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ISO55000 Standard as A Driver for Effective Maintenance Budgeting

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Abstract Companies are suffering from major industrial disasters, financial crisis and continued global instability caused by civil unrest and economic pressure. With the attendant issues associated with the increased economic and market globalization comes the criticality of standards and its role in, increasing productivity and efficiency, decreasing non-value-added information and promoting process through structured asset management techniques. The International Standard for Organization (ISO 55000) was developed specifically for Asset Management (AM), which consists of a series of three components, ISO 55000, ISO 55001 and ISO 55002. ISO 55000 takes a holistic approach to asset management; it is not just about maintenance but also about value creation. ISO 55000 requires changes in policy, processes and people thereby challenge the status quo and it leads to a new regime of asset care.

Asset care requires organizations to comply with standards and various regulations. Adopting ISO 55000 will allow organization to align the way assets are managed and maintained, it improves return on investments by reducing costs, while supporting asset value without sacrificing organizational objectives. Maintenance and reliability processes, programs are aligned with ISO 55000, and span the entire life cycle of the assets including design, engineering, procurement, installation, start-up, operation, maintenance, restoration, decommissioning, and disposal. A popular term for the process is 'from cradle to grave'.

Physical assets are often taken for granted and with increased reliability. Managing assets today is more complex, yet in many organizations, the management of those assets is often unfocused and inappropriate. Organizations with a strong profit focus need to examine ISO 55000 from the perspective of finding methods to leverage it into lower costs and increased outputs.

The aim of this paper is to classify the necessary elements in ISO 55000, which organizations need to adopt in order to improve their approach to asset maintenance budgeting. It will highlight the main issues that need to be addressed when implementing ISO 55000 standard.

Key words: Maintenance, Budget, Asset Management (AM), ISO 55000.

1.0 Introduction

Assets allow organisations to achieve strategic objectives and meet stakeholder needs; therefore, managing these assets optimally has become crucial for organisations to stay competitive in today's global market. This is further compounded by the challenges of intense international competition and market globalization, which place enormous pressure on maintenance systems to improve efficiency and reduce operational costs. Therefore, it has become imperative for maintenance managers to adopt tools, methods, and concepts that could stimulate performance growth and minimize errors, and to utilize resources effectively toward making the organization a "world-class and ensure continued survival. This goal is achieved through obligatory maintenance in conjunction with increasing operational effectiveness, revenue, and customer satisfaction, while at the same time reducing capital, operating, and support costs (J. Mitchell 2002). Keeping existing assets at optimal level is a challenge; though it cost money to maintain assets, the cost is far less than the cost for replacement. Maintenance represents a large percentage of operating costs of an organisation, an area of greater emphasis to assist industries in meeting their objectives but it's an area not deprived of challenges. Company maintenance departments face several problems in their efforts to enhance processes to realize maximum equipment uptime and availability. Evidence show that poor maintenance can result in business failures that can put the public at risk, loss of firm revenues, lack of operations. Unpredicted component failures can be attributed to recurring problems that were constantly partly repaired, hence allowing the root-cause undetermined and delaying the problem to be tackled. This act leads to a negative impact on mean time between failures (MTBF). Migrating amid work locations, collecting parts from the stockroom, manually recording workflow information, and hands-on diagnostics are classic time-wasters, which is difficult. It is predicted that maintenance personnel on average devote less than 30% of their time on concrete productive tasks (Roland 2014). Issues also occur from failure to automatically capture significant workflow and component-level health information, such as periods of operation, equipment condition and maintenance history. Manual data collection is not cost effective and hardly sustainable over long periods of time.

With maintenance departments, moving away from the 'break-and-fix' approach to approaches that focus on optimizing the effectiveness and efficiency of production assets, it raises fundamental issues on how the maintenance cost can be managed. The benefits lie in the fact that by being proactive with firm assets and managing failures before they occur, firms can reduce or eliminate the consequences by forecasting what is likely to happen and deciding in advance about what to do about it thereby reducing major business impact due to equipment breakdown.

