Journal of
Strategic Management
(JSM)

A Study of Operations Management Practices and Non-Financial Performance at Mubuku III Hydro Power Plant in Kasese District

Paul Kasaija, Pereez Nimusima, Crispus Tashobya, Charles Kaggwa, Kato Patrick Samuel, Muhumuza Godfrey, Angee Gladys

AJPO

Journal of Strategic Management
ISSN 2520 - 0461 (Online)
Vol. 11, Issue 1, pp 29-58, 2026
www.ajpojournals.org

A Study of Operations Management Practices and Non-Financial Performance at Mubuku III Hydro Power Plant in Kasese District

Paul Kasaija[1], Pereez Nimusima[2], Crispus Tashobya[3], Charles Kaggwa[4], Kato Patrick Samuel[5], Muhumuza Godfrey[6], Angee Gladys[7]
[1,4,6,7] Department of Business Administration, Mountains of the Moon University, Fort portal, Uganda
[2]Department of Marketing and Logistics Management, Muni University, Arua, Uganda
[3] Department of Business Studies, Kabale University, Kabale, Uganda
[5]Department of Management Sciences, Mountains of the Moon University, Fort portal, Uganda

Article history
Submitted 13.05.2026 Revised Version Received 12.06.2026 Accepted 16.07.2026

Abstract

Purpose: This study examined the relationship between operations management practices and non-financial performance of Mubuku III Hydropower Plant in Uganda. Specifically, the study examined: (i) the relationship between maintenance management practices and non-financial performance and, (ii) the relationship between quality control practices and non-financial performance.

Methodology: A case study research design with a sample size of 48 participants comprising of employees of Mubuku III Hydropower Plant was used and determined using the Krejcie and Morgan (1970) table. Simple random and purposive sampling methods were used to select the respondents and data was collected using questionnaires and interviews. The quantitative data was analysed using descriptive and inferential statistics while qualitative data was analysed using thematic, content and narrative analysis.

Findings: The study findings revealed that maintenance management practices had a weak and statistically non-significant positive relationship with non-financial performance ($r = 0.234$, $p = 0.110$). In contrast, quality control practices exhibited a moderate and statistically significant positive relationship with non-financial performance ($r = 0.342$, $p = 0.017$). The study concludes that maintenance management practices at Mubuku III Hydropower Plant do not have a significant direct effect on non-financial performance unless supported by other factors. In contrast, quality control practices have a moderate and direct positive influence on non-financial performance of Mubuku III Hydropower Plant.

Recommendations: The study recommends enhancement of maintenance planning, effective use of advanced monitoring and predictive maintenance technologies such as real-time sensors, automated diagnostic systems, and data analytics in improving operations reliability and reducing downtime and strengthening maintenance capacity through targeted training and staff empowerment. It also recommends sustaining strict adherence to standard operating procedures and reinforcing continuous quality monitoring systems. Future research should extend to multiple hydropower plants, examine advanced maintenance technologies, and assess the influence of external regulatory and environmental factors on non-financial performance.

Keywords: *Operations Management, Hydro Power Supply, Electricity, Non-Financial Performance, Maintenance Management, Quality Control*

JEL Codes of Classification: *M11; L23; L23; L25; D22*

INTRODUCTION

The performance of hydropower supply systems has overtime attracted the attention of scholars and policy makers considering the significance of electricity for humanity. Electricity is a foundation of every human development effort and envisaged as a big pillar of community progress manifested in various ways including but not limited to: enabling improvement in quality of life by powering cooking, lighting, cooling, heating and household appliance (Olatunde, Okwandu & Akande, 2024); it is a catalyst of modern civilization supporting industrialization, science, transportation, government service delivery and entertainment (Wan, Wang & Miao, 2024); it supports education where learners can read at night and teachers are enabled to use digital teaching methods (Parikh et al., 2021); it supports advancement of healthcare service provision (Vinci et al., 2026); it is a big driver of economic development where factories, banks, farms, businesses and communication systems thrive (Khan et al., 2020). The significance of electricity is also seen in supporting agriculture where modern farming activities like irrigation, refrigeration, food processing and storage depend on (Raji, Allee & Williams, 2024). Enhancement to security and safety (DeCotis, 2025) and promotion of social development have also been cited (Casati et al., 2023) among others. All this apparently explain the sustainable development impact that electricity has on communities (AfDB, 2022; Lozano & Taboada, 2021). Even when recently there has been a global switch to renewable energy discussions largely due to minimal emission of greenhouse gases, generation of hydroelectric power in Africa and elsewhere is still critical. This leads us to the real purpose of this study: to assess the contribution of operations management practices on non-financial performance of Mubuku III Hydro Power Plant. On the basis of the fact that many studies in this area tackled the financial performance of other energy plants, researchers in this paper have interest in non-financial performance aspects (Hewett et al., 2020) of Mubuku III Hydro Power Plant in Kasese district. The conversation tilts away from the profit-and-loss statements of the energy plants (Amasi et al., 2021) to outcomes such as meeting environmental rules, keeping equipment reliable, and earning community trust as part of realization of the impact these aspects have on not only service delivery but also on social economic development of communities. The multifaceted nature of the non-financial performance concept implies that an organisation must deliver a value that cannot be described using the classical financial variables but, through the enforcement of regulation, construction of social legitimacy, preservation of the environment, and its accountability and staff morale (Raucci et al., 2020). It is comprised of routine maintenance, environmental safeguard measures, proactive corporate engagement, constant service delivery and responsive learning and culture in the hydropower sector. Though these are some of the performance indicators that are regarded as intangible in effect, its consequences are tangible, because failure to adhere to this by the hydro plant managers carries a risk of losing reputation, environmental degradation, increased system dysfunction and more rejection by the populace. In such circumstances, several regional and national interventions have aimed to enhance predictive maintenance, quality control structures and legal mechanisms to emphasise the sustainability of plants (ERA, 2023; Fallahi et al., 2025)

Many studies have looked at operations management in a general way and overlook important details like maintenance schedules and quality checks. That oversight leaves practitioners short on actionable guidance about which daily habits actually move the needle for things beyond financial indicators. Moreover, scholars like Gerschewski and Xiao, (2014); and Odilova et al., (2023) argue that the success of the hydropower projects is no longer measured in terms of just financial or even the megawatt output, since the world is moving in the direction of sustainable development and mindful constructions. Related concerns have been raised elsewhere emphasising environmental stewardship, outreach to the community, operational reliability, regulatory compliance, and taking care of employees as key features of efficient workings of hydropower plants (Mujeeb et al., 2025; Maqbool et al., 2020)

The above discussion shows the extent to which Hydro Power Plant Managers and decision makers should be concerned with formulating mitigation strategies to streamline operations and reliability, however, many hydropower facilities in Uganda just like other countries have failed to excel in non-financial performance aspects despite them being technically advanced and supported financially. For example, the Three Gorges Dam in China (Zhang et al., 2021) and Belo Monte in Brazil (Lopes et al., 2024) have been reportedly criticized basing on displacing people, distorting the ecosystems and ignoring the concerns of the stakeholders indicating a low internal culture of accountability and feedback (Castro-Diaz et al., 2024). The Site C Dam in Canada has reportedly exhibited communication breakdown, slowness of quality assurance, lack of proper feedback channels and the consequent lack of reliability in operation and mistrust by the members of the population (Bradford, 2022). The Oroville Dam crisis in the United States demonstrated that problems of organisational learning and responsiveness (and not just a technical issue) had caused a devastating result (Deshpande & Batra, 2024). Such shocks demonstrate how even technically sophisticated projects are susceptible to failures of non-financial performance, ineffective communication, inadequate accountability, and weak safety cultures (Mortey et al., 2019).

Sub-Saharan Africa's hydropower plants' non-financial performance lives a lot to be desired. For instance, poor maintenance, incoherent stakeholder involvement, and degradation of the regulatory compliance have been experienced in the Kainji and Jebba dams in Nigeria (Ishaku et al., 2022; Lumbroso et al., 2015), besides the Inga Dams in the Democratic Republic of Congo being rated low on community involvement, cratering infrastructure and minimal environmental monitoring which has been seen to derail the confidence of people and intentions of sustainability (Bissiri et al., 2024). Kariba Dam on Zambezi river in Zambia and Zimbabwe is quietly framing the tensions between abrupt climate shifts and frayed institutional frameworks, rigid structures, siloed command lines, and hushed staff channels allegedly causing postponement of any timely course correction, underscoring how the human machinery still gets short-changed in high-tech crisis models (Mayoyo et al., 2023; Dube & Nhamo., 2023). Additionally, the Cahora Bassa Dam one of Southern Africa's engineering landmarks has twice erupted into unplanned outages, flooding villages downstream, with investigators, such as Nhamo et al., (2021) blaming those shocks on broken real-time monitoring networks and on communication protocols that failed once the alarms went off. Further still the Gilgel Gibe II and Tekeze stations in Ethiopia have unevenly put maintenance policies into practice an indication of how much leeway local managers feel they have and in how engaged the on-site staff are with the planning process (Tilahun et al., 2023).

