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Estimating mine planning software utilization for decision-making strategies in the South African coal mining sector

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Synopsis

Mine planning software continues to be an important factor when it comes to the development of the South African mining industry. To contribute to this development, a new methodology to define and measure mine planning software utilization in the South African coal mining sector within an evolving data-set framework was developed. An initial data-set showing the mine planning software providers, their corresponding software solutions, as well as the software capabilities and information on the number of licences was collected and compiled in 2012 in an online database for software utilized in the South African mining industry. Details of the database development and implementation were published in the *Journal of the Southern African Institute of Mining and Metallurgy* in 2013. In 2014 the data-set was updated with additional and new information.

In this paper, using the 2012 and 2014 time-stamps, a methodology for estimating the software utilization is developed. In this methodology, three variables: commodity, functionality, and time factor are used to define and measure the software utilization in order to ultimately inform decision-making strategies for software utilization. Utilization in the coal sector was measured according to six different functionalities, namely Geological Data Management, Geological Modelling and Resource Estimation, Design and Layout, Scheduling, Financial Valuation and Optimization. The methodology is useful for stakeholders reviewing existing software combinations or intending to purchase new software in the near future and wanting to estimate the comparative attractiveness of a certain software package. These stakeholders include mining companies, consulting companies, educational institutions, and software providers. The work presented in this paper is part of a PhD research study in the School of Mining Engineering at the University of the Witwatersrand.

Keywords

coal mining, coal sector software utilization, database, South African mining industry.

Introduction

This paper outlines the development of a new methodology to define and measure mine planning software utilization in the South African coal mining sector. Although the calculations can be done for any commodity, in this paper calculations were only done only for coal. Coal, which is used to generate electricity, accounted for almost 26% of South Africa's mining income during 2013 (Statistics South Africa, 2014).

An initial data-set showing the mine planning software providers, their corresponding software solutions, as well as the software capabilities and information on the number of licences was collected and compiled in 2012 in an online database. The database development and implementation was published in the *Journal of the Southern African Institute of Mining and Metallurgy* in 2013 (Katakwa, Musingwini, and Genc, 2013). In 2014 the data-set was updated with additional and new information. Using the updated data-set, a methodology was developed to measure mine planning software utilization in the coal sector in order to ultimately inform decision-making strategies for utilization of the coal sector's software.

Software utilization

Utilization is an important factor as it is often associated with the level of productivity in the South African mining industry. According to the Oxford English Dictionaries (2014), the root of the word 'utilization' comes from the word 'utilize', meaning 'make practical and effective use of'. Hence software utilization can be defined as the effective use of mine planning software, but in general, utilization is associated with the overall equipment effectiveness, which is one of the key performance-based metrics. Overall equipment effectiveness (OEE) is not only one of the most widely used metrics to determine performance against capability of the equipment, but is also commonly used as a key performance indicator (KPI) in Total Productive Maintenance (TPM) and Lean Manufacturing programmes for measuring production efficiency (Vorne Industries, 2008). Detailed information

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regarding overall equipment effectiveness was documented by Genc, Musingwini, and Celik (2015).

OEE is designed for measuring equipment utilization, or hardware utilization, and there is a need for a definition of software utilization, which can be used to establish a framework towards defining strategic mine planning software utilization.

Some researchers have tried to define software utilization using the number of techniques available, such as system-user interaction data to understand how often the software is being used as well as to what degree it is being used. (El-Ramly and Stroulia, 2004). However, this approach cannot be used to measure mine planning software utilization, considering the size of the whole South African mining sector and user privacy. Due to these reasons, a methodology was developed in such a way that utilization of the various mine planning software solutions that are available could be measured. The next section defines this measurement framework.

