The International Journal of Multi-Disciplinary Research
ISSN: 3471-7102

Engineering Asset Management in Zambia – Making it Happen

(Conference ID: CFP/189/2017)

Wencyslouv T Makondo
Independent Asset Management Consultant
WetMak Consult Limited
Lusaka, Zambia
makondo.wencyt@gmail.com

Abstract
The dependence by society on engineering assets for a good quality of life has been unquestionable since mankind first practiced engineering. Consequently, asset management has become indispensably predominant and no longer optional. Unfortunately, the lack of it is still a glaring reality in many developing economies Zambia included based on commonplace public perception and underperformance of both public and private assets.

This paper is a primer and an open invitation to the asset management crusade aimed at raising understanding and practice towards asset-based cultural productivity and sustainability at individual, community, enterprise and national development levels. A research to establish why such an imperative is still not embedded is work in progress. Ultimately, the purpose is to inspire the subject's national flagship.

Keywords: *engineering assets, asset management, productivity, sustainability*

1.0 INTRODUCTION

Engineering asset management (EAM) is a rapidly emerging discipline globally for optimizing value and return on assets. The concept continues to evolve from traditional operations and maintenance (O&M). Australia and New Zealand are here credited as pioneers of modern asset management as the two countries undertook in the 1980s and 1990s, reforms to improve service delivery by water utilities by becoming business based, customer focused, more transparent and accountable.[1] The publication by the two countries, of the first ever International Infrastructure Management Manual (IIMM) in 2000 and the significant improvements of services delivery by the utilities to present day flawless status is testimony.

Further, in Australia and New Zealand, asset management has been integrated in many other sectors of the economy both by individual citizens' conviction and by mandatory measures. For instance in Australia, asset management has been extended to the road transportation sector as well as to municipal local authorities spurred by statutory provisions of the Road Management Act of 2004 and the Local Government Act of 2009 respectively. The Roads Act dramatically changed the legal liability of public agencies for

[1] Schultz, Alexander John, The Role of GIS in Asset Management: Integration at the Otay Water District, December 2012

road design and operations. The new approach to infrastructure funding decisions for Local Governments emphasized long-term asset management plans and long-term financial forecasts.

On the African continent, South Africa (SA) is the asset management leader signified by its Southern African Asset Management Association (SAAMA) founded in 1997 initially as the Southern African Maintenance Association (SAMA). The bold and groundbreaking asset management steps taken by one of the country's major cities is a perfect showcase.

In 2009, the City of Ekurhuleni in SA launched, for the first time ever, a fully fledged multi-year asset management programme called Comprehensive Municipal Infrastructure Asset Management Plan (CMIP) in support of the city's vision called Ekurhuleni Growth and Development Strategy 2025 (GDS 2025) launched earlier in 2005. Today the city through its vision "The Smart, Creative and Developmental City" boasts of being a world class manufacturing and transportation sectors hub in the country thanks to asset management inter alia.[2]

Globally, the publication in 2014 by the British Standards Institute of the ISO 55000, ISO 55001, and ISO 55002 suite of standards on the subject is arguably the epitome of the asset management evolution.

This paper draws freely from these and other milestones in order to position Zambia in the asset management wave and spotlight asset management as a potential area for research and development.

2.0 WHAT IS ENGINEERING ASSET MANAGEMENT?

There is a host of definitions for asset management which can lead to confusion and therefore barriers to the practice. This can easily be mitigated by domestication and adaptation of standards. For the present purpose, asset management has been defined as the coordinated engineering, financial, economic, environmental, statutory, management, and other activities applied to engineering assets with the objective of realizing optimum value from the assets.[3] The preoccupation in this paper is advocacy for the practice. The definition herein will therefore be used for resonance in understanding.

2.1 Understanding Asset Management

In Zambia today, not many people know about asset management and how it can be exploited. Many people think they know about it and its benefits or utopia. Many more are uncertain about the whole concept. Needless to say, the practice still seems elusive in the country based on commonplace public perception and underperformance of both public and private assets. This assertion is however still a research matter towards validation and confident shaping of the asset management roadmap.