However, despite having advanced condition-monitoring programs, a large number of operations stay trapped in a reactive maintenance cycle, which has led to most maintenance teams, execute at least 70% of all maintenance activities in an unplanned manner (Roland 2014). In order to implement a proactive approach that facilitate longer equipment service lives, systematic collection and integration of

equipment health information is essential. Operating against this fact limits organizations' ability to make extensive infrastructure and information systems purchases, which requires implementing and supporting a conventional maintenance management system. These fundamental issues are what underpin the rationale for this paper.

2.0 Effective maintenance: the foundation for cost efficiency

As McKenna and Oliverson (1997) state, maintenance is an important phase of an equipment life cycle during which equipment must be maintained properly for effective performance. Studies have reported that the cost of equipment maintenance could range between 2 to 20 times the acquisition cost. Cavalier and Knapp, (1996) defines cost of maintenance as costs that include lost opportunities in uptime, rate, yield, and quality due to nonoperation or unsatisfactorily operating equipment, equipment-related degradation of the safety of people, property, and the environment. However, come frequently, maintenance cost is simply described as the labor and materials expense needed to maintain equipment in satisfactory operational state.

Maintenance is typically considered by organizations to be a 'cost center; for example, Alsyouf (2006) and Muchiri and Pintelon (2008) both show that maintenance is often treated within organizations as 'subordinate to operations' or a 'necessary evil'. Maintenance is a combination of all technical, administrative, and managerial actions through which the life cycle of an asset is kept in a state it can perform the required function (Komonen 2002). Maintenance is viewed as expensive with performance measures developed to track direct costs or the total duration of forced outages during a specified period. Fortunately, this perception is changing (Kutucuoglu 2001) with maintenance being acknowledged as a major contributor to the performance and profitability of business organizations. Through regular inspections, cleaning, lubricating, and making minor adjustments, minor problems can be detected and corrected before they become a major problem that can shut down a production line. An effective maintenance program requires company participation and support by everyone ranging from the top executive to the shop floor personnel. Against this backdrop, maintenance managers therefore explore every opportunity to improve on profitability and performance as well as achieve cost savings for the organization (Al-Najjar 2004).

Asset maintenance has two essential objectives: (a) high availability of production equipment and (b) low maintenance costs (Komonen 2002). However, a key factor militating against the achievement of these objectives is the nature and intensity of equipment failures in plants. Since system failure can lead to costly operational stoppages for organizations, which may result in low human, material, equipment utilization and loss of customer's confidence, the occurrence of failure must therefore be reduced or eliminated. Thus, maintenance ensures system sustenance by

avoiding factors that can bother effective productivity, such as machine breakdown and its several attendant consequences. Sadly, few companies either see, or take, this opportunity (Baglee 2010). To ensure low maintenance cost is achieved, there is a need for budget planning for maintenance operations, which is discussed in the next section.

3.0 Budget for maintenance operations

Maintenance budget is a significant tool used to control financial resources necessary for running the maintenance department. Maintenance budget is fundamental to business operations; a reliable budget must sustain the readiness of production assets and protect the value of the total asset by staying abreast of the plant's proactive and reactive maintenance workload. In addition, it should decrease the risk of downtime by determining, achieving and sustaining the optimally shortest systemic time to return production assets to readiness and thereby decrease asset over-all operating cost by deriving its true cost.

Maintenance Budget covers many aspects ranging from spare parts, outsourcing, Overhauling, maintenance labours, utilities maintenance and investment and new project. The maintenance operation's budget should predict work the assets do, when, the resources required, and the cost to do it. As business conditions changes and differences from forecast of actual work, resources and costs predicted, decisions to protect or improve the outcome of maintenance operation must be adjusted. A structured predictive budget detailing maintenance workload, its resources and their costs, engaging the methods and tools of data analytics in the maintenance operation should be adopted by organizations.

