



# Labour's utilization and labour's productivity of a gold mine in Saudi Arabia

by M.S.M. Aljuhani\*

## Synopsis

In this paper, one of the human factors that affect productivity in an underground gold mine in Saudi Arabia was investigated and analysed for the purpose of improving productivity. The human factor that was investigated is labour utilization and labour productivity. In the selected mine, labourer's performances were measured carefully. It was found that in this mine, workers spend only 65% of the shift time in a productive work, and they spend 35% of the shift time in non-productive activities. As a result, recommendations were presented to enhance productivity in the selected underground gold mine by enhancing labour utilization.

## Introduction

According to Dean<sup>1</sup>, the largest component of an underground mine's operating expenses is the labour cost, typically from 40% to 50% with some as high as 60% of the total cost. Industrial managers know that the total cost will go down if they can accomplish the job with fewer people. Moreover, enhancing the productivity per man-hour is one of the greatest savings in manpower and that can be a powerful incentive to any mine. Increasing productivity means that the same work can be performed with fewer people. It is very attractive to any productive company to increase productivity without any extra cost. Thus, reducing the cost of labour is seen as a direct goal to reduce the total production cost and increase the mine profitability.

Literature review indicates that in order to optimize productivity, the pertaining factors must be studied. Thus, in this paper, one of the human factors that affect productivity in an underground gold mine in Saudi Arabia was investigated. The human factor that was studied carefully, is labour's utilization and labour's productivity. According to Grayson and Wang<sup>2</sup>, Page, *et al.*<sup>3</sup>, Tomlinson<sup>4</sup>, and Stefanko<sup>5</sup>, the human factors that might affect mining productivity are:

- ▶ labour utilization and labour productivity

- ▶ labour/management relations
- ▶ labour/labour relations and
- ▶ the crew quality.

One of the most important human factors that directly affects any mine productivity is labour utilization and labour productivity. Labour's utilization can be measured using two techniques as follows:

- ▶ measuring labor utilization: the percentage of time the work force is available for productive work during a schedule working period, like a shift
- ▶ measuring labor productivity: the percentage of time that the work force or individual workers are at the work site with tools performing productive job<sup>4</sup>.

Hence, in this study, labour's utilization and labour productivity of an underground gold mine in Saudi Arabia was investigated and analysed for the purpose of improving productivity. Consequently, recommendations were presented to enhance productivity in the selected underground gold mine.

## Measuring labour's utilization and labour's productivity in the selected mine

According to Tomlinson<sup>4</sup>, the factors influencing utilization and productivity of labors for any organization are:

- ▶ late starts, reporting to the work site after the scheduled starting time
- ▶ unsanctioned breaks, unauthorized absences from the work site
- ▶ sanctioned breaks, authorized absences from the work site for lunch or tea breaks
- ▶ in-mine—travel-away from the work site to obtain tools or any thing else and
- ▶ early quits—leaving the work site before

\* Mining Engineering Department, King Abdulaziz University, Jeddah, Saudi Arabia.

© The South African Institute of Mining and Metallurgy, 2002. SA ISSN 0038-223X/3.00 + 0.00. Paper received Mar. 2002; revised paper received Mar. 2002.

# Labour's utilization and labour's productivity of a gold mine in Saudi Arabia

the end of the shift or quit working before the start of lunch break.

Prior to data collecting, discussions with miners individually several times were made in order to discover the factors that influence labour utilization in this mine. As a result, the discussions with the miners revealed that workers use 40% of the shift on non-productive activities such as late starts, early quit at the end of the shift, breaks, and late starts after lunch. Therefore, a data-collecting form was designed in order to measure labour utilization and productivity of the mine. Consequently, non-productive time was measured carefully based on data collected from workers individually during their work using one form for each miner/shift. Data were collected for one month for each miner individually. The data include starting time in the work site, break starting time, in-mine-travel time, and quit time at the end of the shift. Table I shows an example of the data collected for one worker for one shift.

