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## TOWARDS BENCHMARKING OF SAFETY PERFORMANCE IN THE PLATINUM SECTOR

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### Abstract

Safety in South African mines is a subject of significant interest, since many mining companies are experiencing production deficits due to safety-related stoppages. In this paper, safety data from the South African platinum mining sector is analysed for the period 2006 to 2010. The data was obtained from company annual reports as well as the Department of Mineral Resources, and analysis in the study is limited to injury and fatality data only. The overall safety performances of companies in the sector are compared, and opportunities for benchmarking and recognising potential sources of best practice amongst platinum miners are identified.

Improving safety usually incurs a cost, and mining companies are particularly conscious of the importance of controlling costs. However, cost considerations often deal only with direct costs, and it has been shown that indirect costs are usually far more significant. Therefore, a greater safety spend will usually result in the creation of value for the mine since it will reduce the indirect costs associated with accidents. The results of some recent research in this area are presented. In this light, where available, the financial performances of mining companies in the sector, obtained from published annual results, are included in the benchmarking exercise to determine whether there is any correlation with safety performance.

**Keywords:** Platinum sector, benchmarking, safety performance comparison; best practice.

### Introduction

South Africa is one of the wealthiest countries in the world in terms of mineral resources. It is the largest producer of platinum, and one of the leading producers of gold, diamonds, base metals, and coal. The South African mining industry's contribution towards the country's gross domestic product (GDP) varies between 5 to 10 per cent and it currently employs about 500 000 people (Department of Mineral Resources, 2010).

While South Africa continues to be the top platinum producer in the world, it is also important to pay attention to the overall safety performances of companies in the sector. Through analysis of the safety performances of platinum companies, a benchmarking exercise has been conducted to compare safety performances, and the best practice among them has been identified.

In addition, safety performances of the platinum producers have been compared with the financial performances of mining companies in the sector, and a correlation between the two benchmarking exercises has been attempted.

### **What is benchmarking?**

Benchmarking is a process of comparing metrics of interest such as performance, output, or quality indicators, for a specific purpose. The purpose of benchmarking varies widely. It could be undertaken to assist consumers in exercising choice, to aid decision-makers and/or to identify potential sources of good practice. Benchmarking can be undertaken by a range of means. These include comparing published information, comparing processes and practices through one-to-one interaction between parties, and auditing or reviewing processes in which the relative strengths and weaknesses of various organizations or organizational practices are assessed and ranked.

If the purpose of the benchmarking process is to identify good practice, several steps are involved which combine a number of the above activities. For example, firstly ranking the performance of companies in terms of appropriate indicators, then identifying those companies that consistently achieve outstanding results or significant improvements over time, and lastly learning through direct interaction with company representatives how these achievements or improvements have been secured. In the case of safety performance, lagging indicators tracked over time, such as fatality and injury rates, usually provide the basis for ranking and identifying performance of interest (Wynn, 2008 and Stapenhurst, 2009).

### **Selected companies**

In this paper, the safety data from the South African platinum mining sector is analysed for the period 2006 to 2010. The data was obtained from companies' 2010 annual reports as well as from the Department of Mineral Resources, and the analysis in the study is limited to injury and fatality data only. This study focused on five South African platinum miners. The companies selected for this study are listed in Table I, and they have accounted for almost 97 per cent of South Africa's platinum production during 2010 (Platinum Today, 2011).

**Table I-Selected companies**

Anglo American Platinum
Aquarius Platinum
Impala Platinum
Lonmin plc.
Northam Platinum

This analysis is limited to the safety data (fatalities and injuries) of the South African operations only. Injury and fatality rates are presented per million hours worked.

## **Results**

### ***Platinum fatality and injury rates (2006 – 2010)***

In the study, two key performance indicators were used; lost time injury frequency rate (LTIFR), referred to as *injury rate*, and fatality frequency rate (FFR), referred to as *fatality rate*. A lost time injury (LTI) is a work-related injury resulting in the employee being unable to attend work on the next calendar day after the day of the injury. Some companies generally have different interpretations of what constitutes LTIs; some of them regard restricted-work injuries as LTIs whereas others do not. As most of the information presented here was obtained from selected companies' websites, the issue regarding restricted-work injuries could not be verified.

The fatality and injury rates have shown a contradictory picture over the 5-year period. While fatality rates are showing an overall downward trend, the injury rates are showing the opposite. Figure 1 shows platinum mining fatality and injury rates between 2006 and 2010, and Figure 2 shows the actual number of fatalities and injuries during the same period.