To further understand asset management, figure 2.1 summarizes modules and places asset registration as the underlying activity to all other activities.

[2] Boshoff, Louis, Weaving The Integrated Infrastructure Asset Management Thread Through Municipal Strategic Planning: The Ekurhuleni Experience, RSA, February 2011

[3] Adapted from ISO 55000: 2014 Asset Management – Overview, Principles and Terminology and, the International Infrastructure Management Manual.

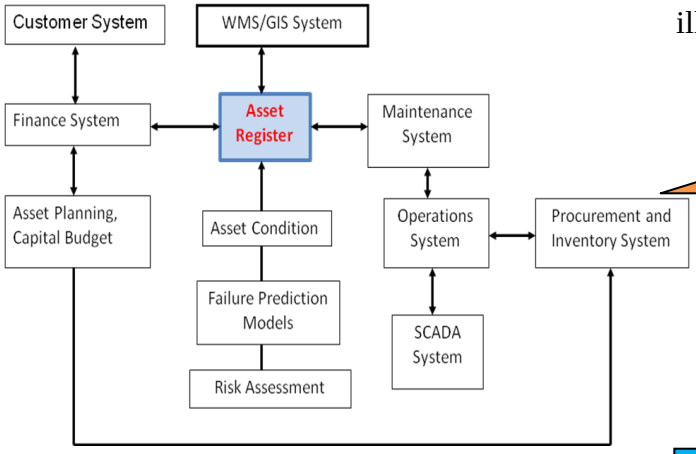

Figure 2.1: Illustration of Asset Management System Modules and Centrality of Asset Register[4]

Note: WMS – Workspace Management System; GIS – Geographic Information System; SCADA – Supervisory Control and Data Acquisition

3.0 WHY ASSET MANAGEMENT?

Assets are the source of revenue generation, security, and profitability within services, process, production and manufacturing, and real estate among other industries both in the public and private domains. When properly embraced, asset management has the potential to deliver a pleasant mix of short to medium term successes and long term sustainability. A caution is however that asset management is not a panacea to poor governance and professional incompetence.

Further, asset management is not a rapid-results quick-fix undertaking. It is usually a medium to long term business strategy which assures dividends once consolidated within the 1 – 3 years horizon.

Ideally, asset management is directed to a single objective – increasing the value and return on assets[5] rather than the mere extension of the life of an asset. In this paper, value has been illustrated through figure 6.1.

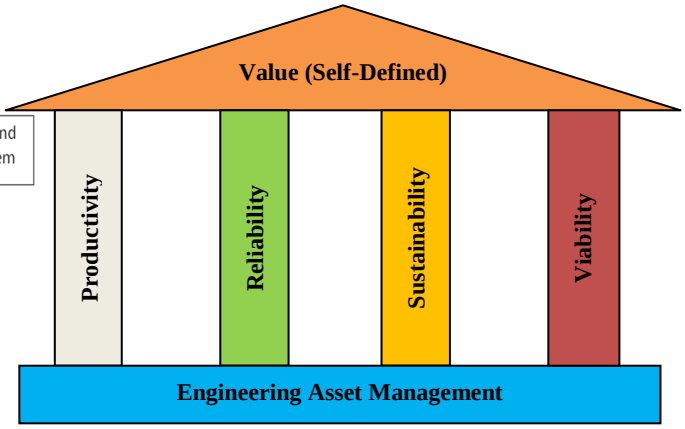

Figure 3.1: Pillars of Value from Asset Management[6]

3.1 Value

In everyday life, value relates to a monetary label called price for an item or the level of importance or usefulness of the item. While this is also valid in asset management, the bottom-line focuses on functional and net worth economic value as they relate to the asset's capability to deliver the intended purpose cost effectively.

3.2 Productivity

Generally, productivity is the achievement of more results from the same inputs and capacity.