Utilization framework

Software utilization can be defined by associating many-to-many, one-to-many, and many-to-one relationships between entity types. In this association, the relationship between software vendors, commodity, functionality, and time factor were used to develop the following terminology:

$$\{C_i, F_l\} \rightarrow S_{k=\{i,l\}}$$

where C_i denotes commodity (i) and F_l denotes functionality (l). Furthermore, S_k is the software that performs tasks on commodity (i) according to functionality (l). In the market there is usually more than one software solution specifically designed for commodity (i) and functionality (l). Genc, Musingwini, and Celik (2015) gave a detailed explanation about the terminology which defined utilization: $u_{i,l}^{(m)}$ is the utilization of the software that performs task on commodity (i) and functionality (l) by using software (m). Although there is no rigid definition of software utilization, it may be defined as a numeric value that falls in to the range between 0 and 1 inclusive, *i.e.*

$$u_{i,l}^{(m)} \in [0,1]$$

thus enabling further analysis of software utilization.

Furthermore, the utilization formula can be extended by considering the time factor (t):

$$u_{i,l}^{(m,t)} = f_{i,l}^{(m,t)} . w_{i,l}^{(m,t)}$$

where $f_{i,l}^{(m,t)}$ is a quantity factor that relates to the software that performs a specific task on commodity (i) and functionality (l) using software (m) at a specific time (t), and $w_{i,l}^{(m,t)}$ is the weighting factor, which will handle the missing data-related issues and/or other factors such as market capitalization of the companies. For instance, $f_{i,l}^{(m,t)}$ can be defined as the total number of sites. For example, if the market capitalization of the software companies X and Y are US$1 million and US$100 million respectively, but both companies have a software solution with the same functionality, then the weighting factor of the small company will be higher than the other software company. Furthermore, the price of the mine planning software as well as support availability plays an important role when considering the weighting factor.

Although software utilization is already defined in a generic way, it can also be defined in a specific way, *i.e.* the relative utilization (r). Relative utilization can be considered as a weighted software utilization, and can be formulated as:

$$r_{i,l}^{(m,t)} = \frac{u_{i,l}^{(m,t)}}{\sum_{n=1}^{M} u_{i,l}^{(n,t)}}$$

where

$$\sum_{n=1}^{M} u_{i,l}^{(n,t)}$$

is total utilization of all software, and is used for normalization.

Calculating relative utilization leads to the weighted market impact of software utilization. In the calculation of relative utilization, three variables were used to generate the results, namely:

- Commodity (i)
- Functionality (l)
- Time factor (t).

The following results were calculated for only one commodity (coal) using six different functionalities (Katakwa, Musingwini, and Genc, 2013):

- Geological data management
- Geological modelling and resource estimation
- Design and layout
- Scheduling
- Financial valuation
- Optimization.

These six functionalities originated from the Open Group's Business Reference Model, which categorizes not only the functionalities of mine planning software, but also mine value chain stages and mining methods (The Open Group, 2010). The Business Reference Model illustrates how the various software solutions interact with each other, although this classification can be debateable. For example, Mine 2-4D software, which is used in mine scheduling, is often used in conjunction with Enhanced Production Scheduler (EPS) as it cannot produce a schedule without the use of EPS. Figure 1 shows the names of available mine planning software solutions and their functionalities along the mining value chain.

The time factor (t) has two timestamp indicators showing different data collection dates:

- September 2012, t=1
- April 2014, t=2.

By using all three variables, the weighted software utilization, and hence the market impact of each participating mine planning software solution, was calculated. The data-set was extracted from the updated database and the programming language GNU Octave was used for the data analysis and calculation of the software utilization per functionality using the two different time-stamps.

It is important to note that if $f_{i,l}^{(m,t)}$ is zero, the subject software either does not support the specific functionality or does not support the specific commodity. Furthermore, when calculating $u_{i,l}^{(m)}$ and $w_{i,l}^{(m,t)}$, the value is set to unity, as at this stage of calculation it was decided that the weighted software utilization did not have any impact on the calculation of the relative software utilization.