In East Africa, non-financial performance issues are being realized through; dangers of siltation, delayed maintenance, and poor-quality controls translating to an increase in inefficiency, as seen in Kenya's Seven Forks Scheme (Amasi et al., 2021); Rwanda's Nyabarongo I Plant experiencing numerous cases of silt accumulation, machinery failure and lack of stakeholder control; Tanzania's Kidatu Dam facing drifted sensor calibrations and a pile of overdue maintenance logs and rigid command chain (Minja, 2024). In Uganda hydropower plants like Isimba and Karuma lie in the shadow of incomplete repairs, half-baked inspection and unreliable transmission connexions (Van de Ven et al., 2024). Criticism has been labelled on them in regard to management failure, bottlenecks in the engineering side and failure to fully engage the communities, which compromises their long-term and short-term viability (Shaktawat & Vadhera, 2021). According to Uganda Electricity Distribution Company (UMEME) (UMEME, 2023), over 70 percent of the rural agrarian households lack a connection to the national grid (UBOS, 2021) which signals not only on the infra-technical deficit, but also a systematic one, in terms of the impossibilities of governing operations, monitoring compliance and aligning interests. Moreover, environmental surveys conducted by National Environmental Management Authority (NEMA, 2024) have shown that the wetlands are deteriorating and the riverbanks are becoming unstable as a result of the hydropower corridors, casting doubt on the successes achieved in integrating environmental duties into daily operational procedures.

Narrowing the discussion to Mubuku III Hydropower Plant in Kasese district, evidence shows that downtime exceeded 120 hours in the plant in large part due to the reactive maintenance, delays and sediment accumulation (ERA, 2022). The field reports indicate inconsistency in the application of the standard operating procedures (SOPs), the audit regimes are neglected, and quality assurance procedures are more or less dormant. Furthermore, consultations with the community are impoverished, and the local populace has also criticised the lack of access to the supervisory mechanisms of the plant, fuelling the perception of institutional obscurity and legitimacy loss (Kasese District Report, 2023). Mubuku III Hydropower Plant is a 9.9 MW mini-hydro run-of-river plant that is not burdened by large scale-driven bureaucracies present in other, larger stations like Isimba and Karuma thus presenting a case for easy operations management practices, maintenance and quality control. However, the plant is reportedly exhibiting maintenance lapses, low employee motivation and community dissatisfaction illustrating a more serious problem of the gap between technical plans and organisational practices.

As much as previous studies have recognised the role that maintenance and quality management play in affecting the performance of hydropower plants, very little has focused on the relationship between the practices and non-financial results like legitimacy, compliance and trust. Although Uganda has made strides in expanding hydropower infrastructure, scholarly attention has disproportionately focused on financial metrics, technical capacity or project economics, often overlooking the non-financial levers that influence long-term viability and public legitimacy. As researchers we observe that how maintenance efforts translate into actual performance outcomes is ostensibly an area that call for further investigation. Moreover, recent reviews of hydropower scholarly articles show a persistent disconnect between theory and daily plant operations, underscoring an urgent need for field-based evidence. To close that gap, the current research turns to the Mubuku III station in Uganda, where managers already experiment with unusual maintenance schedules and staff rotations. This study examines the relationship between operations management practices and the non-financial performance of Mubuku III Hydro Power Plant. The study contributes to hydropower plants' literature arguing that hydropower managers and decision makers should focus on maintenance management and quality control strategies whose impact go beyond hydropower plants' financial indicators to non-financial outcomes like service reliability, operational efficiency and employee satisfaction.

Problem Statement

Hydropower plants are anticipated to be consistently reliable in the illumination of houses, safety, and environmental criteria (Mujjuni et al., 2023). However, for most hydropower facilities in Uganda audits are not performed according to expectations, there is low maintenance and quality checks and management of these plants do not justify their choices, which deteriorates the trust that the population has towards services given and the reliability of the provided service (UMEME, 2023; UBOS, 2021). The result is frequent power cuts, worsening the environmental situation and eroding the riverbanks (Wabukala et al., 2024). These have awakened the regulatory agencies such as the Electricity Regulatory Authority (ERA) and National Environmental Management Authority (NEMA), which shows that in 2020/2021 alone, compliance levels dropped at Mubuku III, from 75% to 3% in 2021/2022 (ERA, 2024). Whereas classical financial variables have been used in many hydropower plant studies, other studies have indicated poor stakeholder consultation, low environmental stewardship and low rural electrification as having numerous negative effects on performance of hydropower plant (NEMA, 2024; UBOS, 2021). The ability of a power plant to enforce regulation, construct social legitimacy, preserve the environment, ensure staff morale and promotion of accountability is envisaged as critical performance aspects (Raucci et al., 2020). Failure to adhere to these principles by the hydro plants exposes them to a great risk of losing reputation, environmental degradation, increased system dysfunction and more rejection by the populace. Routine maintenance, environmental safeguards, proactive corporate engagement, constant service delivery and responsive learning culture are some of the performance indicators that are regarded as intangible yet consequences of ignoring them are tangible in the hydropower sector. According to Kasese District Development report, (2023) Mubuku III continues to experience recurring downtime, insufficient compliance with SOPs, and limited community involvement. Whereas numerous studies address technical barriers, not many studies look into the impact of everyday management on such key non-financial performance outcomes as community trust, environmental compliance, and service reliability. The paper sought to address this gap by examining the non-financial performance of Mubuku III using operations management perspective in attempt to come up with insights into enhancing sustainability and performance within the Uganda hydropower industry.

Purpose of the Study

This study was conducted with the aim of examining the contribution of operations management practices on non-financial performance of Mubuku III hydro power plant in Kasese district

Literature review

Theoretical review

Resource-Based Theory

Resource-Based theory has stood a test of time in strategic management literature explaining that a firm's internal resources are the only key determinants of its performance. Barney, (2001) strongly believed that resources that are valuable, rare, inimitable, and non-substitutable, can enable a firm to attain sustainable competitive advantage over its rival firms in the same industry. This study benefits from the assumptions of this theory by looking at efficient maintenance activities of hydropower plants, their quick reactions to faults and having highly qualified quality-response mechanisms as internal resources that cannot only maintain in place physical assets but also enhance these power plants' legitimacy and environmental custodianship (Fallahi et al., 2025; Fakih, Ghazalian & Ghazzawi, 2020). The theory has been criticized on the basis of its exclusion of external variables, in this case, for example, external regulatory, environmental, and stakeholder pressures which also significantly impact operational success. The theory emphasis on internal resource possession and ignoring how resources are deployed/utilised or put to use has been another source of its criticism (D'Oria et al., 2021). These shortcomings partly reduce the efficiency of the theory in explaining the occurrence of ineffective non-financial results of technically sound practices in hydropower plants, such as Mubuku. Consequently, the study borrows strength from balanced scorecard frame work (Salem, Hasnan & Osman, 2012) that looks at performance appraisal beyond the choices of cash flows to cover internal operations, knowledge and development, customer attitudes, and collectivism. A multi-dimensional lens like this is compatible in the hydropower industry with the current understanding of the importance of achieving sustainability equilibrium between productivity and environmental standards, society, and workers' welfare (Maqbool et al., 2020). However, as much as balanced scorecard frame work is useful in integrating non-financial results, its implementation in hydropower settings is scarcely mentioned, as most of the research tends to favour the focus on financial viability/the long-term outcomes of institutional legitimacy (Ishaku et al., 2022). Importantly, the literature indicates that there has always been a gap in ensuring these theoretical perspectives are integrated. Not all is lost though since the resource-based theory captures maintenance and quality systems as competitive tools and balanced scorecard frame work is a means for assessing more crucial non-financial effects. Nonetheless, in Sub-Saharan Africa, previous empirical studies tend to separate those viewpoints and fail to synthesise them, which results in the fact that the authors could not provide complete explanations of why technically advanced plants can still be more underperforming in terms of stakeholder trust or environmental compliance (Uwihirwe et al., 2024; Tilahun et al., 2023). This study thus has a theoretical contribution in that it forms an integrative framework that fits maintenance and quality-control practices into resource-based view logic but also acknowledging that a balanced performance perspective forms the secondary explanatory role in characterising performance of power plants. By so doing, we suggest that the theorisation of operations management in hydropower be more context-sensitive (Gossal, 2025). This study enhances theory by descriptively explaining technical failures with the predictive influence of operations management. The study provides a more detailed insight into how operational routines result in sustainable or unsustainable performance.

Conceptual Framework

In this study two relationships are conceptualised. The study identifies practices of maintenance management, quality control, and their effect on the non-financial performance of the Mubuku III Hydro power plant. The constructs illustrating the maintenance practices include the observance of preventive schedules, the performance of corrective repairs, and the adherence to the standard operating procedures (Ishaku et al., 2022). The indicators applied to measure non-financial performance are operational reliability, environmental compliance or stakeholder trust (Maqbool et al., 2020). This framework has been developed basing on previous studies as indicated in *figure 1* below depicting how operational management dimensions influence non-financial performance of Mubuku III Hydro power plant. Ostensibly, and as it has been portrayed in this paper, preventive scheduling and rapid reaction have been embraced as effective methods in adding efficacy and operational stability in energy plants through practicing maintenance management (Fallahi et al., 2025). Monitoring of the process, compliance with SOPs and operational internal defect detection are all variables that have repeatedly shown the correlations between compliance with quality control practices and service reliability (Mudenda et al., 2022; Virtanen, 2024). Importantly the non-financial performance aspects like the satisfaction experienced by the employees, the trust shown by the stakeholders involved in the sector, environmental sustainability, and the stability of the services provided by the company (Maqbool et al., 2020) have also been given significance.