Expenses should align with productivity because higher efficiency requires higher expenses linked to proactive maintenance. Budgets should be built up from workload to cost types to unit costs; this allows an optimal spending plan (budget) for fulfilling maintenance's business purpose to sustain the readiness of the assets and value of the asset. Accurate budget needs a lot of forecasting and historical data, most companies over budget or make up maintenance budget refusing to look at expenses in the previous year and add for inflation when creating budgets. Company's should keep track of types of expenses to be offset with capital to balance the budget and, or acquire capital to purchase new equipment. Spending on reliability will ultimately drive maintenance and operating cost down in short and long term, but few financial managers understands that. Financial managers should be concern and cautious with their company's finances, without adequate funding to maintain existing asset; organizations will allow a significant asset condition deficit to grow. Financial constraints are enormous and should be monitored; capital tends to flee from where there is a lot of risk and instead goes to places where there is not so much risk. Managing a maintenance budget includes:

- Establishing priorities

- Regular monitoring and reporting including analysis of budget components against actual expenditure.
- Establishing accountabilities and performance requirements
- Monitoring against benchmarks and policy requirements
- Managing variances and contingencies and monitoring the effects of deferred maintenance where required.

The maintenance budget has two components: (1) Running has a fixed norm based on past data and benchmark among similar plants. (2) Major overhaul, replacement as per maintenance plan and life norms. The challenge for maintenance team is to respect these norms over a period and improve practices to take care of inflation and minor modification, alteration in production system. While in theory most firms understand the criticality of budgeting, in practice however, most management do not abide by its annual maintenance budget or they possibly disregard it and make spending as the year progresses. In other words, management do not regard maintenance budget as a business plan and cannot respect it accordingly (Brown, 2010). This lack of managerial commitment and the lack of adequate monitoring framework to aid in budgeting has created situations of poorly executed budget planning and implementation with many studies showing there is a gap in which maintenance budget is not regarded by organizations as a business plan and respected accordingly. This paper therefore proposes ISO 55000 as the structure with the capabilities of bridging this gap.

4.0 ISO 55000

The recently released ISO 55000 series aim to provide a standardized framework for an asset management system. ISO 55000 manages the financial and physical assets of a company mainly to enhance the return on investment. This standard is more comprehensive and detailed, creating a clearer way to implement an asset management system within any organization. ISO 55000 standard is for organizations that establish, implement, maintain, and improve asset management systems, it allows them extract value from their assets. The standard informs the reader of how to implement and maintain an asset management system at all management levels of an organization by providing guidance of what should be done. It also gives insight into the planning, operation, and support activities that go with such a system. ISO 55000 is designed in such a manner to be able to apply to any asset type, though recognizing the applicability to physical asset management (Woodhouse, 2013). These standards apply to any organization, as long as assets are key factor in achieving business goals. The ISO 55000 family of standard comprised

three documents:

1. ISO 55000; provides critical overview, concepts and terminology;
2. ISO 55001; specifies the requirements for an effective Asset Management System;
3. ISO 55002; offers interpretation and guidance for such a system to be implemented

The adoption of the ISO 55000 series of standards will give assurance to its regulators, clients and investors, by assisting the organization to achieve its objective efficiently. Implementation of the standard boosts proactive maintenance of assets such as plants and this would lead to less failure, few wastage and improved service. ISO 55000 helps organizations establish an Asset Management System (AMS) for optimizing assets; this system communicates with elements that produce policy, objectives and procedures to accomplish an organization's objectives. The key benefit of ISO 55000 is it provides a minimum set of requirements for an effective asset management system, but allows the organization itself to determine how best it should be implemented to suit their needs. However, this would first require the company to understand ISO 55000 (Reyes- Picknell, 2014).