	Geological Data Management	Geological Modelling and Resource Estimation	Design and Layout	Scheduling	Financial Valuation	Optimisation
Bentley Evaluation				■	■	
Bentley Scheduler				■		
BLOCK AGG	■			■		
CADSMine		■	■	■		
Carbon 14 Mine Scheduler				■		
Carbon Economics					■	■
Carbon Micro Scheduler				■		
Carbon Performance Manager					■	
Carbon Processing				■	■	
Carbon Risk					■	■
Carbon V						■
Chronos				■		
Dragsim				■		■
Enhanced Production Scheduler (CAE)				■		■
EPS (MineRP)				■		
EPS Viz (Visualizer)				■		
EPS-PCBC Interface				■		
EPSOT (EPS Schedule Optimization Tool)				■		■
GEMS	■	■	■			
Geological Data Management Solution	■					
HAULNET				■		
Interactive Short Term Scheduler			■	■		
LoM Economics					■	■
Maptek I-Site	■					
Maxipit					■	■
Mine 2-4D			■	■		
Mine Scenario Planning			■	■		
Mineable Layout Optimizer			■			
Mineable Reserves Optimizer (CAE)			■	■		
Mineable Shape Optimizer			■	■		■
mineCAD			■			
mineCAVE			■			
mineHAUL			■			
mineMARKUP	■					
Mineral Beneficiation					■	■
MineSched				■		
mineSERV			■			
mineSTRUCTURE		■	■			
Minex	■	■	■			
MKP (Mining Knowledge Platform)	■	■				
MRM	■	■	■	■	■	■
NPV Scheduler (CAE)				■	■	■
NPV Scheduler (MineRP)				■	■	
Open Pit Metals				■		
PCBC				■		
Pegs Lite	■					
Performance Diagnostics						■
Portfolio Modelling					■	
Qerent Modeller					■	■
Sable Data Warehouse	■					
Services and Logistics			■	■		■
Sirovision	■	■				
Strat 3D		■				
Studio 3 - Engineering			■			
Studio 3 - Geology		■				■
Studio 5D Planner			■	■		
Studio3 - Basics						■
Surpac	■	■	■			
Talpac			■			
Underground Coal				■		
Ventsim Visual (Advanced)			■			
Vulcan	■	■	■			
Whittle					■	■
Workforce Planning					■	■
Xact				■		
Xeras					■	■
Xpac				■		

Figure 1 – Available mine planning software and functionalities along the mining value chain

Results

Six functionalities (l) with two time-stamps (t) were used for the calculations, and the results for each functionality with two time-stamps are presented as tables and figures. Accordingly, a total of $\{6(l) \times 2(t) = 12\}$ tables were created. According to the functionality list provided earlier, the first functionality, 'Geological Data Management' was used with two different time-stamps to produce the first sets of two tables. After generating the tables, pie charts were created for each table for easy interpretation of the results. Consequently, using the functionality list, the remaining tables and figures were created in a similar manner.

The following software providers participated in this study: Geovia, MineRP Solutions, Sable, RungePincockMinarco, Maptek, Cyest Technology and CAE Mining. Note that data on CAE Mining was made available only in the April 2014 data-set. The results presented here do not distinguish between either the mining methods or the type of mine (surface or underground operation).

Geological Data Management functionality

Table I shows the market share of the individual software solutions for coal using the functionality Geological Data Management, as at September 2012. Figure 2 is a graphical representation of Table I. (The column headings $f_{i,l}^{(m,t)}$, $w_{i,l}^{(m,t)}$, $u_{i,l}^{(m)}$ and $r_{i,l}^{(m)}$ in Tables I to IX were defined in the section 'Utilization framework'.)

The results for the September 2012 and April 2014 time-stamps are identical, indicating that there were no changes

between the two different data-sets. This is the reason why there is only a single table showing results for both time-stamps, and similarly, Figure 2 represents both time-stamps.

Minex software clearly is the market leader and the most utilized mine planning software for Geological Data Management. Minex is followed by Sable Data Warehouse, with a 22% market share for the commodity coal.

Geological Modelling and Resource Estimation functionality

The results for the Geological Modelling and Resource Estimation functionality are very similar to those for Geological Data Management, in terms of both time-stamps being identical. Hence there is only one table (Table II) showing results for Geological Modelling and Resource Estimation. Figure 3 is a graphical representation of Table II.