Conceptual Framework

Independent Variables **Dependent Variable**

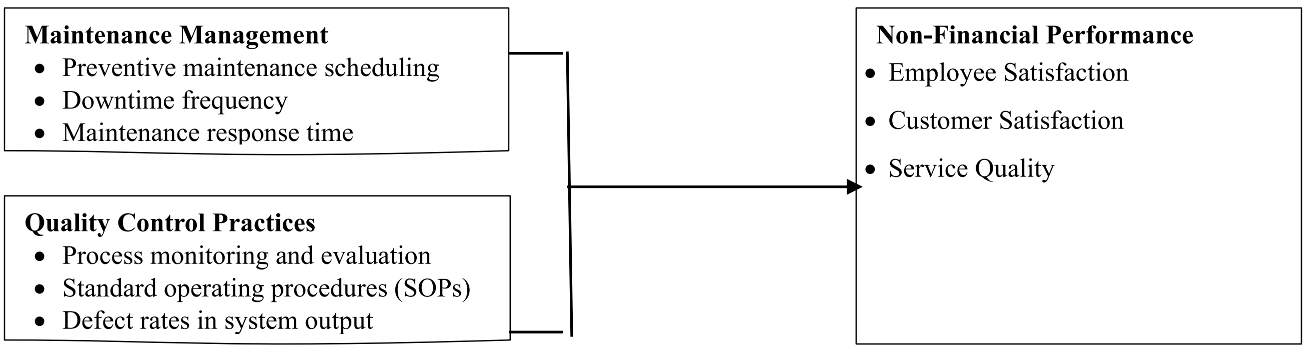

Figure 1: Conceptual Framework

***Source**: Ishaku et al., (2022); Maqbool et al., (2020); Singh et al., (2020).*

Empirical review

Maintenance Management Practices and Non-Financial Performance of Hydro-Power Plants

Effective operations performance of hydropower plants depends largely on the extent to which maintenance is managed. This is true especially when looking at the capital-intensive and technically complex nature of electricity generation infrastructure. The hydropower system managers must ensure asset reliability, operations continuity, and safety, which are prerequisites for sustained non-financial performance outcomes. According to West et al., (2024) preventive maintenance performed at planned intervals to avert equipment failure and predictive maintenance which provides for maintenance planning based on equipment health rather than fixed schedules, reducing unplanned downtime and improving availability must be in place. The overall aim of these two maintenance forms is to reduce unexpected outages and extend equipment life, enhancing operations reliability and availability. Maintenance scheduling literature stresses that optimising when and how maintenance occurs directly affects a plant's ability to meet demand and manage reliability thresholds (Li, Guo & Zhou, 2016). The literature largely underscores that preventive maintenance scheduling, control of downtime frequency, and rapid maintenance response time are essential components of an effective maintenance management system (Iwarue, 2025). However, while these studies provide valuable insights into operations efficiency, their connection to non-financial performance indicators remains underexplored, particularly in developing country contexts hence leaving conceptual gaps that the current study bridged. In a study conducted by West et al., (2024) effective maintenance strategies were found to improve reliability and availability by minimizing unplanned downtime and enhancing safety. Same study reported that poorly planned maintenance is associated with higher equipment failure rates, increased downtime and decreased operations efficiency. Other hydropower asset management literature has indicated that combining condition and reliability-based maintenance with advanced monitoring can increase effective use of resources and system reliability (Ali & Abdelhadi, 2022). These studies in away demonstrate that reduced downtime frequency and improved response time contribute to more dependable electricity supply, an important precursor to improved non-financial outcomes such as customer satisfaction. Preventive maintenance scheduling has ostensibly been portrayed as a mechanism for reducing unexpected equipment failures and prolonging asset life in hydropower plants (Vysokikh, 2026; West et al., 2024). Scholars like Mahmood Ali et al., (2025) argue that structured preventive maintenance scheduling improves system reliability by ensuring timely inspection and servicing of critical components such as turbines and generators. From a non-financial performance perspective, effective preventive maintenance reduces emergency breakdowns, which in turn minimises work pressure and safety risks faced by maintenance personnel, thereby enhancing employee satisfaction. Despite these advantages, most empirical studies on preventive maintenance focus predominantly on technical performance outcomes such as availability and failure rates. Conceptually, they neglect broader organizational outcomes such as service quality perceptions and workforce morale. Impliedly many of them methodologically rely on simulation models or engineering data rather than employee and customer-based measures, creating a gap that the current study sought to address.

Literature has also indicated that high downtime frequency undermines system availability and compromises operations stability in power generation facilities (Iwarue, 2025). A related view is echoed on by Vysokikh, (2026) whose study results demonstrated that frequent outages lead to not only increased customer complaints but also reduced trust in service providers and declining perceptions of service quality. From an internal perspective, persistent downtime contributes to job dissatisfaction among employees due to increased workload, reactive maintenance pressures, and heightened stress levels (Cokki, 2021). While the literature strongly links downtime frequency to reliability and cost inefficiencies, it often fails to empirically link downtime outcomes to employee satisfaction and customer satisfaction metrics. Contextually, most downtime studies are situated in developed economies with advanced infrastructure, limiting their applicability to hydropower plants in developing countries such as Uganda, where operational constraints, skills shortages, and resource limitations may intensify the non-financial impacts of downtime.

Also maintenance response time, defined as the speed at which maintenance teams identify and resolve operations faults, has been identified as a determinant of operations resilience and service continuity. The extent of its effects is documented by West et al., (2024) who argues that shorter maintenance response times significantly reduce outage duration and enhance system reliability. Similar effects are reported by Vysokikh, (2026) who observed that more often than not rapid response times contribute positively to employee satisfaction by reducing prolonged emergency shifts and improving perceptions of organisational support and competence. The same source contends that swift fault resolution enhances customer satisfaction by minimizing service disruptions and reinforces perceptions of service quality and responsiveness. Authors of this paper observe that existing studies primarily examine maintenance response time through efficiency and cost lenses, with limited consideration of its behavioural and perceptual implications. Methodologically, response time is often measured using technical logs without triangulating findings using employee or customer feedback, thereby limiting understanding of its broader performance implications hence research gaps that the current study bridged. This study observes that a significant conceptual gap exists in the literature regarding the integration of maintenance management practices with non-financial performance frameworks. While maintenance practices are well conceptualised within engineering and asset management disciplines, their translation into human and service-oriented outcomes remains fragmented. Methodologically, there is heavy reliance on quantitative operations data, with limited use of mixed-methods approaches that could capture employee and customer perspectives. Contextually, studies focusing on Sub-Saharan Africa are scarce, despite the region's growing reliance on hydropower and persistent operations challenges. In view of the above analysis, this study hypothesized, thus;

H_1: Maintenance management practices have a significant effect on the non-financial performance of Mubuku III Hydro Power Plant.

Quality Control Practices and Non-Financial Performance of Hydropower Plants

The operations' managers' tendency to monitor and improve processes aimed at ensuring that outputs conform to predefined standards is a quality control practice that has been documented (Zacharias, 2022). Such quality control initiatives help ensure operations consistency, reduce defects, and influence broader organizational outcomes such as employee morale, customer satisfaction, and perceived service quality (Abdulkadir, 2023). Since these processes encompass process monitoring and evaluation, standard operating procedures and defect management, no doubt these altogether shape not only the internal but also the external perceptions of a firm's performance (Khan et al., 2017). Process monitoring and evaluation generally involve systematic tracking of operations activities to detect deviations from quality standards while standard operating procedures (SOPs) define consistent steps and protocols for operational tasks, thereby reducing variability and ensuring adherence to quality expectations (Inisha & Elly, 2022). Relatedly, defect rates in system output serve as a quantitative measure of the effectiveness of quality control practices whereby lower defect rates are typically associated with higher product or service reliability (Sadikin, 2023).

In a study conducted by Virtanen et al., (2024) while analysing process monitoring practices at Vietnam's Tri A Hydropower Station observed that irregular monitoring of not detecting pressure build up and turbine wear reduced the efficiency of the plant. Bwanika, (2023)'s study on Uganda's Bujagali Dam has relatively similar results indicating that infrequent control process evaluation lead to the slow identification of faults. This is quite different from Nardini et al., (2024) who reports that real-time monitoring systems coupled with a central control laboratory improve the process responsiveness and reduce the downtimes. A review on these studies indicate that they largely focused more on the technical outcomes rather than the implications for the stakeholders' trust, environmental responsibility, or employee engagement. From all these studies, it can be derived that while process monitoring frameworks are pivotal for sharpening operations efficiency, there was a need to examine the balance with non-financial performance aspects in greater depth hence a gap in research that the current study bridged.