Similarly, the data were collected for 34 different selected miners for one month. Therefore, 850 observations were collected for the 34 different miners. The selected employees have different education and different tasks. They have been selected to represent the average education of the workers of the mine. Table II shows the selected employees and their education. The data were saved on files and analysed in order to determine labour performance of the gold mine.

## Data analysis and results

The data were collected for the 34 miners for one month on a shift basis, and it was saved on files. After data analysis, it was found that miners waste 35.4% on average of their productive time. Table III shows the average non-productive time in the mine during a typical 8-hour shift or 480 minutes for the 34 miners. Of the 480 minutes available for production during each shift, workers available do work for only 310 minutes, or 65% of the total time. It means that there is a significant gap, and through the gap productivity can be improved if the supervisors change the habits of the workers.

In the selected mine, the workers spend 60 minutes in each shift for lunch break. Thus, the total available time for productive work less lunch time =  $480 - 60 = 430$  minutes, or 87.5% of the total shift time. Figure 1 shows that there is a wide variance in the amount of time workers are usually in a production stage versus the time they are available for work and the time they actually get paid for in the selected mine.

The greatest saving in manpower as the result of better productivity can be a powerful incentive to the mine to start the improvement process. Increasing productivity means that the same work can be performed with fewer people. It is very attractive to any productive company to increase productivity without any extra cost. In the selected mine, the total number of workers in a mine department is 74 men, the time that workers are in a productive stage is 65% of total shift time. Therefore, when productivity time of the 74 men is increased from 65% to 75%, 9.86 men working at 75% productive time are gained annually. This was obtained as follows.

In this mine, the total working hours per year is 1800 hrs. The actual productive time per year for the 74 men is calculated as follows:

Table I

An example of one-shift data for one worker in the selected mine

Description	Time	Actual	Wasted time
Starting time of the shift	7:30 am	7:58 am	28 min
Starting time for lunch	12:00	11:47	13 min
Starting work after lunch	1:00 pm	1:12 pm	12 min
End of shift	4:30 pm	4:11 pm	19 min
Travelling time during work = 34 minutes			34 min
<b>Total</b>	<b>480 min</b>	<b>374 min</b>	<b>106 min</b>
<b>Per cent</b>	<b>100%</b>	<b>77.9%</b>	<b>22.1%</b>

Table II

Miners' education of a sample of 34 miners

Elementary	Intermediate	High school	Technical college diploma	Bachelor degree
12	4	7	5	6

Table III

Typical summary of estimated non-productive time in the selected mine

Non-productive time	Minutes	Per cent
Late starts	30	6.3
Unsanctioned breaks	35	7.3
In-mine travel	30	6.3
Early quits	15	3.1
Sanctioned break	60	12.5
<b>Total</b>	<b>170</b>	<b>35.4</b>

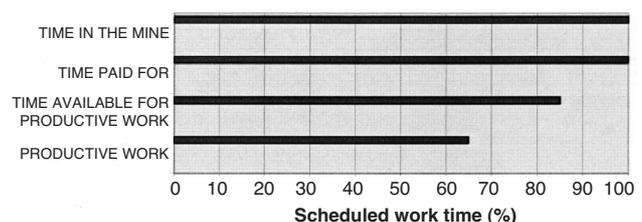


Figure 1—Amount of time the workers get paid for and the time they actually spend performing productive work in the mine

# Labour's utilization and labour's productivity of a gold mine in Saudi Arabia

74 men @ 65% productivity = 74 (1800 MH/man/year)  
(65%)  
= 86580 man-hours per  
year.

74 men @ 75% productivity = 74 (1800 MH/man/year)  
(75%)  
= 99900 man-hours per  
year.

Thus, the added manpower by increasing productivity is:

$$(99900-86580)/(0.75)(1800) = 9.86 \text{ men.}$$

Therefore, it is very attractive for the mine to increase the manpower by 9.86 men without extra cost. In order to achieve that, the mine manager needs to improve the miners' productivity from 65% to 75%. Recommendations are presented to achieve that goal by the mine manager.