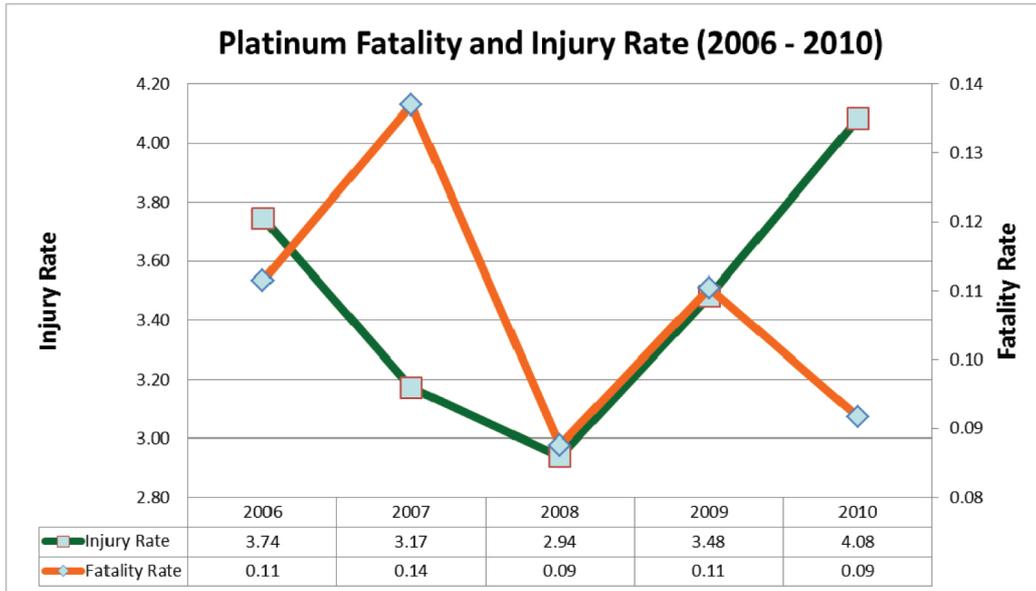


Figure 1–Platinum fatality and injury rates (2006-2010). Source: Department of Mineral Resources

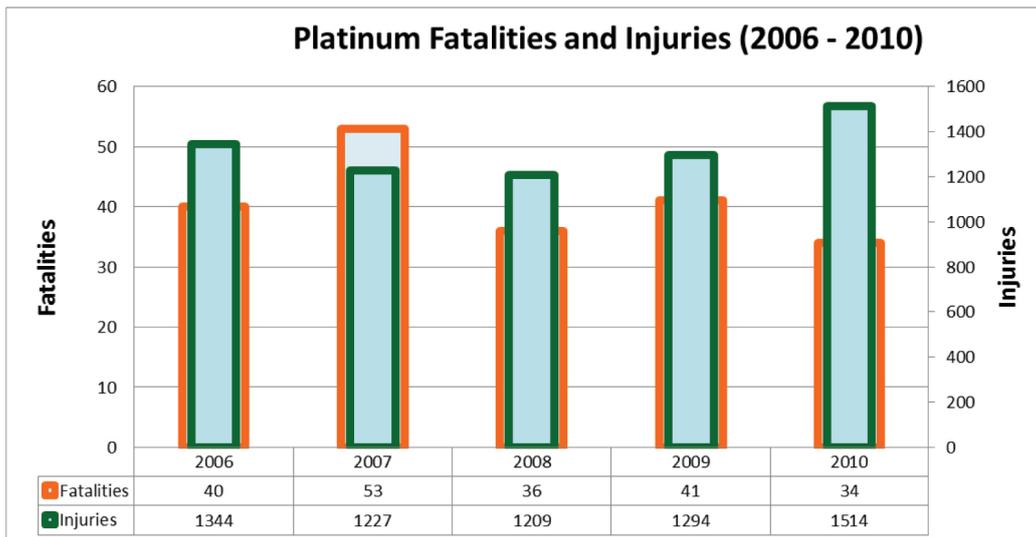


Figure 2–Platinum fatalities and injuries (2006-2010). Source: Department of Mineral Resources

Figure 3 shows the number of people employed in the platinum sector (2006-2010). Although the maximum numbers of people were employed in 2008, the lowest number of injuries as well as second lowest number of fatalities were reported during this period. The large drop in the number of employees from 2008 to 2009 is related to the decrease in the metal price.

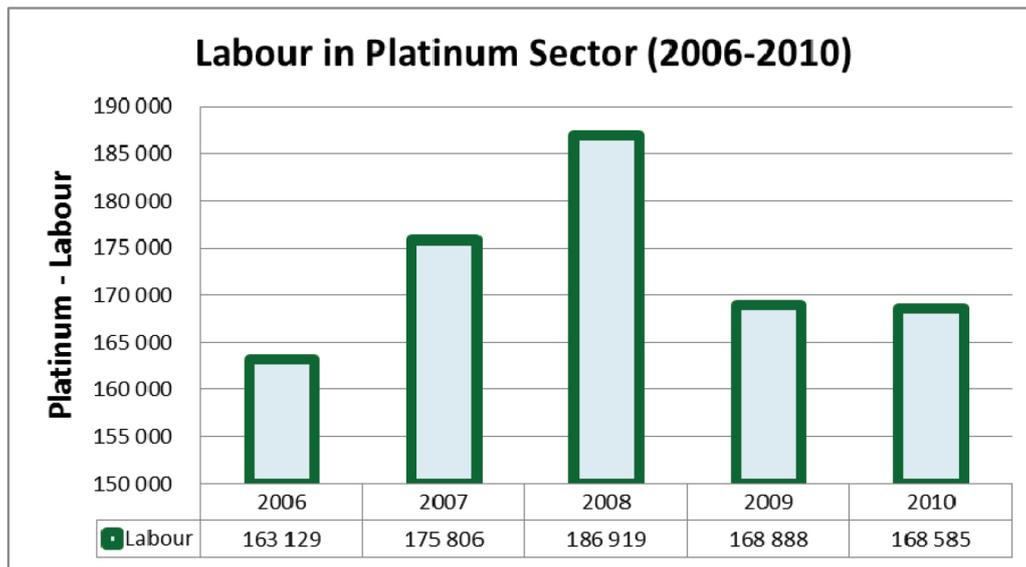
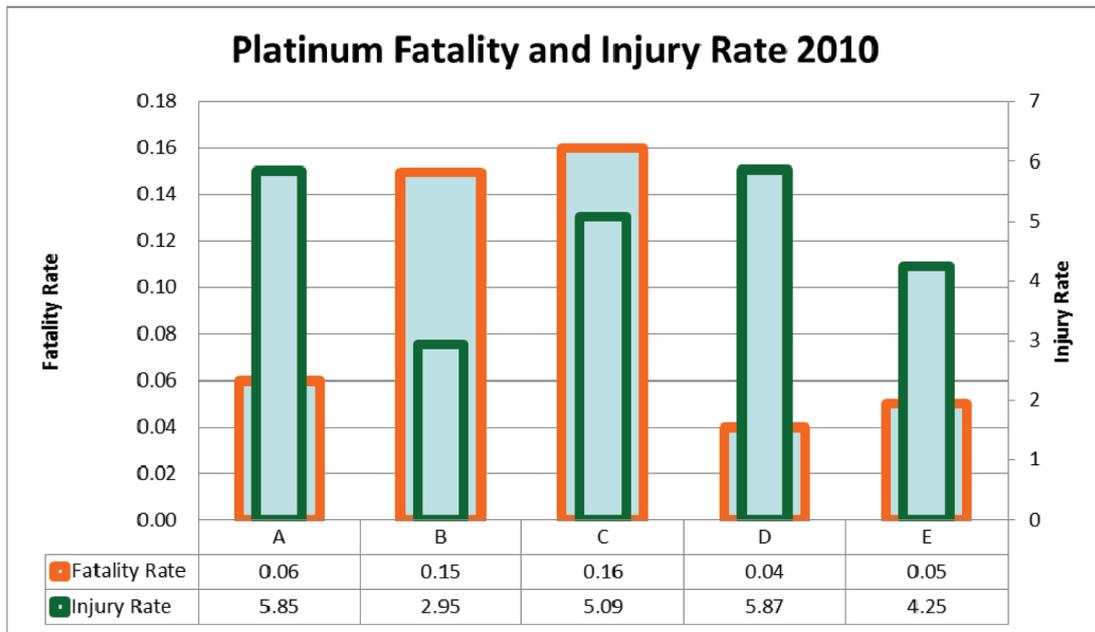