Further still in a study by Inisha and Elly, (2022) while investigating implementation of SOPs noted that if well implemented they enhance clarity around work routines, which can improve employee satisfaction by reducing ambiguity and increasing perceptions of fairness and procedural transparency. Consequences in regard to SOPs implementation vary with Nzioka, (2020) noting that maintenance and shutdown operations at times cause several minor accidents due to errors within the frameworks of the SOPs. A study conducted at Ethiopia's wind farms revealed that procedures which were not updated to fit the context stagnated operations effectiveness (Chen ,2018), quite different from Brazil's infrastructure projects where the use of digitized SOPs that were updated regularly worked effectively (De Souza et al.,2020). The possible explanation for the Brazil' success story was that the embedded SOPs provided guidance automating key areas of work within the technical teams which enabled synchronization of effort towards enhancement of teamwork.

Beyond SOPs implementation, defect rates studies have revealed that high defect rates in system output can be caused by substandard component purchasing, poor rigorous testing processes, enduring turbine outages and forced outages (Sati et al.,2020). This India's case (the Tehri Hydro Development Corporation) differs from Uganda's Nalubaale Dam experience where output quality in terms of voltage and harmonic distortion was reported to fluctuate by over-responding and under-responding due to irregularly calibrated aging instrumentation, coupled with more dynamic informational infrastructures (Fritz, 2018). At Upper Kotmale Hydropower Plant in Sri Lanka, Mallawaarachchi et al., (2024), report that in spite of severe output defects, public satisfaction remains high owing to communication systems and backup servicing frameworks. Relatedly, Mudenda, (2022), while studying Zambia's Kafue Gorge Hydropower Station, noted that regular internal quality inspections lessened the recurrence of mechanical faults by early detection of turbine wear and insulation failure, agreeing with Imo & Aminu, (2019) in their study on Nigeria's Shiroro Hydroelectric Power Plant who reported that plants with documented internal audit procedures experience less unplanned outages and better compliance with safety standards. However, the Ethiopia's Gilgel Gibe II Dam study by Norgaard, (2021) reported that even with frequent audits conducted, issues of persistent non-conformance stagnation are possible especially where there is absence of corrective frameworks or insufficient technical responsibility. All these studies underscored the significance of quality control practices on non-financial performance within hydro power plants, though many of them were conducted in other countries such as India, Zambia, Ethiopia and Nigeria which have different operations contexts than Uganda thereby leaving conceptual gaps that the current study tried to bridge. Also many quality studies emphasize financial outcomes or operations metrics, with fewer studies exploring how quality practices translate into employee satisfaction and customer satisfaction in settings where service reliability is critical. This represents a theoretical gap that the current study aimed to address by linking Quality-control dimensions; monitoring, SOPs, defect rates with non-financial performance indicators. Consequently, we hypothesised that;

H_2: Quality-control practices have a significant effect on the non-financial performance of Mubuku III Hydro Power Plant.

Research Methodology

To achieve the study objectives: (i) assess the relationship between maintenance management practices and non-financial performance, and (ii) examine the relationship between quality control practices and non-financial performance, a case study research design was used. The reason for its choice is that it involves in-depth investigation of a specific subject like a person, group, event, or organization within its real-world context to gain deep understanding of complex issues. The case study research concentrates on a single or few cases to understand them comprehensively, not generalizing to large populations and therefore explains real-world phenomena in their specific environments which controlled experiments often can't (Cvetković et al., 2021). Researchers

Journal of Strategic Management
ISSN 2520 - 0461 (Online)
Vol. 11, Issue 1, pp 29-58, 2026

practically focused on one specific organisation—Mubuku III Hydropower Plant—and sought to examine the contribution of operations management practices on non-financial performance within their real-life operational context. A mixed-methods research approach was used that allows for triangulation of both qualitative and quantitative research methods within a single study (Ahmed, Pereira & Jane, 2024). This approach was preferred because it allows researchers to gather a more comprehensive and holistic understanding of a research question or phenomenon (Jick, 1979).

The sample size of the study comprised 48 participants and these included 19 operations staff, 11 maintenance staff, 13 staff working in quality control and 5 administrative staff of Mubuku III Hydro Power Plant selected from the total population using Krejcie and Morgan (1970) table. Operations staff were considered because they are responsible for the day-to-day running of the plant and directly implement operations management practices that affect reliability, efficiency, and service continuity. Maintenance staff were included since their preventive and corrective maintenance activities influence equipment availability, downtime and operations safety, which are critical dimensions of non-financial performance. Quality control staff were targeted because they monitor standards, compliance, and process effectiveness, thereby influencing operations consistency and system reliability. Administrative staff were included as they support planning, coordination, documentation and policy implementation, which shape how operations management practices are executed across the plant. Collectively, these groups provide comprehensive and relevant insights into how operations management practices relate to non-financial performance at Mubuku III Hydropower Plant. Both probabilistic and non-probabilistic

sampling techniques were used in selection of individuals. Purposive sampling was used for non-probability sampling, while simple random sampling was used for probability sampling (Elfil & Negida, 2017). The study used the survey method in data collection where information was gathered from a sample of individuals by administering standardized questionnaires (Kuphanga, 2024). Close ended structured questionnaires on a 5-point Likert scale helped in collecting quantitative data from the operations, maintenance and quality control staff of Mubuku III Hydro Power Plant, while interview method was used to conduct face to face interviews with selected administrative support staff of Mubuku III Hydro Power Plant. Validity of the data instruments was ensured by conducting a pilot test and also using the content validity index (CVI), which involved having three expert raters to evaluate the relevance of each item in the questionnaire. The set target for CVI was 0.7 as set by (Taherdoost, 2016). Validity test outcomes details are shown in *table 1* below;

Table 1: Showing CVI of the Instrument

	Number of Valid Questions	Number of Invalid Questions	Total Number of Items	CVI
Expert One	25	9	34	0.84
Expert Two	27	7	34	0.86
Expert Three	23	11	34	0.80

Source: Primary Data 2025

Cronbach's alpha test the dependability of the questionnaire, and as shown in *table 2* below, the instrument was proved reliable since the Cronbach's alpha values were above 0.7 (Rak & Wrześniowski, 2023).

Table 2: Reliability of the Quantitative Study Instrument

Variables	Number of items	Cronbach's alpha
Non-Financial Performance	12	0.750
Maintenance Management Practices	10	0.700
Quality Control Practices	11	0.883

Source: Primary Data 2025

To ensure the validity of qualitative instruments, the researchers used several strategies. Pilot testing of the tools was conducted to identify and rectify any issues before the main study, ensuring that the instruments effectively capture the intended data. Triangulation was employed, including data triangulation by collecting information from multiple sources and also methodological triangulation by using different methods to study the same phenomenon. Member checking was utilized, where findings were shared with participants to verify the accuracy of interpretations and make necessary corrections based on their feedback.

Descriptive and inferential data analysis techniques were used for the quantitative study, however this was preceded with subjecting the data to preliminary diagnostic tests to determine whether they met the assumptions for parametric statistical techniques, particularly regression analysis. Specifically, normality of the data was assessed using statistical methods, including the Shapiro–Wilk test, skewness and kurtosis values, as well as visual inspection of normal probability (P–P) plots (though the visual inspection figures are not shown here). The results indicated that the data were approximately normally distributed, with skewness and kurtosis values falling within the acceptable range of ±2 as shown in *table 3* below;

Table 3: Tests of Normality

Tests of Normality						
	Kolmogorov-Smirnova			**Shapiro-Wilk**		
	Statistic	**df**	**Sig.**	**Statistic**	**df**	**Sig.**
Non-Financial Performance	0.261	48	0.00	0.696	48	0.00
Maintenance Management Strategies	0.257	48	0.00	0.882	48	0.00
Quality Control Practices	0.294	48	0.00	0.842	48	0.00
a Lilliefors Significance Correction						

Qualitative data from interviews was cleaned, coded and analyzed using thematic, content and narrative analysis. Thematic analysis was used to identify recurring patterns and themes related to maintenance management practices, particularly preventive maintenance scheduling, downtime frequency, and maintenance response time. This analysis revealed how planned maintenance routines, responsiveness to equipment failures, and frequency of plant outages influence employees' work morale, perceptions of operations reliability, and confidence in service delivery. Similar thematic patterns were identified under quality control practices, including process monitoring and evaluation, adherence to standard operating procedures (SOPs), and defect rates in system output, highlighting their role in ensuring consistent power generation and service reliability. Content analysis was applied to systematically categorize and interpret key operations issues raised by respondents. This included quantifying the frequency of references to operations inefficiencies such as delayed maintenance response, procedural non-compliance, and communication breakdowns. The analysis enabled the study to link specific operations management practices to observable non-financial performance outcomes, particularly employee dissatisfaction, customer complaints related to power interruptions, and perceived inconsistencies in service quality. Narrative analysis further enriched the findings by examining personal accounts and lived experiences of staff, especially maintenance and operations personnel. Overall, the integration of thematic, content, and narrative analysis provided a comprehensive understanding of how operations management practices affect non-financial performance at Mubuku III Hydropower Plant.

Research Findings

Response Rate

Study results show that from the questionnaires a response rate of 100% was attained while for interviews saturation level was attained at the 5th respondent.

Background Characteristics of the Respondents

This section presents the demographic information of the respondents for the study. *Table 4* below shows details in terms of age, gender, education distribution, work experience and professional roles.