## Recommendations to enhance labour's productivity

It is known that poor labour utilization is a factor of bad work habits; it is usually corrected with the control of good leadership. Poor labour productivity is caused by poor preparation for work and poor utilization. It is corrected with well-explained policy or guide to action for workers. In general, the failure to control non-productive activities can result in a significant loss for the mine while the labour could be effectively utilized. Thus, the constructive enforcement of authorized lunch periods, the start of the shift and end of the shift periods are logical first steps in order to improve the level of productivity through labour performance<sup>6</sup>.

Therefore, from this point of view, the first step recommended to improve productivity of the mine through the labour force is to measure the performance of each man and find out the actual time spent performing productive work. However, the biggest problem facing us when measuring individual performance is the mine management. Typically they are more concerned with the negative reactions of the public in being measured, actually than being concerned with poor productivity. Therefore, the mine management is advised to keep all the results of such research a secret. Moreover, the following recommendations for the mine are important to enhance productivity by improving labourer's performance:

- Investigate carefully non-productive time and the cause of that for each individual, and take action to reduce it
- Make an early commitment to improve productivity
- Make productivity improvement part of the mine strategy
- Suggest techniques for measuring individual's performance and get an expert if needed to help the

mine manager for that

- Educate miners on the benefit of improving productivity, especially as we know that the selected mine has a large number of low-education miners. From a random sample of 34 miners, 23 of them have low education (high school or lower) as shown in Table II
- Educate the mine managers about labour control. They must recognize the value of improved productivity and become committed to getting it done and get more control on non-productive time<sup>4,5,7,8</sup>.

## Conclusions

Labour performance and its effect on productivity in a gold mine in Saudi Arabia were investigated and studied. It was found that in the mine, labourers use only 65% of the shift time in productive work. Thus, labour utilization is the most important factor that can be used to elevate productivity in the mine. Consequently, recommendations were presented to enhance productivity through labour utilization. The selected mine is an average mine in terms of mining cost and productivity when compared to gold mines around the world. Yet, its performance could be improved if the mine management implement the results and recommendations of this research study.

## References

1. DEAN, J.M. and GRAYSON, R.L. 'Detailed Manpower Planning for Underground Coal Mines', *Use of computers in the coal industry*, ed. R.L. Grayson, Y.J. Wang, and R.L. Sanford, WVU, Morgantown, USA., 1990.
2. GRAYSON, R.L. and WANG, Y.J. 'Forecasting Underground Coal Mine Productivity with a Microcomputer', *Proceedings of the Second Conference on the Use of Computers in the Coal Industry*, SME-AIME, New York, 1985. pp. 157-164.
3. PAGE, S.J., VOLKWEIN, J.C., and KISSEL, F.N., 'Some continuous Sections Can Cut More Than 1,000 Tons Per Unit Shift', *Coal Age*, vol. 92, no. 1, January 1987. pp. 51-55.
4. TOMLINSON, P.D., 'Equipment Management Breakthrough Maintenance Management Strategy for the 21st Century', Kendall Hunt Publishing Company, Iowa, USA., 1998.
5. STEFANKO, R. 'Coal Mining Technology Theory and Practice', SME-AIME, New York, N, 1983. pp. 52-53, 110-111.
6. BERG, B. 'Qualitative Research Methods for the Social Sciences', Allyn and Bacon, Boston, USA., 1989.
7. MILTON, H.W. and SCOTT, G.B. 'Management and Administration' *SME Mining Engineering Handbook*, Chapter 8.6, 2nd Edition, SME-AIME, New York, NY, 1992.
8. JOSEPH, W.R. and FREDERICK, H.R. 'Labor Relations and Training' *SME Mining Engineering Handbook*, Chapter 8.5, 2nd Edition, SME-AIME, New York, NY., 1992. ◆