Figure 3–Labour in platinum sector (2006-2010.) Source: Department of Mineral Resources

#### ***Fatality and injury rates by company***

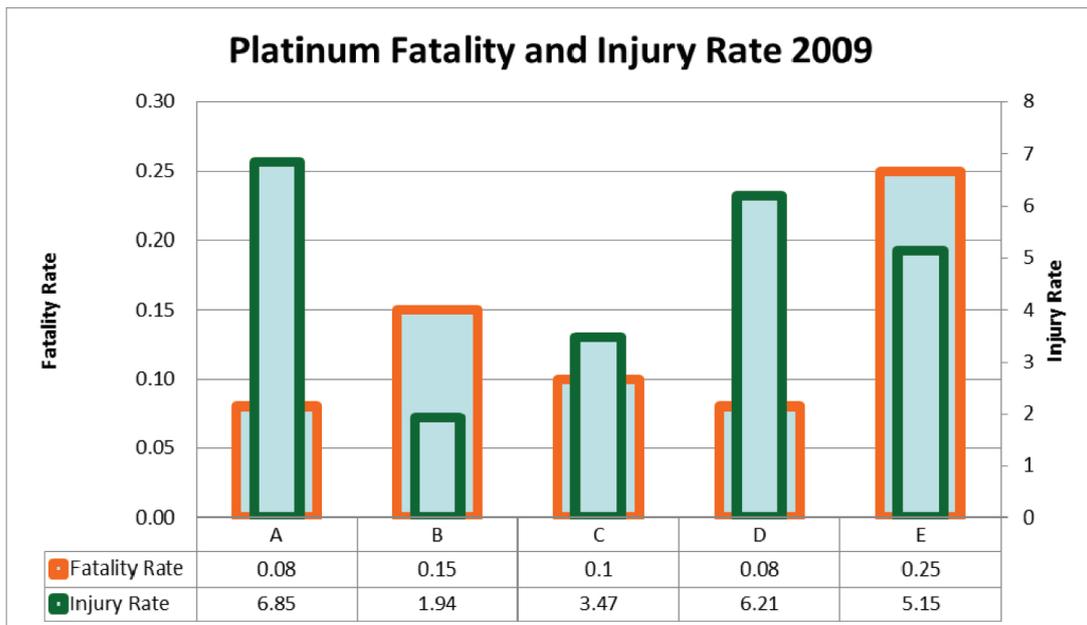
The fatality and injury rates for each selected company are presented in Figures 4–9, which show both rates for successive years in descending order, from 2010 to 2006. Company names are not identified in this presentation. The data have been obtained from the selected companies' 2010 annual reports.

The lowest fatality rate was recorded by company D, followed by company E in 2010. The highest fatality rate was recorded by company C, while company B recorded the second highest fatality rate. Company D recorded the highest injury rate, followed by company A for the same period. Company B recorded the lowest injury rate for 2010 (Figure 4).