Table 4: Showing The Demographics of the Study Respondents

Item		Frequency	Percentage %
Age Group	18 – 24	2	4.2%
	25 – 34	9	18.8%
	35 – 44	20	41.7%
	45 – 54	13	27.1%
	55 and above	4	8.3%
Gender	Male	31	64.6%
	Female	17	35.4%
Highest Level of Education	Certificate	1	2.1%
Competed	Diploma	7	14.6%
	Bachelor's Degree	28	58.3%
	Master's Degree or above	12	25.0%
Years of Experience	Less than 1 year	3	6.3%
	1 - 3 years	8	16.7%
	4 - 6 years	25	52.1%
	More than 6 years	12	25.0%
Department/Role	Maintenance	24	50%
	Operations	14	29%
	Quality Control	10	21%

The study results (*table 4*) show that most respondents (41.7%) were within the age bracket of 35–44 years, followed by those aged 45–54 years (27.1%). Smaller proportions were aged 25–34 years (18.8%), 55 years and above (8.3%), and 18–24 years (4.2%). This means that the majority of respondents were mature and in their productive working years, with sufficient exposure to operations processes within the hydropower plant. Such age distribution implies that respondents were knowledgeable and capable of providing informed opinions on maintenance management practices, quality control practices and their influence on non-financial performance.

The gender distribution results show that the majority of respondents (64.6%) were male, while females constituted 35.4%. This means that the study sample was dominated by male participants, which is consistent with the technical nature of hydropower plant operations where engineering, maintenance, and operations roles are largely male-dominated. The inclusion of female respondents, however, ensured reasonable gender balance, thereby minimizing gender bias and enhancing the credibility and representativeness of the study findings.

Results also show that most respondents (58.3%) had attained a bachelor's degree, while 25.0% possessed a Master's degree or higher. Only a small number held Diplomas (14.6%) and Certificates (2.1%). This means that the respondents were generally well educated and had the technical competence required to understand operations management practices, standard operating procedures, and general plant performance indicators. This level of education enhances the quality, accuracy, and reliability of the data collected.

In terms of work experience, results show that the majority of respondents (52.1%) had between 4–6 years of work experience, while 25.0% had more than six years of experience. Fewer respondents had 1–3 years (16.7%) or less than one year (6.3%) of experience. This means that most respondents had sufficient practical experience within the organization to assess maintenance schedules, downtime frequency, response times and quality control practices, making their responses reliable and relevant to the objectives of the study.

In terms of departments where they belonged, results show that half of the respondents were from the maintenance department (50%), followed by operations staff (29%) and quality control staff (21%). This means that the study captured views from departments directly responsible for implementing operations management practices at Mubuku III Hydropower Plant. Their involvement ensured that the data reflected actual operations realities, thereby strengthening the validity of conclusions regarding the relationship between operations management practices and non-financial performance.

Descriptive Results

This section presents descriptive statistics for the key study variables, namely non-financial performance, operations management practices and quality control practices. Descriptive analysis was conducted using frequencies, percentages, means, and standard deviations to summarize respondents' perceptions based on a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5). The purpose of this section is to provide an overview of the prevailing conditions at Mubuku III Hydropower Plant before testing empirical relationships among the variables.

Descriptive Statistics on Non-Financial Performance (Dependent Variable)

Researchers sought the opinion of the respondents on Non-Financial Performance of Mubuku III Hydro Power Plant and the descriptive statistics showing the respondents' opinions are shown in *Table 5* below.

Table 5: Showing Descriptive Statistics on Non-Financial Performance

Perception Indicators	Mean	Standard Deviation	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Employees at Mubuku III are motivated and satisfied with their working environment.	2.35	1.176	12 25%	19 39.60%	8 16.70%	6 12.50%	3 6.30%
Training and support provided at Mubuku III help employees perform effectively.	2.15	1.321	21 43.80%	12 25%	5 10.42%	5 10.42%	4 8.33%
Customers are satisfied with the reliability of electricity supplied by Mubuku III.	2.35	1.176	12 25%	19 39.60%	8 16.70%	6 12.50%	3 6.30%
Mubuku III responds promptly to customer complaints and concerns.	2.46	1.254	12 25%	17 35.40%	8 16.70%	7 14.60%	4 8.30%
The plant provides reliable and uninterrupted electricity services.	2.46	1.254	12 25%	17 35.40%	8 16.70%	7 14.60%	4 8.30%
Operations at Mubuku III consistently adhere to safety and quality standards.	2.33	1.117	10 20.80%	23 47.90%	7 14.60%	5 10.40%	3 6.30%
Equipment at Mubuku III is well-maintained and dependable.	2.56	1.253	9 18.80%	20 41.70%	7 14.60%	7 14.60%	5 10.40%
The plant addresses faults and technical issues in a timely manner.	2.56	1.236	8 16.70%	22 45.80%	6 12.50%	7 14.60%	5 10.40%
Mubuku III complies with environmental regulations set by authorities.	2.33	1.117	10 20.80%	23 47.90%	7 14.60%	5 10.40%	3 6.30%
The plant actively minimizes negative impacts on the environment.	3.65	1.229	4 8.30%	5 10.40%	8 16.70%	18 37.50%	13 27.10%
Mubuku III engages stakeholders (community, regulators) in its operations.	2.06	1.227	22 45.80%	11 22.90%	7 14.60%	6 12.50%	2 4.20%
The local community and regulators trust Mubuku III to operate responsibly.	2.35	1.12	10 20.80%	22 45.80%	8 16.70%	5 10.40%	3 6.30%

Source Primary Data, 2025

Results (*Table 5)* indicate mixed perceptions regarding employee motivation and satisfaction with the working environment at Mubuku III Hydropower Plant. Accordingly, employees are neither motivated nor satisfied with their working environment (Mean 2.35). It was also reported that no sufficient training and support (mean 2.15) is provided to employees. The mean score of 2.35 indicates a general perception that customers are dissatisfied with service reliability, while also the mean score of 2.46 indicate the plant's sluggishness in responding to customer complaints. Furthermore, respondents revealed that the plant electricity services are not reliable, partly because they do not adhere to safety and quality standards (mean 2.33), equipment are not well-maintained (mean 2.56), do not address faults and technical issues in time (mean 2.56) and do not comply with environmental regulations (mean 2.33). Even when the plant tries to minimize negative impacts on the environment (mean 3.65), it does not sufficiently engage stakeholders (community, regulators) in its operations (mean 2.06) the reason why they don't trust it (mean 2.35).

Maintenance Management Practices and Non-Financial Performance of Mubuku III Hydro Power Plant

Table 6: Showing Descriptive Statistics of Maintenance Management Practices

Perception Indicators	Mean	Standard Deviation	SD	D	N	A	SA
Our plant follows a well-structured preventive maintenance schedule that minimizes unexpected equipment failures.	3.88	1.248	3 6.3%	5 10.4%	7 14.6%	13 27.1%	20 41.7%
The preventive maintenance schedule contributes to improved employee confidence in operations reliability.	4.04	1.202	2 4.2%	5 10.4%	6 12.5%	11 22.9%	24 50.0%
Equipment downtimes occur frequently due to inadequate maintenance planning.	2.79	1.383	9 18.8%	17 35.4%	4 8.3%	11 22.9%	7 14.6%
Frequent downtimes negatively affect workforce morale and disrupt service delivery.	3.75	1.082	2 4.2%	5 10.4%	8 16.7%	21 43.8%	12 25.0%
Maintenance teams respond quickly to system failures, ensuring minimal disruption.	3.85	0.967	1 2.1%	4 8.3%	8 16.7%	23 47.9%	12 25.0%
Delays in maintenance response time leads to dissatisfaction among internal staff and external stakeholders.	3.96	1.237	3 6.3%	4 8.3%	7 14.6%	12 25.0%	22 45.8%
Critical components like control panels and transformers are always available when needed.	2.77	1.292	7 14.6%	20 41.7%	3 6.3%	13 27.1%	5 10.4%
Inadequate availability of critical equipment reduces staff efficiency and public trust in plant operations.	3.85	1.321	4 8.3%	5 10.4%	6 12.5%	12 25.0%	21 43.8%
Spare parts are readily available, enabling timely maintenance interventions.	2.71	1.352	9 18.8%	19 39.6%	3 6.3%	11 22.9%	6 12.5%
Delays in spare parts procurement have led to reduced customer or community confidence in the plant.	3.77	1.341	4 8.3%	6 12.5%	7 14.6%	11 22.9%	20 41.7%
Our maintenance staff are adequately trained to handle both routine and advanced diagnostic tasks.	3.63	1.142	3 6.3%	6 12.5%	7 14.6%	22 45.8%	10 20.8%

Results in *table 6* indicate generally positive perceptions regarding the existence and effectiveness of preventive maintenance practices at Mubuku III Hydropower Plant. It follows a well-structured preventive maintenance schedule that minimizes unexpected equipment failures (mean 3.88) and this has always led to improved employee confidence (mean 4.04). However, the study reports failures in maintenance planning leading to equipment downtimes (mean 2.79) which often lead to reduced workforce morale and disrupted service delivery (mean 3.75). The study discovered that maintenance teams respond quickly to system failures (mean 3.85) since the internal team is aware that inadequate availability of critical equipment reduces staff efficiency and public trust in plant operations (mean 3.85), and the training of maintenance staff to handle both routine and advanced diagnostic tasks has always helped (mean 3.63). Unfortunately, however critical components like control panels and transformers are not always available when needed (mean 2.77), just like spare parts that are also not readily available for timely maintenance interventions (mean 2.71).