Observing these requirements, (ISO 55001) allows for consistent decision-making on activities that affect asset-related risks, performance, and cost profiles. This indicates that management should be equipped to make objective, predictable, and consistent decisions that involve trade-offs between short- and long-term effects, and optimal combinations of interrelated and conflicting benefits. ISO 55001 specifically requires that "the method for decision-making and prioritizing of the activities and resources to achieve its asset management plan(s) and objectives shall be documented" (ISO 55001, 2014). ISO 55000 further requires that the organization "shall retain appropriate documented information as evidence of the results of monitoring, measurement, analysis and evaluation" (ISO 55001, 2014).

4.1 Structures in ISO 55000

ISO 55000 begins by organizational reform of policy, targets and outcomes, to ensure reliability and productivity of assets; organizations should adopt the following structures of ISO 55000:

Organizational context: Organization should define the drivers and constraints relevant to its purpose and ability to achieve its outcomes e.g. regulatory, financial, organizational culture and environment and values of the organization. Stakeholders should be involved in decision-making and also contribute to the organizational objectives.

Leadership: ISO 55000 describes three main requirements, leadership and commitment, policy and organisational roles, responsibilities and authority. Leadership and commitment requires that senior management should ensure adequate resources are available and Asset Management Policy that is appropriate to the organization is established. Ensure that roles, responsibilities are assigned, communicated and effectively executed.

Planning: Plans should address what will be done, when and who will do it, and how it will be undertaken and evaluated. Plans must align and be consistent with the AM system; it should be determined and documented. The standard outlines a number of requirements that should be met or consider, plans should address this;

- Decision-making and prioritizing methods and criteria
- Processes and methods for managing assets throughout their life cycles
- Resources
- Evaluation criteria
- Overall time horizon for the plan
- Review periods
- Actions to that address risks and opportunities.

Support: Cooperation with other departments will be required for effective AM and execution of the AMS. Information must be accessible, documented, controlled, communicated and auditable. Personnel must be competent; competency needs should be evaluated and updated as needed periodically.

Operation: Organization should determine the techniques to monitor and measure the asset and how the data will be analyzed, evaluated and validated. Change must be managed and processes for the implementation of the AM plans should be fed back into the design and operation of the asset management system, including any activities that are outsourced.

Performance evaluations: The necessity to monitor asset performance regarding outputs, targets and level of services is an important viewpoint when using management systems. The use performance indicators for measurement of processes, achievement of the goals should be feasible approach of asset administration. The report on asset performance must be documented, analysed and evaluated.

Improvements: Failure occurs because of inadequacy or non-conformity, activities to control and correct are obligatory along with dealing with consequences. The organization should establish processes to identify potential failures through asset performance and evaluate the need for corrective and preventive action for continual improvement.

4.2 ISO 55000 influence in maintenance: A driver for excellence

The challenge for organizations is the necessity of maintaining and often increasing, operational effectiveness, revenue and customer satisfaction, while at the same time reducing capital, operating and support cost (J. Mitchell 2002). Many organizations simply are not aware of how to improve maintenance processes or if they are, they think that it will cost them too much to do so and this perception flies in the face of the facts. Maintenance and reliability processes, programs fit within ISO 55000, the new standard is definitely not about maintenance and reliability but it spans the entire life cycle of the assets: design, engineering, procurement, installation, start-up, operation, maintenance, restoration, decommissioning, and disposal. A popular term for the process is 'from cradle to grave'.

ISO 55001 require an organization to set up a life cycle management plan that include the risk associated with the specific asset and the consequences of this risk (Anon 2014). The process of determining when machinery will fail helps to determine the life cycle of the assets and how to manage the asset efficiently.

ISO 55000 standards proposed that asset management guarantee assets fulfilling its required purpose. Organizations should develop and implement processes that connect the performance and purpose of assets to the organizational objectives, implementing these processes to assure capability across the life cycle of assets, providing monitoring and continuous improvement and providing necessary resources and competent personnel to demonstrate assurance by commissioning asset management activities while operating the asset management strategy. With ISO 55000 Organization are able to:

- Understand the downstream affects if their equipment shuts down.
- Track the why of any breakdowns using error codes etc. so that they can have an effective predictive maintenance program.