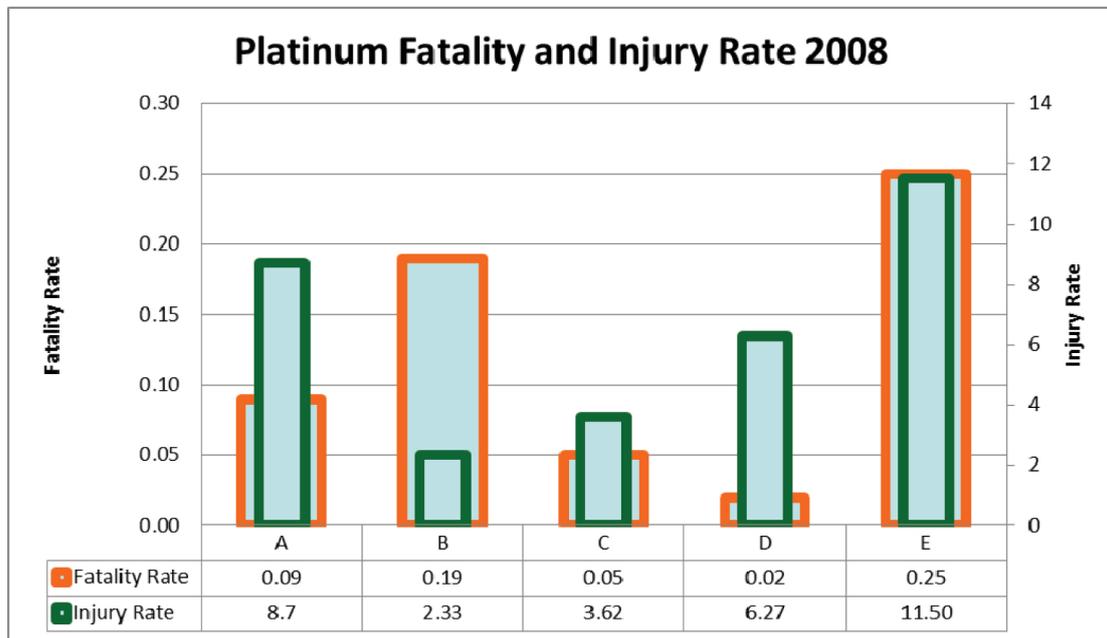
**Figure 4–Platinum sector fatality and injury rate by company – 2010**

In 2009, companies A and D recorded the lowest fatality rates and company E recorded the highest fatality rate, followed by company B. The lowest injury rate was recorded by company B. Company A recorded the highest injury rate for the same period (Figure 5).



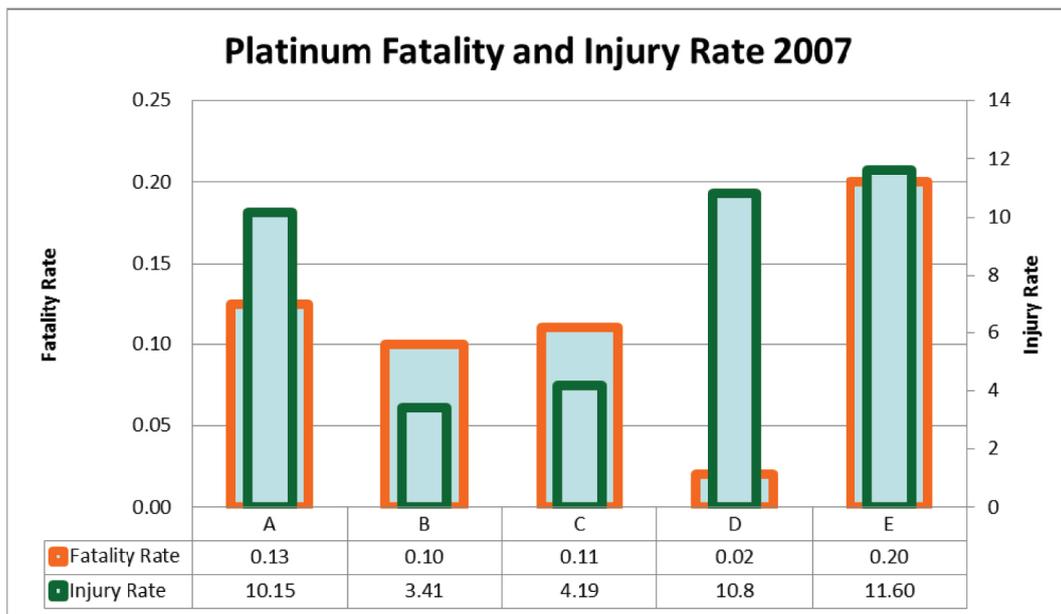
**Figure 5–Platinum sector fatality and injury rate by company – 2009**

Company D recorded the lowest fatality rates in 2008. The highest fatality and injury rate was recorded by company E, while company B recorded the second highest fatality rate. Company B recorded the lowest injury rate for 2008 (Figure 6).



**Figure 6–Platinum sector fatality and injury rate by company – 2008**

In 2007, company D recorded the lowest fatality rate. The highest fatality and injury rate was recorded by company E. The lowest injury rate was recorded by company B (Figure 7).



**Figure 7–Platinum sector fatality and injury rate by company – 2007**

In 2006, company E recorded the highest fatality rate while company A recorded the second highest fatality rate. Company E’s fatality rate was more than three times higher than the remaining companies. Company A recorded the highest injury rate, while company B recorded the lowest injury rate for 2006 (Figure 8).

The lowest fatality rate was registered by company D, while company B recorded the lowest injury rate over the 5 years reviewed. Company E recorded the highest fatality and injury rate, while company A recorded the second highest injury rate for the same period. Company B recorded the second highest fatality rate for the five-year period under review (Figure 9).

The *most improved company* in respect of the fatality rate as well as the injury rate was company E in the 5-year period.

The 5-year comparison points to where best practice could be found. The management systems and approach of company E could be investigated further through on-site interaction. An issue for investigation could also include specific information on the management of fatal and non-fatal risks, and the nature of the major hazards associated with the operations of the company E. How company E has changed its approach to minimize risks could be of interest. Understanding the context that enables companies D and C to achieve the lowest fatality and injury rate respectively may be helpful to others wishing to achieve the same. The nature of the hazards associated with these companies’ operations and the challenges which they pose may be helpful in designing strategies for improving safety by helping to identify ‘watch-points’.

