











(OS) in the sense that it contained some manganese already. It is important to remember that this sand comes from the extraction of the ore and the washing process. This sand was obtained by separation of ultrafine (0 to 0.1 mm), manganese sand (0.1 to 1 mm) and manganese fines (1 to 10 mm). Then it was beneficiated and reached a grade level of 46% Mn and 5 to 7% silica (SiO<sub>2</sub>), 5 to 6% Al<sub>2</sub>O<sub>3</sub>. On the environmental point of view, the company is no more using the Oggouee Sand which is a natural resources but is now helping the Moulili River to regain its normal shape. On the operational view, the quantity of beneficiated manganese needed for the sintering process decreased because of the manganese present in the MS for a given quantity of agglomerated product. The left beneficiated manganese has since then sold to external customers, thus added into the company's product range.

### 6.3 Impact on maintenance department

In the department of maintenance the formalisation of EMS brought some more task in the work process. In an agreement with a supervisor and as a way to measure difference occasioned by the changes in operations, the following work process came out. One shows the work before and the other one after the formalisation.

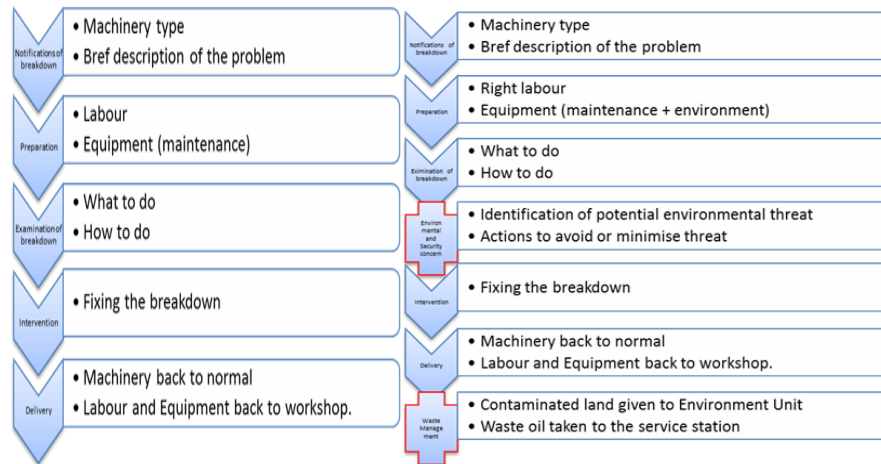


Figure. 3 Comilog Maintenance Incorporating Enviromental Aspects

In the above Figure 3, two compulsory steps were added because of the company's engagements towards the environment. In environmental protection, things must done in a way that if everything goes well, not a single drop of oil or grease for instance falls on the ground. As a result the mechanics must make sure that all the necessary equipment at hand and all operational procedures are respected. It shows how much environmental concern it taken into consideration. However on a productive front, it has a positive impact on the maintenance work backlog. The maintenance work backlog is a measure in means of hours of the work to be performed by a maintenance department (Wireman 2005, p. 33). Consequently if the work backlog increases, the production department will have less machinery available, thus production slows down.

The maintenance department was alerted by the ISO 14001 external auditors about the excessive recurrence of hydraulic hose breakages. In fact the company used heavy machinery in which oil is essential and circulates through hoses at high pressure i.e. up to 5000 psi (34.5 Mpa = 345 bar). Even though these hydraulic hoses are built to handle such a high pressure of oil, they nevertheless are required to be replaced after a period of time generally determined by the manufacturer (Parker Hannifin Ltd 2008, pp. Aa-1). Regarding Comilog a maintenance schedule does exist it is shown in Figure 4 below:

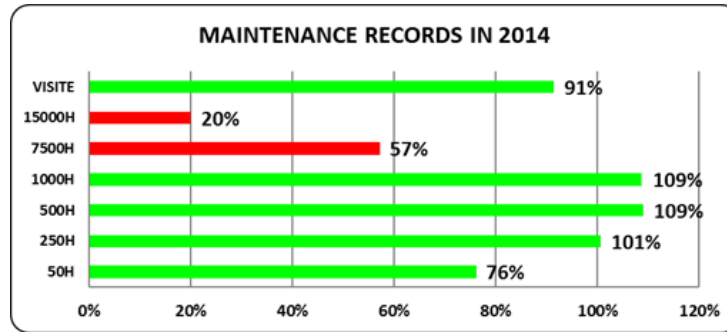


Figure. 4 Camilog Hydraulic Hose Maintenance Records

The green lines on the figure above showed that objectives had been reached and red ones had failed in this regard. Even though five out of seven objectives seemed to have been achieved, it is important to understand that the 15000H and 7500H are the major maintenance cases; with only one overall maintenance. This maintenance included even a new engine in which the machinery had a replacement of all hydraulic hoses. Other type of maintenance also considered hydraulic changes or checks but not as thoroughly as the major ones. The problems with 7500H and 15000H were caused mostly by the fact that the production side did not release machinery for maintenance on time. As a result the environment considerations would be always at risk as well as compromising the productivity of the maintenance department.