Minex software is again the market leader, with a 82% share, followed by Surpac with 22%.

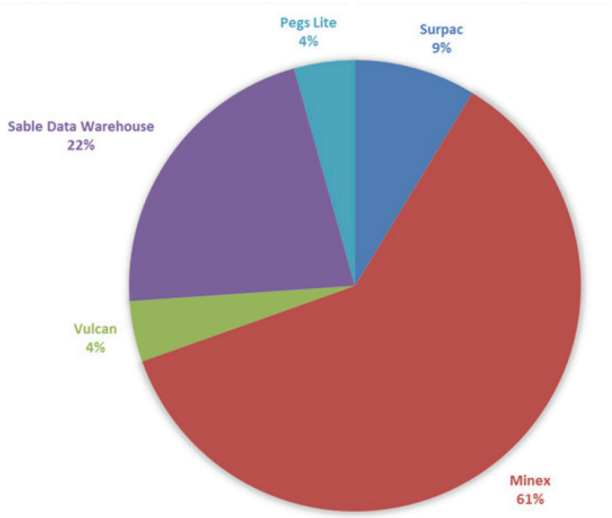

Figure 2 – Geological Data Management functionality: software utilization for coal

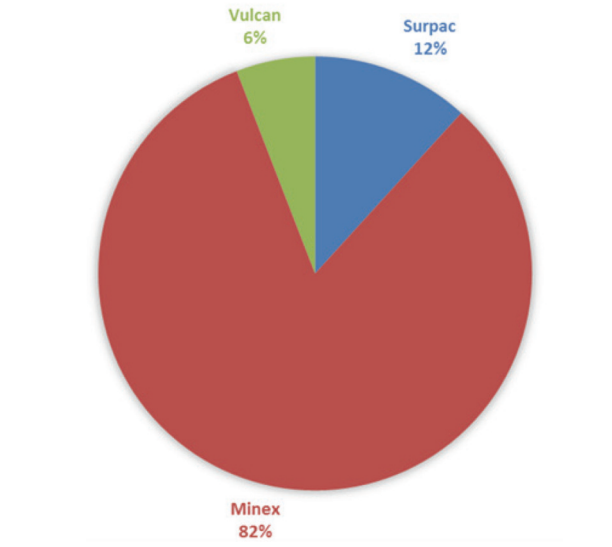

Figure 3 – Geological Modelling and Resource Estimation functionality: software utilization for coal

Table I

Geological Data Management functionality: software utilization for coal

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	BLOCK AGG	0	1	0	0
2	GEMS	0	1	0	0
3	Geological Data Management	0	1	0	0
4	Maptek I-Site	0	1	0	0
5	mineMARKUP	0	1	0	0
6	Minex	14	1	14	0.6087
7	MKP (Mining Knowledge Platform)	0	1	0	0
8	MRM	0	1	0	0
9	Pegs Lite	1	1	1	0.0435
10	Sable Data Warehouse	5	1	5	0.2174
11	Sirovision	0	1	0	0
12	Surpac	2	1	2	0.087
13	Vulcan	1	1	1	0.0435

Table II

Geological Modelling and Resource Estimation functionality: software utilization for coal

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	CADSMine	0	1	0	0
2	GEMS	0	1	0	0
3	Minex	14	1	14	0.8235
4	MKP (Mining Knowledge Platform)	0	1	0	0
5	MRM	0	1	0	0
6	Sirovision	0	1	0	0
7	Strat 3D	0	1	0	0
8	Studio 3 - Geology	0	1	0	0
9	Surpac	2	1	2	0.1176
10	Vulcan	1	1	1	0.0588

Design and Layout functionality

Table III shows the Design and Layout software results as at September 2012, while Table IV shows results as at April 2014. Figure 4 is a graphical representation of both tables.