While reference to the broad aspects of productivity is worthwhile, asset productivity focuses on four basic steps:

i) Understanding the asset structure,
ii) Disaggregating the business or operation to identify key areas of asset need,

[4] Asian Development Bank, Water Utility Asset Management, A uide for Development Practitioners, 2013

[5] Mitchell, John S, Physical Asset Management Handbook, Fourth Edition, 2007, pp. 1-2

[6] Source: Makondo, Wencyslouv T, 2017

iii) Customizing the asset benchmarking and,
iv) Estimating the impact of improvements on value.

3.3 Reliability

This is the 'trustworthiness' determined by the capacity of the asset to perform the intended purpose repeatedly with neither adversity nor risks. In the asset management delivery chain, reliability tends to be the overarching bottom-line when considering functional value.

3.4 Sustainability

In asset management, sustainability refers to the asset's capacity to continue a defined desirable behaviour 'indefinitely'.

3.5 Viability

This is the capacity of the asset or assets system to continue on a sound basis economically and be able to deliver to expectations.

Further, the Maintenance Score Card (MSC) is an emerging tool to make asset management a source of competitive advantage.

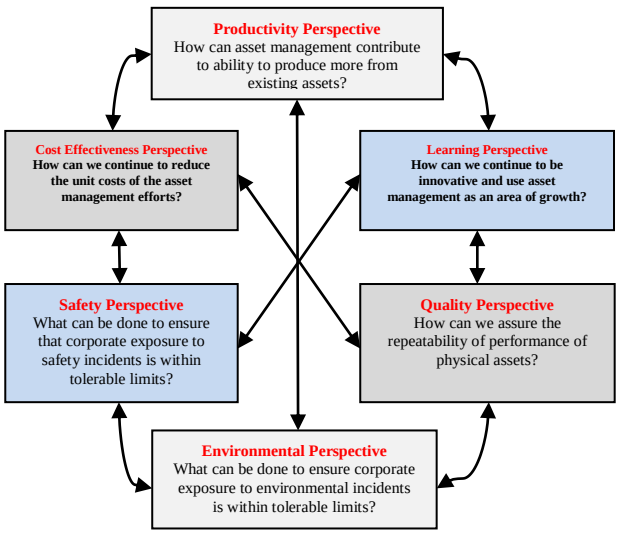

Figure 3.2: The Maintenance Scorecard Model[7]

A cost/risk relationship must be explored according to each industry's operational environment.

The benefits of asset management include but not limited to:

i) Better knowledge of own assets and assets systems,
ii) Improved ability to explain and defend budgets/investments to financiers,
iii) Integration of data from the various unit operations of the organization or national economy,
iv) Better internal coordination,
v) Better focus on priorities,
vi) Better understanding of risks/consequences of alternative investment decisions,
vii) Increased ability to balance between capital and operating expenditure,
viii) Non-cost savings business benefits,
ix) Reduced costs without sacrificing service or quality levels,
x) Operational and Capital improvement projects that meet the true needs,
xi) Improved asset productivity in meeting desired targets.

As asset management becomes enshrined and more comprehensive, a wider range of benefits is realizable and must be tracked.

[7] Mather, Daryl, The Maintenance Scorecard: Creating Strategic Advantage, 2005, pp. 31-32

4.0 WHERE IS ZAMBIA IN THE ASSET MANAGEMENT WAVE?

There is research work in progress from which it is anticipated that a clearer position and appreciation of asset management will emerge and inform asset managers, owners, and decision makers about the missed opportunities. Subsequently, case studies on selected organizations, government departments and institutions will supplement this paper.

In a snapshot comparison with the pioneers, Zambia is making slow progress through the National Maintenance Policy (NMP) which is currently being drafted[8]. The first ever Infrastructure Report Card (IRC) Framework 2012 and Zambia's 2014 Infrastructure Scorecard officially launched on 21st June 2015 by the Engineering Institution of Zambia (EIZ) is another milestone worth building on. The IRC significantly cites poor maintenance culture and inadequate resource allocation in the past as the main inadequacies in the development and management of national infrastructure in the country.

5.0 HOW WILL ASSET MANAGEMENT HAPPEN IN ZAMBIA?

Identification of barriers and enablers of asset management must explicitly be explored with a sense of urgency by research as a prerequisite.