#### 6.4 Impact on main warehouse

The other department covered by the study was purchasing, as the main warehouse had to go through several changes in order to be ISO 14001 compliant. In fact with the intention to get their EMS certified to ISO 14001 the warehouse had to deal with anarchic storage of dangerous material; potential chemical reactions of dangerous products mixing together; dangerous products exposed to rainwater and any ambient temperatures; soil, air and water pollution. For this reason the following actions were taken from the year 2010: identifying all chemical products available at hand, grouping chemicals with identical pictograms, construction of appropriate storage facilities for chemicals and storing chemicals on retention trays. Therefore these actions impacted both the environment and the productivity positively. Hazardous products are now stored accordingly as adequate storage facilities were built for this purpose. There is a clearer visual categorization of products as shown in Figure 5 below.



Figure. 5 New Warehouse Material Categorization Order (right)

The clearer vision and organisation of material makes it easier now for new employees' to adapt. The figure below displays the layout of the warehouse. From 2010 to 2015 the green and grey section were built. Grey sections are just roof covered and open on the sides while the grey ones are completely closed and air conditioned for goods requiring such features.



Figure.6 Warehouse Space Reorganized

## 7. Recommendations

It appears from the above data that the environmental concern has had impacts that are both good and bad depending on the departmental activities being carried out. From around year 2000 to the ISO 14001 certification in 2012, impacts in terms of production are positive. This is explained by the process of recycling manganese fines and sand that used to be considered as waste. As a result of that recycling, new product were added to the range of the company. However the maintenance work backlog of the maintenance department is now subjected to take longer than before due to environmental concern. The best recommendation has to always have all equipment ready in order not to waste much time when a repair is needed. Regarding the oil pollution due to hydraulic hoses breaks, the solution lies between a better understanding between both production and maintenance department. Indeed if the maintenance program is properly followed they would be less chance to have these hoses break. This also shows that despite the desire to be environmentally friendly, production always remains the number one priority of a company especially when there was no EMS from the beginning of operations. The warehouse has seen great improvement of its productivity and environment performance as well. From an archaic storage to a complete reshaping of it facilities, it now enjoys good work performance and less product.

## 8. Conclusion

The idea that EMS with or without certification can enhance a company's performance has been assessed in a Gabonese mining company. The results show that some departments have improved on their productivity and some did not. Because this research was done in the mining industry only and in some departments that seem to be relevant to the research, results cannot be generalised. However one important aspect of such a research is to show



the importance of conducting such a study in a qualitative approach. It was found that in industries such as the mining one, recycling is the key to productivity improvement. As it is known globally through Lavoisier, nothing is new but everything get transformed. Hence further study may need to be undertaken to see whether service industries can benefit from EMS in the same manner. EMS ISO 14001 was recommended as an “enabler of good business” as seen in the warehouse of Comilog. When activities are performed in a stipulated correct standard way, departments such as warehouse can only gain from it. A formal EMS tends also to be an upset for businesses that have long existed without environmental concern before. When production is the only main focus, EMS can find hard to be properly implemented or followed. In any company going for formal EMS must really be the centre of its operation and strategy especially in the execution of business’ objectives.

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## Biography

**Ignatio Madanhire** is a PhD student in Engineering Management at the University of Johannesburg, South Africa. He is also a lecturer with the Department of Mechanical Engineering at the University of Zimbabwe. He has research interests in engineering management and has published works on cleaner production in renowned journals.

**Charles Mbohwa** is a Professor of Sustainability Engineering and currently Vice Dean Postgraduate Studies, Research and Innovation with the University of Johannesburg, SA. He is a keen researcher with interest in logistics, supply chain management, life cycle assessment and sustainability, operations management, project management and engineering/manufacturing systems management. He is a professional member of Zimbabwe Institution of

Engineers(ZIE ) and a fellow of American Society of Mechanical Engineers(ASME).

**Thierry Ngoundou Boulamatari** is an MSc at the University of Johannesburg, South Africa, his studies involves work on environmental management systems in mines in Gabon. Most of his work is based on the research he is currently doing in Gabon.