Descriptive Statistics on quality control practices and non-financial performance of Mubuku III Hydropower Plant

Table 7: Showing descriptive Statistics on Quality Control Practices and Non-Financial Performance

Perception Indicators	Mean	Standard Deviation	SD	D	N	A	SA
Our plant regularly monitors operations processes to detect early signs of system stress or inefficiencies.	3.58	1.182	4 8.3%	5 10.4%	8 16.7%	21 43.8%	10 20.8%
Real-time monitoring systems have helped reduce faults and improve stakeholder confidence.	3.52	1.271	5 10.4%	6 12.5%	7 14.6%	19 39.6%	11 22.9%
Standard Operating Procedures (SOPs) are consistently applied during operations and maintenance tasks.	2.21	1.051	13 27.1%	20 41.7%	8 16.7%	6 12.5%	1 2.1%
Employees have confidence in the effectiveness and clarity of the SOPs used in our plant.	3.69	1.223	4 8.3%	5 10.4%	6 12.5%	20 41.7%	13 27.1%
The plant experiences low defect rates in system output (e.g., voltage fluctuations, turbine noise).	2.69	1.323	8 16.7%	21 43.8%	3 6.3%	10 20.8%	6 12.5%
High defect rates, when they occur, are promptly addressed and communicated to relevant teams or stakeholders.	2.4	1.198	11 22.9%	20 41.7%	8 16.7%	5 10.4%	4 8.3%
Regular internal audits and quality checks help prevent serious system failures or operations non-compliance.	3.92	1.235	2 4.2%	6 12.5%	8 16.7%	10 20.8%	22 45.8%
Audit findings lead to timely corrective actions and improvements.	3.63	1.16	3 6.3%	6 12.5%	8 16.7%	20 41.7%	11 22.9%
Staff at our plant receive regular training on quality assurance standards and practices.	3.65	1.376	5 10.4%	6 12.5%	8 16.7%	11 22.9%	18 37.5%
Quality assurance training has enhanced employee confidence and reduced operations errors.	3.6	1.198	3 6.3%	7 14.6%	8 16.7%	18 37.5%	12 25.0%
There is a functional system for receiving and responding to customer complaints or concerns.	3.71	1.398	5 10.4%	6 12.5%	7 14.6%	10 20.8%	20 41.7%

Findings in *table 7* relating to the regular monitoring of operations processes indicate generally positive perceptions among respondents. The plant regularly monitors operations processes to detect early signs of system stress or inefficiencies (mean 3.58) and also has real-time monitoring systems to help reduce faults and improve stakeholder confidence (mean 3.52). Besides this the plant does regular internal audits and quality checks (mean 3.92), does regular training on quality assurance standards (mean 3.65) and has functional system for receiving and responding to customer complaints or concerns (mean 3.71), all this improve employees' confidence in the effectiveness and clarity of the SOPs used in the plant (mean 3.69). However, the existent standard operating procedures are not consistently applied during operations and maintenance tasks (mean 2.21) and also high defect rates which are not always promptly addressed nor communicated to relevant teams or stakeholders (mean 2.4).

Pearson's Correlation results

Pearson's Correlation Analysis Between Maintenance Management Practices and Non-Financial Performance of Mubuku III Plant

To test the hypothesis that maintenance management practices are related to non-financial performance of Mubuku III Hydropower plant, Pearson's Correlation Coefficient was determined and the results are shown in *table 8* below.

Table 8: Showing Pearson Correlation between Maintenance Management Practices and Non-Financial Performance

Correlations		**Maintenance Management Practices**	**Non-Financial Performance**
Maintenance Management Practices	Pearson Correlation	1	.234
	Sig. (2-tailed)		.110
	N	48	48
Non-Financial Performance	Pearson Correlation	.234	1
	Sig. (2-tailed)	.110	
	N	48	48

Table 8 above presents the results of the Pearson correlation analysis examining the relationship between maintenance management practices and non-financial performance at Mubuku III Hydropower Plant. Maintenance management practices in this study were measured by preventive maintenance scheduling, downtime frequency, and maintenance response time, while non-financial performance was measured in terms of employee satisfaction, customer satisfaction, and service quality. The results indicate a positive but weak statistically insignificant relationship between maintenance management practices and non-financial performance ($r = 0.234$, $p = 0.110$). This suggests that although improvements in maintenance management practices may be associated with better non-financial performance outcomes, the relationship is not strong enough to be considered statistically meaningful within the study sample. The research hypothesis that maintenance management practices have a significant effect on the non-financial performance of Mubuku III Hydro Power Plant was rejected. The lack of statistical significance implies that maintenance management practices alone do not have a direct or consistent influence on employee satisfaction, customer satisfaction, or service quality at the plant. This finding suggests that the effectiveness of maintenance management practices may depend on the presence of other enabling factors.

Journal of Strategic Management
ISSN 2520 - 0461 (Online)
Vol. 11, Issue 1, pp 29-58, 2026

Pearsons Correlation Between Quality Control Practices and Non-Financial Performance

To test the hypothesis that there is relationship between quality control practices and non-financial performance of Mubuku III Hydropower plant, Pearson Correlation Coefficient was determined and the results are shown in *table 9* below.

Table 9: Correlation Between Quality Control Practices and Non-Financial Performance

Correlations		Quality Control Practices	Non-Financial Performance
Quality Control Practices	Pearson Correlation	1	.342*
	Sig. (2-tailed)		.017
	N	48	48
Non-Financial Performance	Pearson Correlation	.342*	1
	Sig. (2-tailed)	.017	
	N	48	48

*. Correlation is significant at the 0.05 level (2-tailed).

Table 9 above presents the results of the Pearson correlation analysis conducted to examine the relationship between quality control practices and non-financial performance at Mubuku III Hydropower Plant. Quality control practices in this study were measured by process monitoring and evaluation, adherence to standard operating procedures (SOPs), and control of defect rates in system output, while non-financial performance was measured through employee satisfaction, customer satisfaction, and service quality. The findings indicate a positive and statistically significant correlation between quality control practices and non-financial performance ($r = 0.342$, $p = 0.017$). This implies that improvements in quality control practices are associated with corresponding improvements in non-financial performance outcomes. Specifically, effective process monitoring, consistent application of SOPs, and reduced defect rates tend to enhance service reliability, strengthen customer satisfaction, and improve employee confidence in operations processes. The research hypothesis that quality-control practices have a significant effect on the non-financial performance of Mubuku III Hydro Power Plant was accepted. Although the strength of the relationship is moderate, the statistical significance at the 0.05 level suggests that the association is not due to chance. This indicates that quality control practices play a meaningful role in shaping non-financial performance, even though they may not be the sole determinants of outcomes such as employee morale and service quality.

Discussion of Results

Relationship Between Maintenance Management Practices and Non-Financial Performance

The study found that there is a positive but weak relationship between maintenance management practices and non-financial performance at Mubuku III Hydropower Plant ($r = 0.234$, $p > 0.05$). However, the relationship was not statistically significant, suggesting that maintenance management practices alone do not strongly or consistently determine employee satisfaction, customer satisfaction, or service quality without the influence of other factors. A review of some of the in-depth interview extracts reveal the same, for example;

*"[...] .... "Preventive maintenance has become a critical part of how the plant operates. Scheduled inspections and servicing help us identify potential faults early, which reduces sudden equipment failures that could otherwise disrupt power generation and affect staff confidence."[....] (*KII 1*)*

"[....]....*Even though all maintenance activities are not carried out exactly on time, having a structured schedule gives the team a clear guide on what needs to be done and when. This alone has significantly reduced emergency breakdowns compared to the past." [...]* (KII 4)

These quantitative and qualitative findings agree with Vysokikh, 2026 and Mahmood Ali et al., (2025) who emphasized that structured preventive maintenance schedules enhance asset reliability and reduce unplanned outages in hydropower systems. Lozano & Taboada, (2021) observed that effective maintenance strategies improve system availability and operations safety, reinforcing the current study's finding that preventive maintenance is a key strength within the plant's maintenance management framework. This implies that preventive maintenance functions act as a critical internal capability, consistent with the resource-based theory, where embedded maintenance routines represent valuable organizational resources that support non-financial performance through reliable service delivery.

Relationship Between Quality Control Practices and Non-Financial Performance

The study revealed a positive and statistically significant relationship between quality control practices and non-financial performance at Mubuku III Hydropower Plant ($r = 0.342$, $p < 0.05$). This indicates that effective quality control practices particularly process monitoring, adherence to SOPs, and defect control are meaningfully associated with improved employee satisfaction, customer satisfaction, and service quality. A close scrutiny on interview extracts as shown below shows more details:

[....] ...."Real-time monitoring systems allow operators to see what is happening across the plant instantly. When anomalies occur, alerts are triggered, enabling immediate response, which has significantly reduced the frequency and severity of faults."[....] (KII 5)

[....]...."When faults are reduced and outages are minimized, customers and regulators gain confidence in the plant's ability to manage operations effectively. Real-time data gives management evidence to communicate performance improvements transparently."[.....] (KII 1)

These findings align with Inisha and Elly, (2022), who emphasize that continuous process monitoring enables early fault detection and promotes proactive decision-making. Similarly, Nardini et al., (2024) demonstrated that real-time monitoring systems enhance process responsiveness and reduce downtime in hydropower facilities. This implies that process monitoring functions act as a strategic operations capability (Sati et al.,2020), consistent with the resource-based theory, where embedded monitoring capabilities represent valuable internal resources that enhance service reliability and non-financial performance.