Further, while policy such as the NMP is a good starting point, a legal backing induces the much desired 'from policy to action' progress. Dedicated national legislation will be an important catalyst to viewing asset management in a different way.

The advocacy for curriculum development in institutions of higher learning and for mandatory requirements for asset management also constitutes the purpose of this paper. The institutions of higher learning, with science and engineering faculties, must step out of the classroom and boundaries to interact with industry, other institutions and community to deliver asset management knowledge.

The introduction of the Engineering Maintenance course module at the University of Zambia (UNZA) Engineering faculty is a good foundation which must be revolutionized.

5.1 Sector Level Asset Management

The water sector in Zambia through the regulator National Water Supply and Sanitation Council (NWASCO) is leading in the advocacy for asset management. The introduction in 2015 for the first time of asset management regulatory indicators is testimony. The regulator intends to compel water utilities to not only have 'a well elaborated maintenance management system in place, but will monitor and report implementation of the same'[9]. The geographic information system was also recommended as being one of the versatile tools among other options in the implementation of asset management. These two components of asset management indeed constitute the implementation foundation irrespective of the sector. This start is therefore recommended to provide a reference and control centre for other sectors.

Inherently, asset management demands the promotion of an integrated, inter-disciplinary and inter-sectoral approach. Political leadership and communities are also important. The advocacy for legislative duress in this paper places political leadership in the overriding importance.

6.0 ASSET MANAGEMENT IMPLEMENTATION PROCESS

There is no one-size-fits-all solution in the implementation of asset management. Intending

[8] Ministry of Works and Supply, Planning Department

[9] NWASCO, Urban and Peri-Urban Water Supply and Sanitation Sector Report 2015, pp. 34-36

implementers have to define their roadmap using the general principles of asset management which remain valid for all sectors.

The proper understanding of asset management is therefore a key prerequisite in the implementation process. Armed with principles of asset management, some critical thinking is essential as illustrated in figure 6.1.

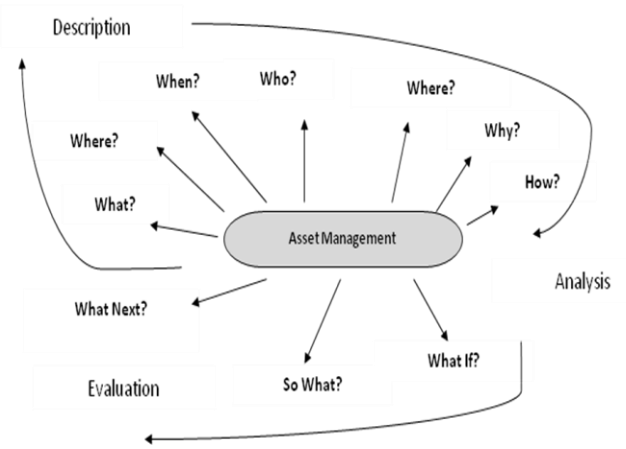

Figure 6.1: Critical thinking model for Asset Management[10]

The input/output asset model in figure 6.2 is an ideal single sheet reference manual during critical thinking.