The pie charts in Figure 4 show that the only difference between September 2012 and April 2014 is the inclusion of the Studio 5D Planner, from CAE Mining, in the 2014 data-set. Studio 5D Planner has a 5% market share in the April 2014 time-stamp. Nevertheless, Minex continues its dominance in the coal mining sector with a 64% market share in April 2014 compared to 67% in September 2012, followed by Talpac software, with 19% and 18% respectively for Design and Layout functionality.

Scheduling functionality

Table V shows the Scheduling functionality results as at September 2012 for coal, while Table VI shows the results using the second time-stamp, April 2014. Figure 5 is a graphical representation of both tables.

Similar to the results for Design and Layout, the entry of CAE Mining software once again visible in the April 2014 time-stamp, with Studio 5D Planner and Enhanced Production Scheduler software both having a 2% market share. However, although it lost 3% of the market share between September 2012 and April 2014, Xpac is still the leader in the coal mining sector when it comes to Scheduling functionality software. Xpac is followed by Dragsim software,

Table III

Design and Layout functionality: software utilixation for coal as at September 2012

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	CADSMine	0	1	0	0
2	GEMS	0	1	0	0
3	Interactive Short Term Scheduler	0	1	0	0
4	Mine 2-4D	0	1	0	0
5	Mine Scenario Planning	0	1	0	0
6	Mineable Layout Optimizer	0	1	0	0
7	Mineable Reserves Optimizer (CAE)	0	1	0	0
8	Mineable Shape Optimizer	0	1	0	0
9	mineCAD	0	1	0	0
10	mineSERV	0	1	0	0
11	Minex	14	1	14	0.6667
12	MRM	0	1	0	0
13	Services and Logistics	0	1	0	0
14	Studio 3 - Engineering	0	1	0	0
15	Studio 5D Planner	0	1	0	0
16	Surpac	2	1	2	0.0952
17	Talpac	4	1	4	0.1905
18	Vulcan	1	1	1	0.0476

Table IV

Design and Layout functionality: software utilization for coal as at April 2014

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	CADSMine	0	1	0	0
2	GEMS	0	1	0	0
3	Interactive Short Term Scheduler	0	1	0	0
4	Mine 2-4D	0	1	0	0
5	Mine Scenario Planning	0	1	0	0
6	Mineable Layout Optimizer	0	1	0	0
7	Mineable Reserves Optimizer (CAE)	0	1	0	0
8	Mineable Shape Optimizer	0	1	0	0
9	mineCAD	0	1	0	0
10	mineSERV	0	1	0	0
11	Minex	14	1	14	0.6364
12	MRM	0	1	0	0
13	Services and Logistics	0	1	0	0
14	Studio 3 - Engineering	0	1	0	0
15	Studio 5D Planner	1	1	1	0.0455
16	Surpac	2	1	2	0.0909
17	Talpac	4	1	4	0.1818
18	Vulcan	1	1	1	0.0455

with an 11% market share on both the 2012 and 2014 time-stamps.

Financial Valuation functionality

Table VII shows the Financial Valuation functionality results. The results for both time-stamps were found to be identical, hence there is only one table. Figure 6 is a graphical representation of Table VII.

It can be clearly seen that Xeras is the market leader in Financial Valuation software, with a 92% share. Xeras is followed by Carbon Economics software, with an 8% market share.