Theoretical implications

The study contributes empirically by extending operations management research into the underexplored context of hydro power plants. Much of the existing literature on maintenance management practices and quality control practices is concentrated in manufacturing, hospitality, and commercial service sectors. By focusing on Mubuku III Hydropower Plant, this study addresses a significant contextual gap and provides empirical evidence from a technically intensive and highly regulated infrastructure setting. The findings demonstrate that operations management practices do not function uniformly across sectors, thereby enriching sector-specific understanding of how non-financial performance is shaped in energy generation environments.

The study contributes theoretically by advancing the application of the resource-based theory in explaining non-financial performance outcomes. While the theory has traditionally emphasized tangible assets and financial performance, this study conceptualizes maintenance management practices and quality control practices as strategic internal resources that influence employee satisfaction, customer satisfaction, and service quality. The findings show that not all internal resources exert direct effects; rather, their effectiveness depends on organizational conditions.

The study contributes to policy and practice-oriented knowledge by generating context-specific insights that can inform operations management in public and semi-public infrastructure organizations. The findings provide evidence that strengthening internal conditions like maintenance and quality control is not merely a human resource concern but a strategic operation imperative. This contributes to a growing body of applied knowledge that bridges theory and practice, particularly in developing country contexts where technical systems and human dynamics must be jointly managed to achieve sustainable non-financial performance outcomes.

Conclusion

On the basis of the study objectives, the study makes the following conclusions.

That maintenance management practices at Mubuku III Hydropower Plant, when implemented in isolation, do not exert a statistically significant direct influence on non-financial performance outcomes such as employee satisfaction, customer satisfaction, and service quality. While routine maintenance activities are present, their effectiveness is constrained by limited employee involvement, centralized decision-making, and weak feedback mechanisms. These conditions reduce employees' sense of ownership and restrict the translation of technical maintenance efforts into improved service-related outcomes. The study therefore concludes that maintenance management practices alone are insufficient to drive non-financial performance unless they are supported by other enabling factors.

Lastly, the study concludes that quality control practices have strong and direct positive influence on non-financial performance at Mubuku III Hydropower Plant. Adherence to standard operating procedures, process monitoring, and consistency in quality assurance were found to significantly enhance employee satisfaction, customer satisfaction, and service quality. The findings suggest that quality control practices must be deeply institutionalized within the plant's operations framework, enabling them to deliver consistent outcomes even in the presence of limited employee participation in decision-making. Employees perceive clear procedures and defined quality standards as reducing ambiguity, improving coordination, and supporting operations stability. Consequently, the study concludes that quality control practices constitute a critical operations capability that directly enhances non-financial performance through procedural discipline, standardization, and process reliability. This affirms the central role of quality control as a foundational driver of service excellence and stakeholder confidence at Mubuku III Hydropower Plant.

Limitations and Areas for Further Research

Limitations of the Study

Firstly, the study was conducted exclusively at Mubuku III Hydropower Plant, which limits the generalizability of the findings to other hydro power plants or infrastructure organizations. Operations management practices, quality control practices and stakeholder dynamics may differ across plants due to variations in size, technology, management structures, and local socio-economic conditions. Therefore, caution should be exercised when extrapolating these findings to other settings.

Secondly, the study relied solely on interviews and questionnaires to collect data. While these instruments provided valuable insights into employee perceptions and experiences, they are inherently subjective and prone to response bias. Participants may have provided socially desirable answers, underreported challenges, or emphasized positive aspects due to fear of negative repercussions, particularly in areas concerning study variables. The absence of observational or secondary data sources, such as maintenance logs, performance records, or system monitoring data, limited the ability to validate participant responses and triangulate findings comprehensively.

Thirdly, the study employed a cross-sectional design, capturing data at a single point in time. This limits the ability to establish causal relationships or examine changes in maintenance management practices, quality control practices and non-financial performance over time. All these concepts evolve and their long-term effects on employee satisfaction, customer satisfaction, and service quality may differ from the snapshot captured in this study.

Last but not least, the study focused on selected dimensions of operations management practices (maintenance management and quality control) potentially overlooking other relevant factors. External influences such as regulatory changes, technological innovations, environmental conditions, and stakeholder pressures were not deeply analyzed, yet they could affect non-financial performance outcomes.

Areas for Further Research

Future research should examine maintenance management practices and non-financial performance across multiple hydro power plants in Uganda and other developing countries. This would allow for comparative analysis and help identify operational, infrastructural, and administrative factors that either enhance or constrain effective maintenance management and its influence on employee satisfaction, service quality, and customer trust. A multi-site approach could also provide insights into best practices that are scalable across different operational contexts.

Future research could explore the effectiveness of advanced monitoring and predictive maintenance technologies such as real-time sensors, automated diagnostic systems, and data analytics in improving operations reliability and reducing downtime. Investigating these technologies in different hydro power plants would reveal how technological interventions interact with existing maintenance schedules, staff capacity to influence non-financial performance outcomes.

Future research could also examine the integration of external factors such as regulatory compliance, community expectations, and environmental challenges in operations management performance assessments. Understanding how these external pressures influence maintenance and quality control practices and their ultimate effect on employee satisfaction, customer confidence, and service reliability would provide a more holistic understanding of non-financial performance in the hydro power sector.

REFERENCES

Abdulkadir, K., (2023). Total Quality as an Effective Tool for Achieving Customer Satisfaction, Patronage, Productivity Gains and Sustainability in Organizations. *Studies in Economics and Business Relations*, 4(2):37-53; DOI: 10.48185/sebr.v4i2.893

Ahmed, A., Pereira, L., Jane, K., (2024). Mixed Methods Research: Combining both qualitative and quantitative approaches. Accessed online on 18/05/2026, https://www.researchgate.net/publication/384402328_Mixed_Methods_Research_Combining_both_qualitative_and_quantitative_approaches

Ali, A., and Abdelhadi, A., (2022). Condition-Based Monitoring and Maintenance: State of the Art Review, *Appl. Sci.,* 12(2), 688; https://doi.org/10.3390/app12020688

Amasi, A., Wynants, M., Blake, W., & Mtei, K. (2021). Drivers, impacts and mitigation of increased sedimentation in the hydropower reservoirs of east Africa. *Land,* 10(6), 638.

Barney, J. B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27(6), 643–650.

Bissiri, M., da Silva, P. P., Moura, P., & Figueiredo, N. C. (2024). Are West Africa's policy, planning, and regulatory frameworks missing the harmonization piece of the power pooling-renewable energy puzzle? *Energy Policy*, 190, 114161.

Bradford, M. J. (2022). Assessment and management of effects of large hydropower projects on aquatic ecosystems in British Columbia, Canada. *Hydrobiologia*, 849(2), 443–459.

Bwanika, M. B. (2023). Dam breach modelling and flood inundation mapping of an earth embankment dam using HECRAS.

Casati, P., Moner-Girona, M., Khaleel, S.I., Szabo, S., Nhamo, G., (2023). Clean energy access as an enabler for social development: A multidimensional analysis for Sub-Saharan Africa. *Energy for sustainable development,* Volume 72, 114-126, https://www.sciencedirect.com/science/article/pii/S0973082622002344

Castro-Diaz, L., Lopez, M. C., Moore, S., Radonic, L., Hodbod, J., & Moran, E. (2024). Multidimensional and multitemporal energy injustices: Exploring the downstream impacts of the Belo Monte hydropower dam in the Amazon. *Energy Research & Social Science*, 113, 103568.

Chen, Y. (2018). Comparing North-South technology transfer and South-South technology transfer: The technology transfers impact of Ethiopian Wind Farms. *Energy Policy*, 116, 1–9.

Cokki, C., (2021). Effect of Work Overload on Job Satisfaction Through Burnout. *Jurnal Manajemen*, 25 (1):56; DOI: 10.24912/jm.v25i1.703

Cvetković, V. M., Nikolić, N., & Lukić, T. (2024). Exploring Students' and Teachers' Insights on School-Based Disaster Risk Reduction and Safety: A Case Study of Western Morava Basin, Serbia. *Safety*, 10(2), 50

D'Oria, L., Crook, T. R., Ketchen, D. J., Sirmon, D. G., & Wright, M. (2021). The Evolution of Resource-Based Inquiry: A Review and Meta-Analytic Integration of the Strategic Resources–Actions–Performance Pathway. *Journal of Management*, 47(6), 1383-1429.

