

Framework for Implementation of Industry 4.0 Tools and Technologies in Electrical Power Generation Plants Asset Management.

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Abstract

Power production systems are made up of assets that support material handling and production of electricity. As these assets deteriorate, it may be difficult to deliver the expected quality of service, and to meet regulatory requirements and sustainable development goals (Lutchman, 2018).

Moreover, Covid 19 has accelerated both manufacturing and service industries to go digital (Biard & Nour, 2021), increasing demand for both electrical power and production systems reliability. This challenge imposes an increase in the focus on efficiency of physical asset management and has prompted power production Industries to look for innovative solutions that yield maximum value for physical asset management functions. The arrival of asset management 4.0 concepts enables the exploitation of big data to improve and manage system reliability (Longhitano, et al., 2021).

Furthermore, asset performance depends on various factors like quality of maintenance and operating environmental factors, such that even two identical assets will seldom obey their estimated mean time to failure (Longhitano, et al., 2021). Considering this, a data driven approach is necessary as it spot deviations in time and maintenance is done when required, increasing its effectiveness (Jasiulewicz-Kaczmarek, et al., 2020).

The present research aims to develop a data driven asset management framework that is enhanced by Industry 4.0 technologies to execute the key functions of asset management in the operation, maintenance, and management phase of the physical asset's life cycle, and effectively integrate the environmental, social, and economic aspects into physical asset management related activities to improve system performance and extend its service life.

Keywords

Industry 4.0, Physical Asset Management, Electricity Industry, Maintenance 4.0 and Power Generation.

Biographies

Tsitsi Mashupeka is a Master of Engineering in Industrial Engineering student at Stellenbosch University and her research focus is on Implementation of Industry 4.0 tools and technologies in power plants asset management. She worked as an Industrial Engineer trainee at Zimbabwe Power Company for 1 year and 2 years at Econet Wireless Zimbabwe as Ecocash Brand Ambassador when Ecocash was still in its infancy stage. Having worked as a trainee industrial engineer and brand ambassador, she has developed specialized skills in business engineering and attributes in delivering solutions using continuous improvement principles and agile methodologies. Her key research interests are in sustainable service delivery in both manufacturing and service industries. She has completed the eleven courses available in the Task Force on Climate Related Financial Disclosures (TCFD) framework recommendations. She was recently selected to participate in the Future 17 Challenge Program at Stellenbosch University which seeks equip students with knowledge to solve global sustainability challenges using the UN's Sustainable Development Goals (SDGs). She is constantly looking for opportunities to use her capabilities in the design and optimisation of efficient systems that integrate climate change related issues in product design, sourcing, manufacturing, and service delivery.

Her career objective is to solve problems and improve the quality of life for the people and environment through the study, design, planning and optimization of highly complex operational systems and processes to improve their efficiency and effectiveness in value creation for all participants in the complete chain.

Professor Stephen Matope is currently an associate professor in the Department of Industrial Engineering, Stellenbosch University with over 16 years of lecturing industrial engineering related subjects at university level. His research interests are in advanced

manufacturing covering additive manufacturing, manufacturing processes and manufacturing systems. He has so far co-authored over 70 peer-reviewed journal papers, international and national conference papers. He is a registered professional engineer with the following engineering boards: 1) Engineering Council of South Africa (ECSA), 2) South African Institute for Industrial Innovative Learning Factories (NIL) and was the first coordinator for NIL on the South African side. He has so far supervised 7 PhD students of which 3 have graduated, the other 4 are still yet to complete soon. He has successfully supervised MEng and BEng students (over 35 in number) in company-based industrial engineering projects. He was an invited Visiting Research Scientist at Chemnitz University of Technology, Germany, in 2011. He is an external examiner for five universities: three in South Africa (SA) and two in Zimbabwe (Zw). He is a registered journal article reviewer e.g. for South African Journal for Industrial Engineering and Zimbabwe Journal of Science and Technology (ZJST). He served(s) 1) as an organizing international committee member for the Competitive Manufacturing international conferences (e.g., COMA'16 and COMA'19), 2) as an international scientific committee member for the 9th Conference on Learning Factories 2019 (CLF) in Braunschweig, Germany, 3) as an international scientific committee member for the 10th Conference on Learning Factories (CLF) 2020 in Graz, Austria.