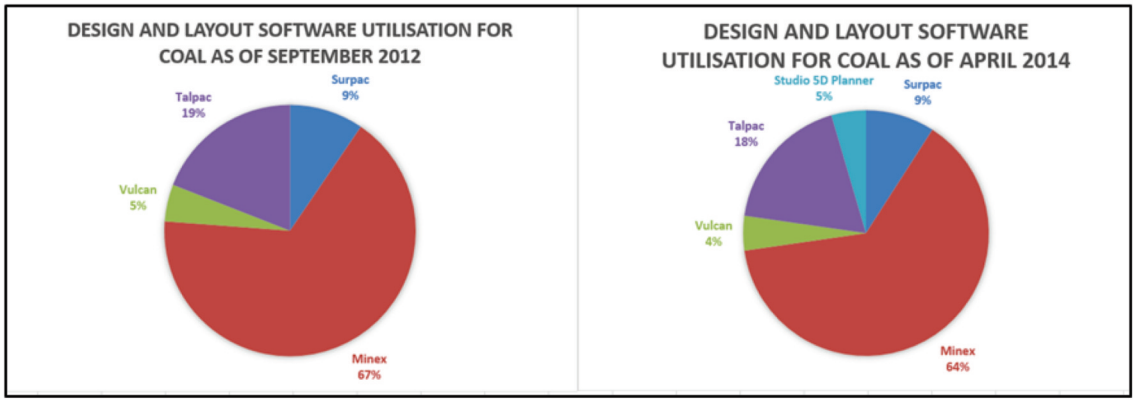

Figure 4 – Design and Layout functionality: software utilization for coal

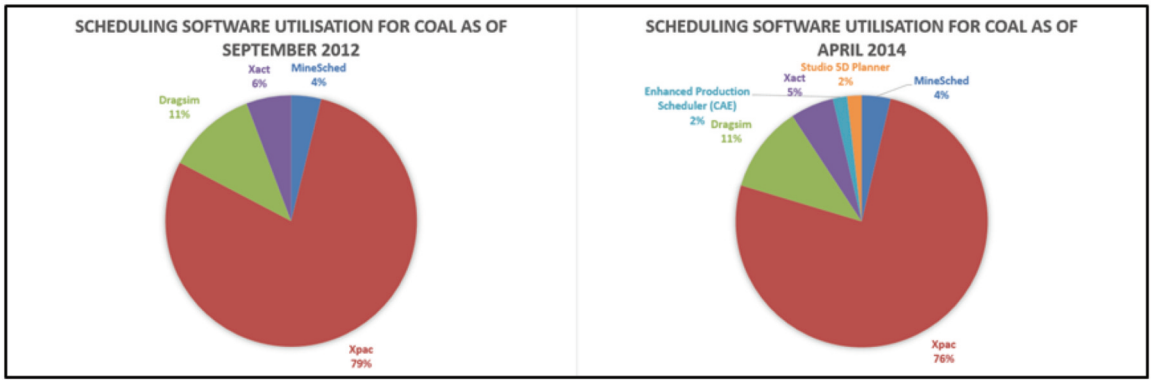

Figure 5 – Scheduling functionality: software utilization for coal

Table V

Scheduling functionality software: utilization for coal as at September 2012

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	Bentley Evaluation	0	1	0	0
2	Bentley Scheduler	0	1	0	0
3	BLOCK AGG	0	1	0	0
4	CADSMine	0	1	0	0
5	Carbon 14 Mine Scheduler	0	1	0	0
6	Carbon Micro Scheduler	0	1	0	0
7	Carbon Processing	0	1	0	0
8	Chronos	0	1	0	0
9	Dragsim	6	1	6	0.1154
10	Enhanced Production Scheduler (CAE)	0	1	0	0
11	EPS (MineRP)	0	1	0	0
12	EPS Viz (Visualizer)	0	1	0	0
13	EPS-PCBC Interface	0	1	0	0
14	HAULNET	0	1	0	0
15	Interactive Short Term Scheduler	0	1	0	0
16	Mine 2-4D	0	1	0	0
17	Mine Scenario Planning	0	1	0	0
18	Mineable Reserves Optimizer (CAE)	0	1	0	0
19	Mineable Shape Optimizer	0	1	0	0
20	MineSched	2	1	2	0.0385
21	MRM	0	1	0	0
22	NPV Scheduler (CAE)	0	1	0	0
23	Open Pit Metals	0	1	0	0
24	PCBC	0	1	0	0
25	Services and Logistics	0	1	0	0
26	Studio 5D Planner	0	1	0	0
27	Underground Coal	0	1	0	0
28	Xact	3	1	3	0.0577
29	Xpac	41	1	41	0.7885