Table II summarizes the findings about where to seek best practice.

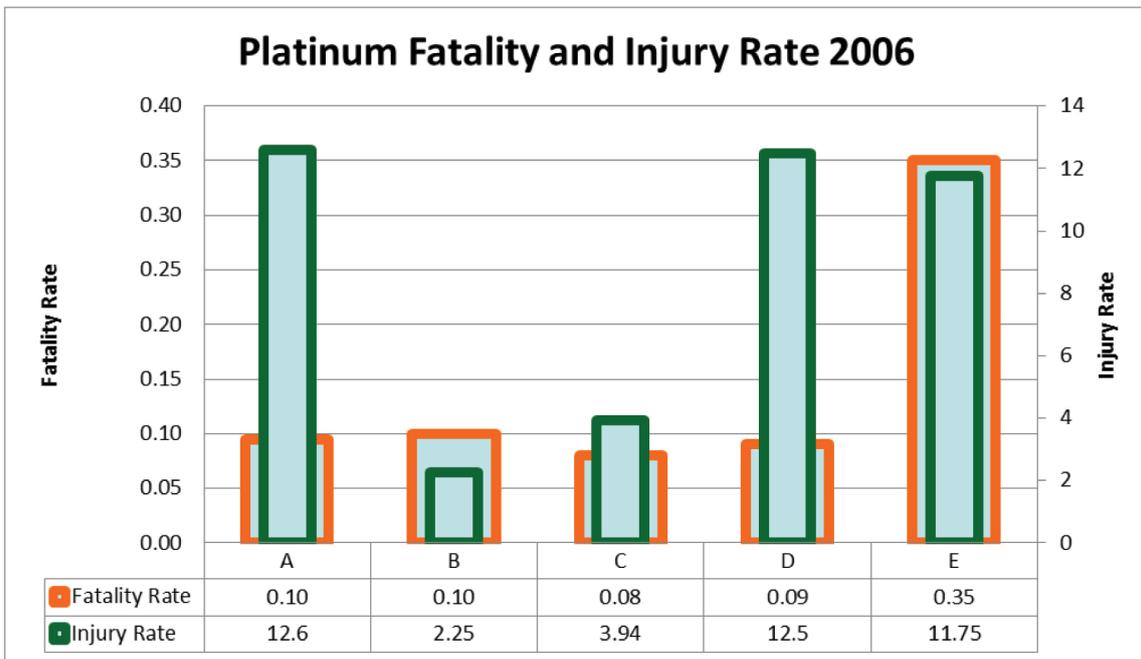


Figure 8–Platinum sector fatality and injury rate by company – 2006

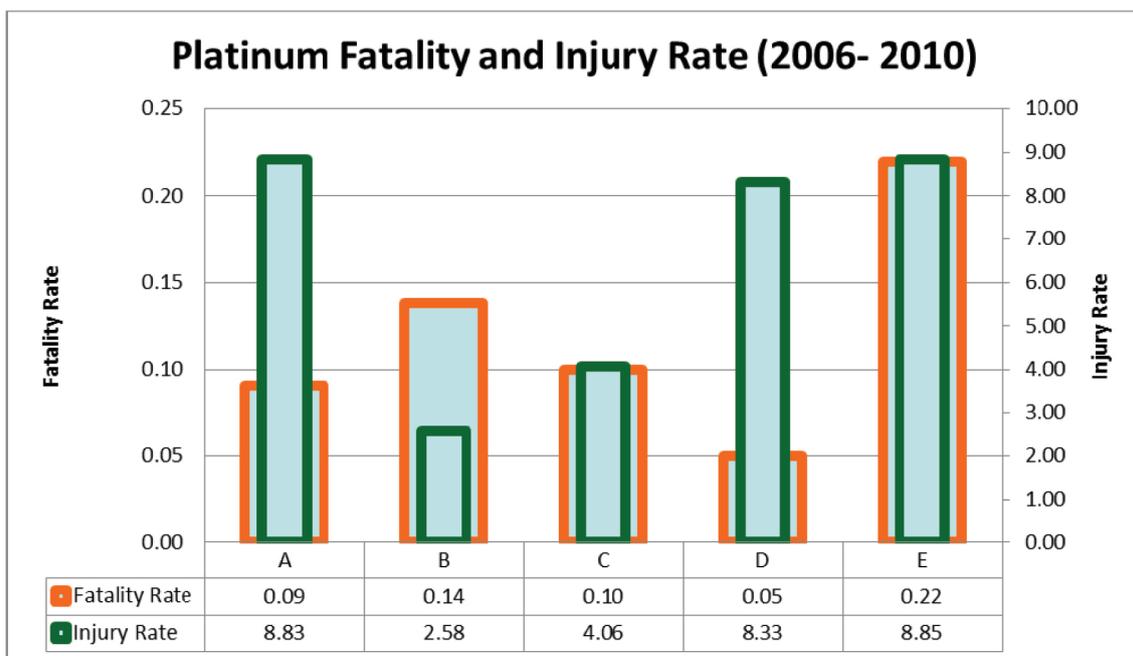


Figure 9–Aggregated Platinum sector fatality and injury rate by company – (2006-2010)

**Table II-The highest and the lowest fatality and injury rate by company (2006-2010)**

	2006	2007	2008	2009	2010	OVERALL
<b>Fatality rate - highest</b>	E	E	E	E	B	E
<b>Fatality rate - lowest</b>	C	D	C	D	D	D
<b>Injury rate - highest</b>	A	E	E	A	D	E
<b>Injury rate - lowest</b>	B	B	B	B	B	B

### **Approach to improve safety**

Improving safety usually incurs a cost, and mining companies are particularly conscious of the importance of controlling costs. However, cost considerations often deal only with direct costs, and it has been shown that indirect costs are usually far more significant. Therefore, a greater safety spend will usually result in the creation of value for the mine since it will reduce the indirect costs associated with accidents. The results of some recent research in this area are as follows.