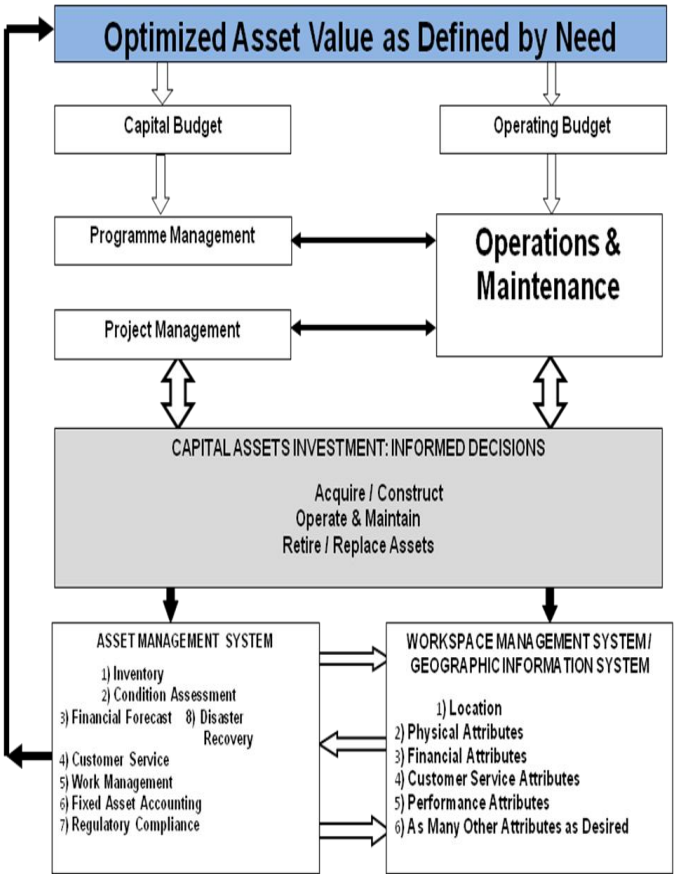

Figure 6.2: Input/Output Asset Management Model[11]

Proper asset registration and O&M practices underlie most asset management implementation activities.

6.1 Levels of Asset Management

Implementation of asset management involves several activities undertaken sequentially at different scales.

6.1.1 Core Asset Management

This is the basic level of asset management which traditionally may be referred to as operations and maintenance (O&M). It involves:

[10] Hilsdon, John, Learning Development Advisor, University of Plymouth, 'Critical Thinking', Learning Development, Plymouth University, 2010

[11] Adapted: Cagle, Ron F, Infrastructure Asset Management: An Emerging Direction, AACE International Transactions, 2003

a) Maintaining a systematic inventory or asset register,
b) Having a defined maintenance programme for sustaining the aggregate body of assets or assets systems,
c) Establishing and maintaining an integrated asset management system,

6.1.2 Tactical Asset Management

This is the day-to-day deployment of smart interventions in order to achieve the short-term goals.

6.1.3 Strategic Asset Management

This has the biggest and longer term scope for impacting the asset management bottom-line because it also involves the design and acquisition of new systems and assets.

Depending on maturity level of the intending implementer, and given the usually extensive nature of public assets and limitations of private enterprises, adoption of the Pareto (80/20) Principle in selecting and rolling out asset management practice is helpful. The Principle states that about 80% of problems come from 20% of assets. Alternatively, 80% of the full desired result is from 20% of the full effort. Further, figure 5.3 is an example of the asset risk rating process. Assets with a very high consequence of failure and a moderate probability of failure are classified as "critical assets". This consequence and likelihood of failure evaluation method (CLEM) is a handy tool for phased prioritization.

Multiplier			**Consequence (Cost) of Failure**					**Score**
Probability of Failure			X	1	2	3	4	5
			1	1	2	3	4	5
			2	2	4	6	8	10
			3	3	6	9	12	15
			4	4	8	12	16	20
			5	5	10	15	20	25
Likelihood		**Example Events**	**Risk Rating**					-
5	(Almost Certain)		11(M)	16(H)	20(H)	23(Ex)	25(Ex)	-
4	(Likely)		7(M)	12(M)	17(H)	21(Ex)	24(H)	-
3	(Possible)		4(L)	8(M)	13(H)	18(H)	22(Ex)	-
2	(Unlikely)		2(L)	5(L)	9(M)	14(H)	19(H)	-
1	(Rare)		1(L)	3(L)	6(M)	10(M)	15(H)	-
Risk Rating		**Risk Level**	**Guidelines for Risk Matrix**					-
21 – 25		(Ex) Extreme	Eliminate, Avoid, Implement Specific Action Plans / Procedures to Manage & Monitor					-
13 – 20		(H) High	Proactively Manage					-
6 – 12		(M) Medium	Actively Manage					-
1 - 5		(L) Low	Monitor, Manage as Appropriate					-

Figure 5.3: *Consequence and Likelihood Evaluation Matrix*[12]

Risk = Probability of Failure x Consequence of Failure

Identification of barriers and enablers of asset management is second to asset registration in the roll out process. This paper identifies two breakthrough factors to consider under both barriers and enablers in the start-up stages.