Table VI

Scheduling functionality: software utilization for coal as at April 2014

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	Bentley Evaluation	0	1	0	0
2	Bentley Scheduler	0	1	0	0
3	BLOCK AGG	0	1	0	0
4	CADSMine	0	1	0	0
5	Carbon 14 Mine Scheduler	0	1	0	0
6	Carbon Micro Scheduler	0	1	0	0
7	Carbon Processing	0	1	0	0
8	Chronos	0	1	0	0
9	Dragsim	6	1	6	0.1111
10	Enhanced Production Scheduler (CAE)	1	1	1	0.0185
11	EPS (MineRP)	0	1	0	0
12	EPS Viz (Visualizer)	0	1	0	0
13	EPS-PCBC Interface	0	1	0	0
14	HAULNET	0	1	0	0
15	Interactive Short Term Scheduler	0	1	0	0
16	Mine 2-4D	0	1	0	0
17	Mine Scenario Planning	0	1	0	0
18	Mineable Reserves Optimizer (CAE)	0	1	0	0
19	Mineable Shape Optimizer	0	1	0	0
20	MineSched	2	1	2	0.037
21	MRM	0	1	0	0
22	NPV Scheduler (CAE)	0	1	0	0
23	Open Pit Metals	0	1	0	0
24	PCBC	0	1	0	0
25	Services and Logistics	0	1	0	0
26	Studio 5D Planner	1	1	1	0.0185
27	Underground Coal	0	1	0	0
28	Xact	3	1	3	0.0556
29	Xpac	41	1	41	0.7593

Table VII

Financial Valuation functionality: software utilization for coal

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	Bentley Evaluation	0	1	0	0
2	Carbon Economics	1	1	1	0.0833
3	Carbon Performance Manager	0	1	0	0
4	Carbon Processing	0	1	0	0
5	LoM Economics	0	1	0	0
6	Maxipit	0	1	0	0
7	Mineral Beneficiation	0	1	0	0
8	MRM	0	1	0	0
9	NPV Scheduler (CAE)	0	1	0	0
10	Portfolio Modelling	0	1	0	0
11	Qerent Modeller	0	1	0	0
12	Whittle	0	1	0	0
13	Xeras	11	1	11	0.9167

Optimization functionality

Table VII shows the Optimization software results as at September 2012, while Table IX shows results as at April 2014. Figure 7 is a graphical representation of both tables.

The only difference between the two pie charts is the presence of the Enhanced Production Scheduler (CAE) software in the April 2014 chart, with a 5% market share. However, Xeras (58%) and Dragsim (32%) continued their dominance in 2014.

Conclusion

A methodology for the evaluation of mine planning software utilization in the South African coal mining sector has been developed. In this framework, three variables, namely, commodity (i), functionality (l), and time factor (t) were used to calculate the results. Although the calculations can be done for any commodity in a similar manner, this paper deals only with utilization in the coal sector. Six functionalities, namely Geological Data Management, Geological Modelling and Resource Estimation, Design and Layout, Scheduling, Financial Valuation, and Optimization were applied using two different time-stamps (September 2012 and April 2014).