Rock-related accidents continue to be a major contributor to the total number of accidents in the South African mining industry. To address this problem, research has recently been carried out at the University of the Witwatersrand (Rwodzi, 2010; Nezomba, 2012), specifically dealing with the problem of rockfalls, the main rock-related cause of fatalities in the industry. The scope of the research was different from the usual technical approach in that it has taken the costs of both direct and indirect consequences of rockfalls into account. The research has shown that, making use of structural geological data inputs, the probability of occurrence of rockfalls can be predicted. The predictions have shown satisfactory agreement with measured dimensions of actual rockfalls, thus validating the approach. Such predictions take the installed rock support into account, and thus it is possible to compare predictions of rockfall occurrences for alternative support systems, and hence determine the likely safety consequences corresponding with each system. In addition, since it has often been stated that a safe mine is a profitable mine, the financial consequences of the rockfalls can be quantified, thus allowing the creation or destruction of value associated with alternative support systems, to be determined. The results of the research show very clearly that indirect consequences, in particular the cost of loss of production, would be the major contributors to destruction of value from the mine.

The direct cost of rock support is usually low in comparison with the indirect costs, and hence the implementation of more effective (and usually more costly) rock support that will reduce the occurrence of rockfalls, will enhance safety and result in the creation of substantial value for the mining operation. The results of the research have been summarized in two publications (Joughin *et al.*, 2012a and 2012b), and illustrate clearly the linkage between safety and costs (value). Table III, from Joughin *et al.* (2012b), shows a set of results for one mine that illustrate comparative cost and safety data for several alternative support systems, demonstrating a substantial safety benefit.

**Table III-Comparative costs and injuries associated with alternative support systems  
(Joughin et al., 2012b)**

Support scenario	Cost per m <sup>2</sup>							Injuries per 100 000 m <sup>2</sup>	
	Support cost	Expected losses due to rockfalls					Total cost		
		Dilution	Sweepings	Re-support	Production	Injury			
1.5m cable anchors	R 80.00-	R 49.93	R 8.65	R 3.63	R 40.95	R 35.57	R 138.72	R 218.72	5.6
2.0m cable anchors	R 84.00-	R 31.36	R 6.47	R 2.13	R 35.20	R 23.24	R 98.40	R 182.40	3.6
2.5m cable anchors	R 89.00-	R 23.75	R 5.36	R 1.53	R 18.13	R 17.98	R 66.74	R 155.74	2.8
3.0m cable anchors	R 94.00	R 18.65	R 5.39	R 1.20	R 23.94	R 16.47	R 65.66	R 159.66	2.6
3.5m cable anchors	R 99.00+	R 13.30	R 4.19	R 0.79	R 22.14	R 12.63	R 53.05	R 152.05	2.0
4.0m cable anchors	R 104.00+	R 10.73	R 3.02	R 0.63	R 11.36	R 10.05	R 35.78	R 139.78	1.6
1.5m (12T)+pencil sticks	R 121.00	R 31.06	R 8.87	R 3.58	R 40.98	R 27.95	R 112.44	R 233.44	4.4

As a consequence of these research results, it was decided to investigate whether there has been any similar linkage between the financial performance of South African platinum mining companies and their safety performance. Financial results were retrieved from the selected companies' published annual results.

Annual financial results between 2008 and 2011 were assessed to determine whether there is any correlation between safety and financial performance. The financial comparisons were made using five categories, namely:

- Earnings before interest and tax (EBIT)
- Net profit
- Headline earnings per share (cents) (HEPS)
- Dividends per share (cents) (DPS)
- Net asset value per share (cents) (NAVPS)

Tables (IV–VIII) show the selected companies’ financial performances accordingly. An exchange rate of 8:1 between ZAR and USD is used where applicable, as two companies reported their financial results in USD. The remaining three companies’ financial results were reported in ZAR.

**Table IV-Company EBIT (000's)**

	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>
<b>A</b>	R 8 943 000	R 13 365 000	R 4 040 000	R 19 269 000
<b>B</b>	R 450 752	R 673 432	R -491 392	R 2 242 536
<b>C</b>	R 9 853 000	R 7 449 000	R 9 521 000	R 22 294 000
<b>D</b>	R 2 496 000	R 2 024 000	R -936 000	R 5 264 000
<b>E</b>	R 523 962	R 962 187	R 941 900	R 2 358 851

**Table V-Company net profit (000's)**

	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>
<b>A</b>	R 5 178 000	R 10 379 000	R 3 429 000	R 14 450 000
<b>B</b>	<b>-R 83 168</b>	R 222 184	<b>-R 365 936</b>	<b>-R 386 208</b>
<b>C</b>	R 6 638 000	R 4 715 000	R 6 020 000	R 17 596 000
<b>D</b>	R 2 064 000	R 992 000	<b>-R 1 816 000</b>	R 2 840 000
<b>E</b>	R 349 209	R 641 026	R 630 482	R 1 492 811

**Table VI-Company HEPS (cents)**

	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>
<b>A</b>	136.5	193.5	29.8	560.9
<b>B</b>	24.8	4.0	<b>8.8</b>	73.6
<b>C</b>	110.5	78.6	100.1	206.5
<b>D</b>	108.8	49.6	<b>111.2</b>	331.2
<b>E</b>	9.0	17.8	17.2	62.7