7.0 CONCLUSION

The relationship between humans and engineering assets has become symbiotic. Consequently, engineering asset management has become predominant and no longer an option for many industries and government policy makers.

There is no doubt that asset management is capable of enhancing the prospects of industry and the economy for the wellbeing of community. It is also a fact that there is no shortage of both human and financial resources to make asset management happen in Zambia. The expertise, techniques, and know-how already exist. A mere reorientation of both, supported by asset management policy and

[12] Asian Development Bank, Water Utility Asset Management, A Guide for Development Practitioners, 2013

legislative duress can begin to make the difference.

8.0 ACKNOWLEDGEMENT

The author would like to thank the Ministry of Works and Supply, Ministry of Local Government, The University of Zambia, and the National Water Supply and Sanitation Council for being receptive.

Mr Mike Sondalini, Executive Director of Lifetime Solutions, Australia, Dr Joseph Mathew, Chief Executive Officer, The Asset Institute, Australia, and Dr Rudolf Fredrick Stapelberg, Principal, the Academy for Professional Education and Training have all been quite inspirational and are hereby sincerely acknowledged.

9.0 REFERENCES

[1] Schultz, Alexander John, The Role of GIS in Asset Management: Integration at the Otay Water District, A Thesis Presented to the Faculty of the USC Graduate School, University of Southern California, December 2012

[2] International Standard, ISO 55000:2014 Asset Management – Overview, Prinicpels and Terminology, 2014

[3] International Standard, ISO 55001:2014 Asset Management – Management Systems – Requirements, 2014

[4] International Standard, ISO 55002:2014 Asset Management – Management Systems – Guidelines for the Application of ISO 55001, 2014

[5] Supplement to the International Infrastructure Management Manual 2011: Quick Guide to Meeting ISO 55001 Requirements, February 2014 – v1.0,

[6] Boshoff, Louis, Weaving The Integrated Infrastructure Asset Management Thread Through Municipal Strategic Planning: The Ekurhuleni Experience, RSA, 2011, Paper, 1st World Congress on Infrastructure Asset Management in Kuala Lumpur, Malaysia, February 2011

[7] Davis, Robert, An Introduction to Asset Management, A Simple but Informative Introduction to the Managemnent of Physical Assets,

[8] Cagle, Ron F, Infrastructure Asset Management: An Emerging Direction, AACE International Transactions, 2003

[9] Asian Development Bank, Water Utility Asset Management, A Guide for Development Practitioners, 2013

[10] New Mexico Environmental Finance Center, New Mexico Tech, Asset Management: A Guide for Water and Wastewater Systems, 2006

[11] Ministry of Works and Supply, Planning Directorate, 2017

[12] NWASCO, Urban and Peri-Urban Water Supply and Sanitation Sector Report 2015, pp. 34-36

[13] Marlow, David, Sustainability-Based Asset Management, Water for a Healthy Country Flagship Report, CSIRO, December 2008

[14] Hilsdon, John, Learning Development Advisor, University of Plymouth, 'Critical Thinking', Learning Development, Plymouth University, 2010

[15] Mitchell, John S, Physical Asset Management Handbook, Fourth Edition, 2007, pp. 1-2

[16] Mather, Daryl, The Maintenance Scorecard: Creating Strategic Advantage, 2005, pp. 31-32

[17] McKeon, Paul, CGI, Ramshaw, Darren, EDF Energy, Implementing Enterprise Asset Management for Dummies, 2013

[18] US Department of Transportation, Federal Highway Administration, Transportation Asset Management in Australia, Canada, England, and New Zealand, International Technology Exchange Program, November 2005

[19] German Ministry of Economic Development and Cooperation (BMZ) and the Government of Switzerland, implemented by GIZ (ORF MMS) and Network of Associations of Local Authorities of South-East Asia Europe (NALAS), Report on International Asset Management Practices, September 2014

[20] Sondalini, Mike, How to Make PA55 and ISO 55001 Successful, Lifetime Reliability Solutions, Australia, December 201