>
<th>Overall Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Working with explosives</td>
<td>59%</td>
<td>78%</td>
<td>48%</td>
<td>43%</td>
<td>63%</td>
<td>44%</td>
<td>74%</td>
<td>58%</td>
</tr>
<tr>
<td>8. Ground failure, cave-ins, etc. (geo-technical)</td>
<td>78%</td>
<td>63%</td>
<td>67%</td>
<td>50%</td>
<td>63%</td>
<td>54%</td>
<td>86%</td>
<td>67%</td>
</tr>
<tr>
<td>6. Working with fire</td>
<td>65%</td>
<td>85%</td>
<td>80%</td>
<td>64%</td>
<td>62%</td>
<td>71%</td>
<td>75%</td>
<td>71%</td>
</tr>
<tr>
<td>12. Working with chemicals</td>
<td>61%</td>
<td>81%</td>
<td>80%</td>
<td>85%</td>
<td>83%</td>
<td>65%</td>
<td>69%</td>
<td>73%</td>
</tr>
<tr>
<td>5. Working within confined space</td>
<td>73%</td>
<td>91%</td>
<td>81%</td>
<td>89%</td>
<td>81%</td>
<td>74%</td>
<td>76%</td>
<td>80%</td>
</tr>
<tr>
<td>4. Working at height</td>
<td>71%</td>
<td>94%</td>
<td>85%</td>
<td>70%</td>
<td>88%</td>
<td>83%</td>
<td>82%</td>
<td>81%</td>
</tr>
<tr>
<td>7. Lifting objects</td>
<td>79%</td>
<td>95%</td>
<td>86%</td>
<td>79%</td>
<td>81%</td>
<td>81%</td>
<td>86%</td>
<td>83%</td>
</tr>
<tr>
<td>3. Working with electricity</td>
<td>79%</td>
<td>94%</td>
<td>86%</td>
<td>80%</td>
<td>90%</td>
<td>79%</td>
<td>87%</td>
<td>84%</td>
</tr>
<tr>
<td>1. Working with vehicles</td>
<td>77%</td>
<td>91%</td>
<td>87%</td>
<td>88%</td>
<td>89%</td>
<td>78%</td>
<td>95%</td>
<td>85%</td>
</tr>
<tr>
<td>10. Falling objects</td>
<td>79%</td>
<td>93%</td>
<td>92%</td>
<td>84%</td>
<td>84%</td>
<td>88%</td>
<td>92%</td>
<td>87%</td>
</tr>
<tr>
<td>11. Working with machinery</td>
<td>85%</td>
<td>96%</td>
<td>87%</td>
<td>95%</td>
<td>91%</td>
<td>83%</td>
<td>87%</td>
<td>89%</td>
</tr>
<tr>
<td>9. Slips, trips, and falls</td>
<td>94%</td>
<td>92%</td>
<td>95%</td>
<td>85%</td>
<td>90%</td>
<td>90%</td>
<td>96%</td>
<td>92%</td>
</tr>
<tr>
<td>13. Working in dusty environments</td>
<td>92%</td>
<td>98%</td>
<td>98%</td>
<td>85%</td>
<td>88%</td>
<td>92%</td>
<td>92%</td>
<td>92%</td>
</tr>
</tbody>
</table>