**Table VII-Company DPS (cents)**

	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>
<b>A</b>	R 70.0	R 0.0	R 0.0	R 350.0
<b>B</b>	R 6.4	R 4.8	R 0.0	R 16.0
<b>C</b>	R 57.0	R 39.0	R 32.0	R 147.5
<b>D</b>	R 12.0	R 12.0	R 0.0	R 47.2
<b>E</b>	R 1.5	R 4.0	R 7.8	R 33.0

**Table VIII-Company NAVPS (cents)**

	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>
<b>A</b>	R 26 617.77	R 25 999.53	R 18 794.54	R 17 870.07
<b>B</b>	R 1 703.36	R 1 666.56	R 1 331.36	R 1 944.40
<b>C</b>	R 9 712.97	R 8 986.74	R 8 301.43	R 8 442.98
<b>D</b>	R 12 175.20	R 11 157.36	R 9 822.72	R 10 855.36
<b>E</b>	R 2 812.37	R 2 610.52	R 2 462.13	R 1 402.58

Following the power crisis, the platinum price rose to an all-time high of \$2290 an ounce on 4 March, 2008. Tables IV–VIII all show that the companies’ selected financial indicators were highest in 2008 due to the high metal prices. Since then the metal price has fluctuated and the last four year (2008 to 2011) the average metal price was around \$1530. The drop in price also affected HEPS and DPS negatively over the last four years. EBIT value dropped between 53 per cent to 80 per cent between 2008 and 2011 (Table IV). A similar comparison was made for the safety performances in the platinum sector (Figures 1–3).

While the fatality rates improved by 18 per cent between 2006 and 2010, the injury rate worsened by 9 per cent for the same period. In terms of the individual company performances, companies A, D, and E showed clear improvements in their safety performances while company E showed the best improvements. Figure 10 shows the fatality and injury rates for companies A, D, and E from 2006-2010.

Similar to the EBIT, the net profit also suffered and dropped between 27 per cent and 78 per cent between 2008 and 2011 (Table V). Although their profitability dropped substantially, the selected companies continue posting reasonable profit margins. In terms of the individual company performances, companies B and C showed either very little or no improvement in their safety performances. Although company C performed very well financially, its safety performance deteriorated. Figure 11 shows the fatality and injury rates for companies B and C from 2006-2010.