4.3 Benefit of ISO 55000 if implemented in maintenance budgeting.

The implementation of a holistic asset maintenance strategy using the ISO 55000 will reap significantly larger benefits from improved maintenance practices. These benefits include:

- Substantial improvement of asset reliability.
- Lower costs of servicing assets.
- Greater uptime and availability.
- Less downtimes and outages.
- Higher return on assets as well as in invested capital
- More Efficient and Effective Training: better-defined procedures and documentation facilitates employee training and knowledge transfer.

Organization will be aware of robust financial information, which is based on integrated processes between the asset management and finance functions. Therefore, this will allow the organization to improve assessment of financial position and funding requirements in relation to assets ((ISO55000, 2014).

4.4 *Factors that will hinder effective maintenance budgeting*

Management belief maintenance is cost focus rather than a profit focus, which affects the application of new program (ISO 55000) and Advance maintenance strategies. Challenges:

- Lack of leadership commitment to policies and procedures
- No willingness to change.
- Lack of understanding of ISO 55000 system.
- Challenge with maintenance budget versus low-end equipment improvement
- Lack of skilled maintenance technicians
- Maintenance culture of firefighting rather than preventive.
- Lack of culture of continuous improvement.

5.0 Recommendations and Conclusion

In light of the all that have been discussed here, it is clear that ISO 55000 does not take the place of maintenance strategy; companies must have a holistic maintenance strategy that will aid improvement strategies which effect performance and maintenance functions in an organization. However, since not all physical assets in an organization are equal in terms of value proposition, some are more critical to achieving the objectives of the business than others, and organizations could implement ISO 55000 on their critical asset to reduce cost. Likewise, some assets present a higher degree of risk to business goals than others do.

ISO 55000 requires everything be documented including the processes, procedures, and the measurements and other record that provide evidence of compliance. Clearly, there is a need to collaborate with other functional areas within the organization, most notably finance, human resources, information management and top management. The training and learning of every staff needs to be enhanced with theory to guide practice and gradually introduce the concept of risk to asset management, and penetrate into all aspects of operations management. By establishing and implementing suitable assets management system, risk can reduce; performance and competitive advantage will continuously rise, helping improve the company's social image and reputation.

When planned asset management system is established or reviewed, it is essential to ensure the method is consistent and aligned with internal and external context of

the organization. It is necessary since it can influence the scope and design of the asset management system, the organization should make a clear statement how the asset management objectives will align with the organization as well as establish a decision-making process that reflects stakeholder need and define value. It is mandatory to implement a risk-based, information-driven, decision-making and planning process to transform the organizational objectives into asset management plans. In addition, the organizations must strive to integrate the asset management processes with the functional management processes.

The maintenance budget should be regarded as a business plan and respected accordingly. Asset maintenance will be judged by maximizing value for money and satisfying stakeholders' expectations. Asset managers need not only to understand a broad range of engineering issues, but also to embrace and understand strategic business planning and finance risk and stakeholder management skills alongside the technical vision. More importantly, they need to be able to communicate their ideas and plans effectively at all levels of the corporate hierarchy by providing business cases with full financial and technical details. Another skill that is essential to good asset management is the assessment and management of risks. To assess risk, the asset manager needs to identify the critical assets i.e. those assets that could significantly affect the business if they suffer unplanned downtime. To do this they need to understand how the business operates, what functions really make money and what assets are required to support this.

5.1 Conclusion

Ouertani et al. (2008) argue that maintenance has an impact on the capability and performance of assets and that this should be viewed in terms of value contribution. Improving maintenance is a tactical task; its operations are complex, particularly if the supplier has to manage various assets at different sites. Thus, the use of monitoring technology to monitor asset health is suggested (Lightfoot 2011). Efficient maintenance has its own economic objectives (Saranga and Knezevic 2000), which requires decrease in downtime, cost and avoid penalties associated with the unavailability of assets. Many factors influence maintenance costs, including asset condition (i.e., age, type, and condition), operator expertise and experience, company policy, type of service, skills of maintenance personnel, operational environment, equipment specification, and regulatory controls. In order for the organization to become cost effective, responsive in operation and meet the requirements of customers in the constantly competing environment, techniques and management practices (ISO 55000) should be properly implemented (Kedar, et al., 2008).