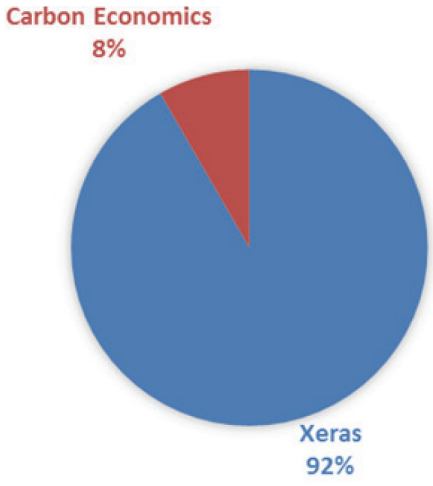

Figure 6 – Financial Valuation functionality: software utilization for coal

Table VIII

Optimization functionality software: utilization for coal as at September 2012

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	Carbon Economics	1	1	1	0.0556
2	Carbon V	0	1	0	0
3	Dragsim	6	1	6	0.3333
4	Enhanced Production Scheduler (CAE)	0	1	0	0
5	LoM Economics	0	1	0	0
6	Maxipit	0	1	0	0
7	Mineable Shape Optimizer	0	1	0	0
8	Mineral Beneficiation	0	1	0	0
9	MRM	0	1	0	0
10	NPV Scheduler (CAE)	0	1	0	0
11	Performance Diagnostics	0	1	0	0
12	Qerent Modeller	0	1	0	0
13	Services and Logistics	0	1	0	0
14	Studio 3 - Geology	0	1	0	0
15	Studio3 - Basics	0	1	0	0
16	Whittle	0	1	0	0
17	Xeras	11	1	11	0.6111

Table IX

Optimization functionality: software utilization for coal as at April 2014

m	Software	$f_{i,l}^{(m,t)}$	$w_{i,l}^{(m,t)}$	$u_{i,l}^{(m)}$	$r_{i,l}^{(m)}$
1	Carbon Economics	1	1	1	0.0526
2	Carbon V	0	1	0	0
3	Dragsim	6	1	6	0.3158
4	Enhanced Production Scheduler) (CAE	1	1	1	0.0526
5	LoM Economics	0	1	0	0
6	Maxipit	0	1	0	0
7	Mineable Shape Optimizer	0	1	0	0
8	Mineral Beneficiation	0	1	0	0
9	MRM	0	1	0	0
10	NPV Scheduler (CAE)	0	1	0	0
11	Performance Diagnostics	0	1	0	0
12	Qerent Modeller	0	1	0	0
13	Services and Logistics	0	1	0	0
14	Studio 3 - Geology	0	1	0	0
15	Studio3 - Basics	0	1	0	0
16	Whittle	0	1	0	0
17	Xeras	11	1	11	0.5789

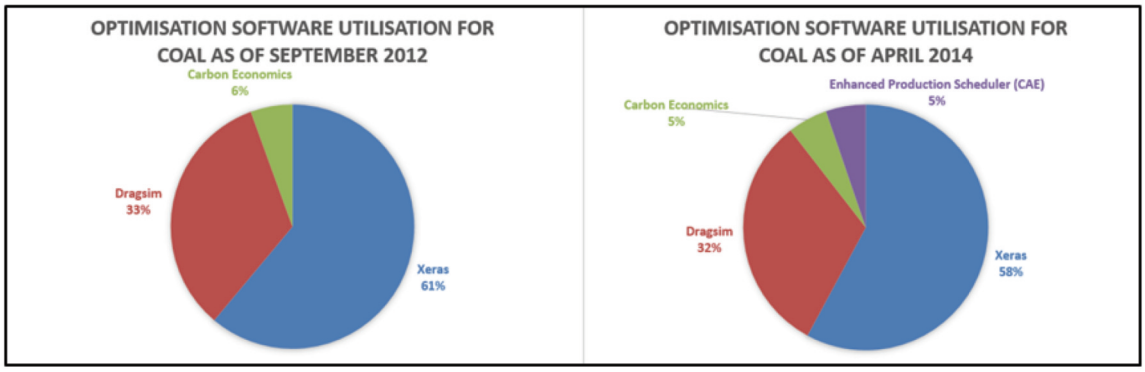

Figure 7 – Optimization functionality: software utilization for coal

Data on CAE Mining software was made available only in the April 2014 data-set, nevertheless the CAE Mining market impact is minimal in the coal sector.

By using this newly developed framework, utilization of the various mine planning software solutions was measured. This methodology provides an opportunity for software users to review existing software combinations, or those intending to purchase new software with a tool for estimating the comparative attractiveness of certain software packages. For example, mining companies can position themselves better by acquiring combinations of mine planning software; consulting companies can advise their clients more effectively to make the right choices of software solution; tertiary education institutions offering mining-related qualifications can choose which software to expose their students to; and software providers can strategically position themselves in the mine planning software market.

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