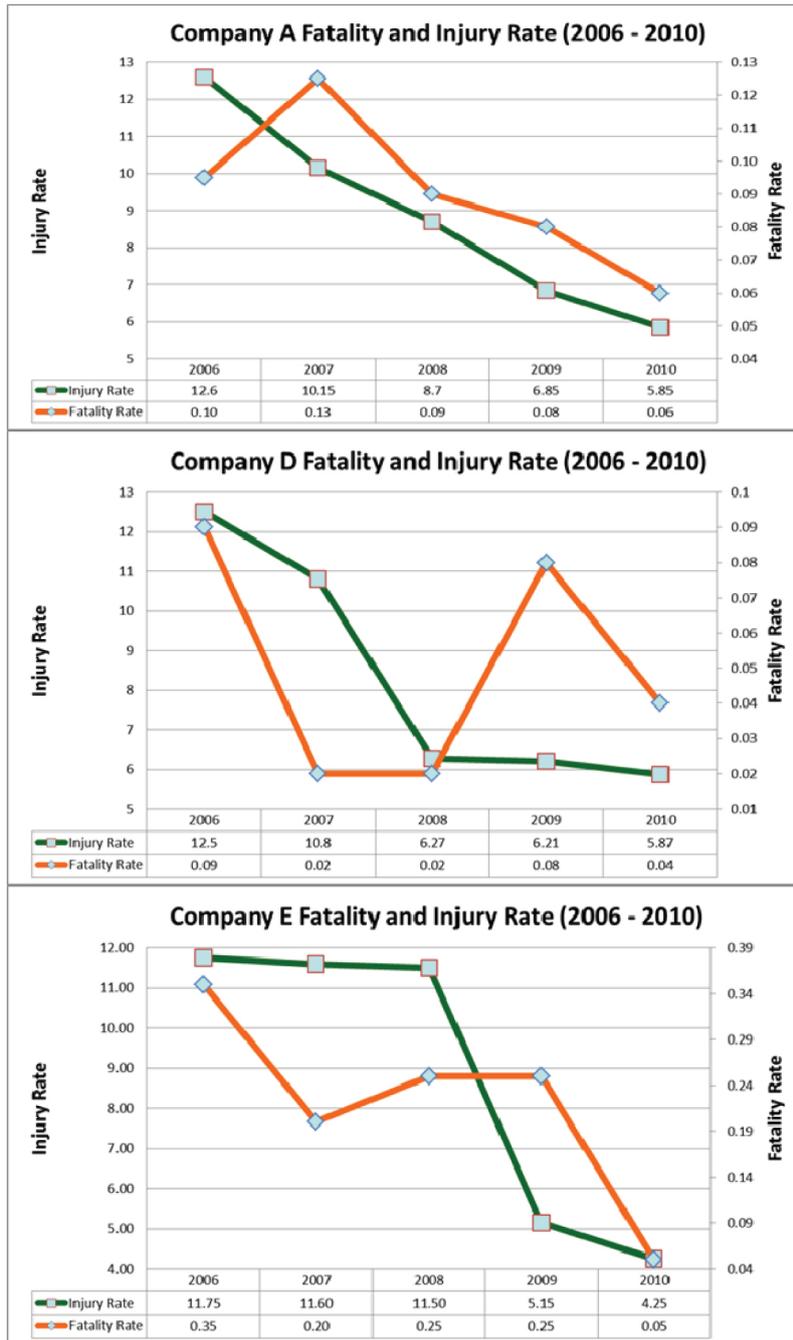
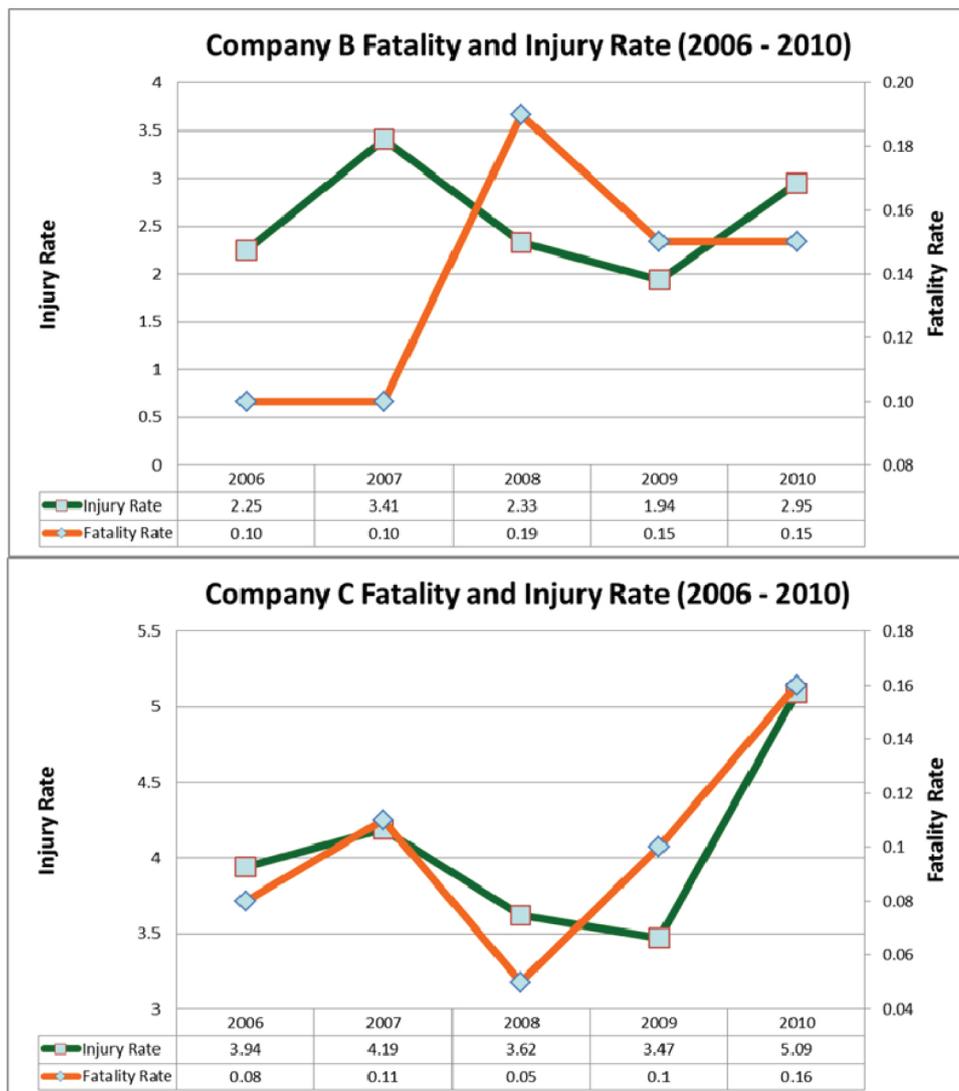


Figure 10–Fatality and injury rates for companies A, D, and E (2006-2010)



**Figure 11– Fatality and injury rates for companies B and C (2006-2010)**

HEPS values dropped between 46 per cent and 86 per cent between 2008 and 2011 (Table VI), and DPS values dropped between 60 per cent and 95 per cent over the same period (Table VII).

In terms of NAVPS values, only company B values dropped by 12 per cent, while the remaining companies' NAVPS values increased between 12 per cent and 101 per cent between 2008 and 2011 (Table VIII).

From the comparison made above, it is clear that there is no correlation between safety and financial performances among platinum miners. This is considered to be a positive finding, since it definitely does not indicate any tendency to place profit before safety.

## Conclusions

In this paper, safety data from the South African platinum mining sector has been analysed for the period 2006 to 2010. The data was obtained from company annual reports as well as from the Department of Mineral Resources, and analysis in the study has been limited to injury and fatality data only. The overall safety performances of companies in the sector are compared, and opportunities for benchmarking and recognizing potential sources of best practice amongst platinum miners are identified.

While the data set is representative of the majority of platinum producers, it is not representative of the platinum mining sector as a whole, and the best performance among the selected companies can be identified. Nevertheless, this study gives a clear indication about where the best practices amongst the selected companies can be found, and where problems can be anticipated. It is apparent that high levels of injuries – fatal and non-fatal - correspond to situations in which large numbers of people are potentially exposed to major hazards. This implies that attention to both the control of major hazards and to the reduction of numbers of people potentially exposed, would lead to improvements in safety.

Rock support that will reduce the occurrence of rockfalls, and hence will minimize associated indirect costs, will enhance safety and result in the creation of substantial value for the mining operation. The financial performances of mining companies in the sector were compared with safety performance, and the results showed that there is no obvious connection between safety and financial performance amongst platinum miners.

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