ISO 55000 is the first standard to widely capture the applicable 'must do' items for the management of any asset; it is essential for large asset intensive and increasing distribution assets; ISO 55000 does not define the 'how to', as it depends on organizational context and the assets to be managed. ISO 55000 can be applied to any

company where assets are central to their business; it is fundamental for organizations to manage the variety of assets, which it depends on. ISO 55000 permits a company to identify assets that are critical to fulfilling its investor requirements, business goals and demonstrates the management of its assets. It manages the risks and costs related with possessing assets, in an organized, efficient method that supports frequent improvement and continuing value creation. Companies that are implementing or aim to implement ISO 55000 are better positioned to react to dynamic markets, increasingly stringent regulatory pressures, and demanding shareholders. The existence of ISO 55000 provides significant opportunities to re-examine and refine asset owner and service provider relationships, governance and regulatory frameworks and insurance, customer relations and other stakeholder confidence. Global practices have shown that asset management can improve the economic efficiency of an organization by consciously focusing on life cycle, value realization. ISO 55000 allow organization to improve assessment of financial position and funding requirements in relation to assets (ISO55000, 2014).

ISO 55000 structures must be incorporated within the organization's existing goals, structure, culture and their real benefits will be realized (Reyes-Picknell 2014). Management should make adequate budget provision for the maintenance of its assets in line with its approved asset management plans (ISO 55000) throughout the life of assets, and undertake all maintenance activities on a routine basis. Budgeting should be done on estimated current costs rather than historic budget provisions or percentage of the total operating budget. Organisation should base maintenance budget allocation on the change in condition that could be achieved through the allocation. Funds should be allocated to all condition categories in a balanced manner.

ISO 55000 demands all be documented, management should document the impact of inadequate budgeting on the useful life expectations of assets, whether it affects business operations, commitments to customers and/or legislative requirements regarding the availability of asset-based services, and operating income projections. Such document or report will aids in preparing realistic budget. Companies that implement ISO 55000 will improve its financial performance and achieve production plan targets within their maintenance budget. With this implementation of ISO 55000, companies will achieve effective maintenance budgeting and can therefore turn their focus to survival and growth, a critical area in this turbulent business world.



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Authors' Biography

 A portrait of Ihemgbulem Ibifuro, a young Black woman with her hair pulled back, wearing a purple and white striped shirt under a dark purple vest. She is looking slightly to the right of the camera.	<p>Ihemgbulem Ibifuro</p> <p>Ihemgbulem Ibifuro is a research student in the School Engineering. Her research interests include International standards for asset management, Strategic asset management for sustainable business. She also has interest in ISO 55000 asset management standards within small to medium enterprises. She is involved in a number of research projects, including a study on Assessing the effectiveness of ISO 55000 standard in small to medium sized enterprises (SMEs), Identifying organizational requirements for the implementation of ISO 55000 in small to medium sized enterprises (SMEs).</p>
 A portrait of Dr Baglee David, a man with short dark hair, wearing a dark polo shirt with a logo. He is smiling and standing in a laboratory or workshop setting with various pieces of equipment.	<p>Baglee David</p> <p>Dr Baglee David is a Senior Lecturer at the University of Sunderland, a Visiting Professor of Operations and Maintenance at the University of Lulea Sweden and a Visiting Associate Research Professor at the University of Maryland USA. His research interests and numerous publications include the use of advanced maintenance techniques within a range of industries. He has worked on several national and international projects developing and implementing a range of condition monitoring tools and techniques. David is a member of the International Society for Engineering Asset Manager and a member of the Institution of Engineering and Technology and on the editorial board of several international journals.</p>