2

Maintenance Productivity and Performance Measurement

Aditya Parida and Uday Kumar

2.1 Introduction

Maintenance productivity is one of the most important issues which govern the economics of production activities. However, productivity is often relegated to second rank, and ignored or neglected by those who influence production processes (Singh et al. 2000). Productivity in a narrow sense has been measured for several years (Andersen and Fagerhaug, 2007). Since maintenance activities are multi-disciplinary in nature with a large number of inputs and outputs, the performance of maintenance productivity needs to be measured and considered holistically with an integrated approach. With increasing awareness that maintenance creates added value to the business process; organizations are treating maintenance as an integral part of their business (Liyanage and Kumar, 2003). For many asset-intensive industries, the maintenance costs are a significant portion of the operational cost. Maintenance expenditure accounts for 20–50 % of the production cost for the mining industry depending on the level of mechanization. In larger companies, reducing maintenance expenditure by $1 million contributes as much to profits as increasing sales by $3 million (Wireman, 2007). The amount spent on the maintenance budget for Europe is around 1500 billion euros per year (Altmannshopfer, 2006) and for Sweden 20 billion euros per year (Ahlmann, 2002). In open cut mining, the loss of revenue resulting from a typical dragline being out of action is US $ 0.5–1.0 million per day, and the loss of revenue from a 747 Boeing plane being out of action is roughly US $ 0.5 million per day (Murthy et al. 2002). Therefore, the importance of maintenance productivity is understood more and more by the management of the companies.

There are several examples when lack of necessary and correct maintenance activities have resulted in disasters and accidents with extensive losses, like; Bhopal, Piper Alpha, space shuttle Columbia, power outages in New York, UK and Italy, during 2003. From asset management and changes in legal environment, the asset managers are likely to be charged with “corporate killing” due to changes in the legal environment for the future actions or omissions of the maintenance efforts (Mather, 2005). BP refinery in US paid a US $21m fine and spent US $1b for
repairs for an explosion at Texas City refinery, killing 15 and injured about 500 persons, making it the deadliest refinery accident (Bream, 2006). Prevention of such an accident could have enhanced BP’s image besides saving a billion US$. The measurement of maintenance performance has essentially become an essential element of strategic thinking for service and manufacturing industry. Due to outsourcing, separation of asset owners and asset managers, and complex accountability for the asset management, the measurement of asset maintenance performance and its continuous control and evaluation is becoming critical. As a result of the dramatic change in the use of technology, there is a growing reliance on software and professionals from other functional areas, for making or managing decisions on asset management and maintenance. Therefore, the performance of the maintenance process is critical for the long term value creation and economic viability of many industries. It is important that the performance of the maintenance process be measured, so that it can be controlled and monitored for taking appropriate and corrective actions to minimize and mitigate risks in the area of safety, meet societal responsibilities and enhance the effectiveness and efficiency of the asset maintained. A measure commonly used by industries is the maintenance performance for measuring the maintenance productivity.

In general, productivity is defined as the ratio of the output to input of a production system. The output of the production system is the products or services delivered while the input consists of various resources like the labour, materials, tools, plant and equipment, and others, used for producing the products or services. With a given input if more outputs of products or services can be produced, then higher productivity efficiency is achieved. Efficiency is doing the things right or it is the measure of the relationship of outputs to inputs and is usually expressed as a ratio. These measures can be expressed in terms of actual expenditure of resources as compared to expected expenditure of resources. They can also be expressed as the expenditure of resources for a given output. Effectiveness is doing the right things and measures the output conformance to specified characteristics.

Productivity is a combined measure for effectiveness and efficiency, i.e., a productive organization is both effective and efficient. Measurement of productivity needs to consider various inputs and outputs of the products or services produced to be adequate and appropriate. Improvement in maintenance productivity can be achieved through reduction in maintenance materials as well as reductions in projects, outages and overhaul savings (Wireman, 2007). Production and service systems are heavily affected by their respective maintenance productivity. Maintenance systems operate in parallel to production systems to keep them serviceable and safe to operate at minimum cost. One way to reduce the operation cost and production cost is to optimize utilization of maintenance resources (Duffuaa and Al-Sultan, 1997), which enhances maintenance productivity. In order to measure the effectiveness of any maintenance system, we need to measure its productivity and identify the areas where improvements can be made (Raouf and Ben-Daya, 1995). Therefore, measuring maintenance productivity performance is critical for any production and operational company in order to measure, monitor, control and take appropriate and timely decisions. Since the cost of maintenance for different industries is substantial as compared to the