De Souza, F., Borges, F., Wyse, M., Mognhol, T., & Melhado, S. (2020). Infrastructure Projects and Project Management in Brazil: Challenges and Trends in Building a Body of Knowledge in Project Management in Developing Countries; *World scientific*, Vol. Volume 3 (pp. 659–701). https://doi.org/doi:10.1142/9789811224720_0020

DeCotis, P.A., (2025). Energy's Role in National Security. *Climate and Energy*, 41(11):21-26; DOI: 10.1002/gas.22465

Deshpande, Y. D., & Batra, S. (2024). Smart Sensor Networks for AI-Enabled Condition Monitoring in Electrical Systems. *Research Journal of Computer Systems and Engineering*, 5(1), 23–33.

Dube, K., & Nhamo, G. (2023). Evaluating climate Change's impact on hydroelectricity in the Zambezi River basin. *Heliyon*, 9(12).

Elfil, M., & Negida, A., (2017). Sampling methods in Clinical Research; an Educational Review. Emerg (Tehran), 5(1), accessed online on 18/05/2026; https://pmc.ncbi.nlm.nih.gov/articles/PMC5325924/

ERA. (2022). Annual report fy 2021-22.

ERA. (2023). Annual report fy 2020-21.

ERA. (2024). Annual report fy 2020-21.

Fakih, A., Ghazalian,P.L., Ghazzawi, N., (2020). The Effects of Power Outages on the Performance of Manufacturing Firms in the MENA Region. *Review of Middle East Economics and Finance*, 16(3); DOI: 10.1515/rmeef-2020-0011

Fallahi, F., Yildirim, M., Zhao, S., & Qiu, F. (2025). A Sensor-Driven Optimization Framework for Asset Management in Energy Systems: Implications for Full and Partial Digital Transformation in Hydro Fleets. http://arxiv.org/abs/2504.15483

Fritz, W. (2018). Analysis of the effect of renewable generation on the power quality of the grid, modelling and analysis of harmonics.

Gerschewski, S., & Xiao, S., (2014). Beyond financial indicators: An assessment of the measurement of performance for international new ventures. *International Business Review*, 24 (4); DOI: 10.1016/j.ibusrev.2014.11.003

Gossal, A. (2025). Pluralism in Practice: Stakeholder Engagement in Southeast Asian Environmental Governance. https://www.diva-portal.org/smash/record.jsf?pid=diva2:1983958

Hewett, C. J. M., Wilkinson, M. E., Jonczyk, J., & Quinn, P. F. (2020). Catchment systems engineering: A holistic approach to catchment management. *Wiley Interdisciplinary Reviews*: Water, 7(3), e1417.

https://www.researchgate.net/publication/308118049_balanced_scorecard_weaknesses_strengths_and_its_ability_as_performance_management_system_versus_other_performance_management_systems

Imo, E., & Aminu, M. (2019). Maintenance management in hydropower project: Safety aspects in Shiroro dam project in focus. In Sustainable and Safe Dams Around the World/Un monde de barrages durables et sécuritaires (pp. 1712–1720). CRC Press.

Inisha, L., Elly, B., (2022). Establishing Robust Monitoring and Evaluation (M&E) Systems. Accessed online on 18/5/2026; https://www.researchgate.net/publication/385561328_Establishing_Robust_Monitoring_and_Evaluation_ME_Systems

Ishaku, H. P., Adun, H., Jazayeri, M., & Kusaf, M. (2022). Decarbonisation strategy for renewable energy integration for electrification of West African nations: a bottom-up EnergyPLAN modelling of West African power pool targets. *Sustainability*, 14 (23), 15933.

its ability as performance management system versus other performance management systems.

Iwarue, J., (2025). Impact of Preventive Maintenance Practices on Productivity. *British Journal of Management and Marketing Studies*, 8(1):118-137; DOI: 10.52589/BJMMS-QRMKXG9R

Jick, T.D., (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative Science Quarterly*, Vol. 24, No. 4, pp. 602-611

Journal of Environment and Earth Science, Vol 2, No.9, accessed online on 18/5/2026;

Kasese District Development Report. (2023). Crosscutting Performance Measures No. Summary of requirements Definition of compliance Justification Score Local Government Service Delivery Results 1 Service Delivery Outcomes of DDEG investments.

Khan, M.I., Kanwal Khan, K.I., Sheeraz, M., & Mahmood, S., (2017). Impact of Quality Management Practices on the Performance of Manufacturing Sectors. Special Issue: Abasyn *Journal of Social Sciences*; accessed online on 18/5/2026, https://www.researchgate.net/publication/330912377_Impact_of_Quality_Management_Practices_on_the_Performance_of_Manufacturing_Sectors

Khan, N., Shehzad, F., Fahad, S., Faisal, S., Naushad, M., Akbar, A., (2020). Review of Electricity Impact on Economic Growth of the world. *SSRN Electronic Journal*; DOI: 10.2139/ssrn.3682240

Krejcie, R.V. & Morgan, D. W. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, 30, 607-610.

Kuphanga, D., (2024). Questionnaires in Research: Their Role, Advantages, and Main Aspects. DOI: 10.13140/RG.2.2.15334.64325

Li, Z., Guo, J., Zhou, R., (2016). Maintenance Scheduling Optimization based on Reliability and Prognostics Information. *Conference: 2016 Annual Reliability and Maintainability Symposium (RAMS)*, DOI: 10.1109/RAMS.2016.7448069

Lopes, D., Preto, I., & Freire, D. (2024). Exploring Optimal Strategies for Small Hydro Power Forecasting: Training Periods and Methodological Variations. *Engineering Proceedings*, 68(1), 27.

Lozano, L., and Taboada, E.B., (2021). The Power of Electricity: How Effective Is It in PromotingSustainable Development in Rural Off-Grid Islands in the Philippines?. *Energies*, 14 (9):2705; DOI: 10.3390/en14092705

Lumbroso, D. M., Woolhouse, G., & Jones, L. (2015). A review of the consideration of climate change in the planning of hydropower schemes in sub-Saharan Africa. *Climatic Change*, 133, 621–633.

Mahmood Ali, B., Al-Musawi, T.J., Mohammed, A., Fakhruldeen, H.F., Munshid Hanoon, T., Khurramov, A., Khalaf, D.H., Algburi, S., (2025). Sustainable strategies for preventive maintenance and replacement in photovoltaic power systems: Enhancing reliability, efficiency, and system economy. *Unconventional Resources*, Volume 6, https://doi.org/10.1016/j.uncres.2025.100170

Mallawaarachchi, V. T., Senanayake, S., Disaratna, V., & Perera, B. (2024). Application of subcontracting as a quality improvement tool for building constructions in Sri Lanka. *International Journal of Construction Management,* 24(1), 44–56.

Maqbool, R., Deng, X., & Ashfaq, S. (2020). Success of renewable energy projects under the financial and non-financial performance measures. *Sustainable Development*, 28(5), 1366–1375.

Mayoyo, A., Chapoto, A., Matchaya, G., Aheeyar, M., Chiwunze, G., Ebrahim, G., Ajayi, O. C., Afun-Ogidan, O., Fakudze, B., & Kasoma-Pele, W. (2023). Digital climate adaptation in agriculture profile for Zimbabwe. Colombo, Rotterdam, and Abidjan: *International Water Management Institute*, Global Centre on Adaptation, and the African Development Bank.

Minja, E. A. (2024). Imagining Hydropower: Transnational Narratives and Realities of the Stiegler's Gorge Project in Tanzania, 1960s–1980s. Zamani: *A Journal of African Historical Studies*, 1(1), 52–82

Mortey, E. M., Kouassi, K. L., Diedhiou, A., Anquetin, S., Genoud, M., Hingray, B., & Kouame, D. G. M. (2019). Sustainable hydroelectric dam management in the context of climate change: Case of the Taabo Dam in Côte D'Ivoire, West Africa. *Sustainability*, 11(18), 4846.

Mudenda, F. (2022). Criteria development for the data selection process to compile the Zambian hydropower atlas.

Mudenda, F., Van Dijk, M., & Bekker, A. (2022). Development of evaluation framework for the selection of run-of-river hydropower potential sites to be included in the Zambian Hydropower Atlas. *Journal of Water and Climate Change*, 13(11), 4000–4018.

Mujeeb, A., Oladigbolu, J., Shola Bakare, M., Atima Ibrahim, A., (2025). Pathways to environmental sustainability through energy efficiency: A strategic next energy vision for sustainable development by 2050. *Scientific African*, Volume 30, https://doi.org/10.1016/j.sciaf.2025.e03053

Mujjuni, F., Betts, T., & Blanchard, R. (2023). Uganda's hydropower system resilience to extreme climate variability. *Climate*, 11(9), 177.

Nardini, A. G. C., Escobar Villanueva, J. R., & Pérez-Montiel, J. I. (2024). Hydrological Monitoring System of the Navío-Quebrado Coastal Lagoon (Colombia): A Very Low-

Cost, High-Value, Replicable, Semi-Participatory Solution with Preliminary Results. *Water*, 16(16), 2248.

NEMA. (2024). National state of the environment report 2024 national environment management authority. www.nema.go.ug

Nhamo, G., Dube, K., & Chikodzi, D. (2021). A reflection of hydrological and other emerging perspectives of Lake Kariba's operation noah. The Increasing Risk of Floods and Tornadoes in Southern Africa, 63–79.

Norgaard, S. P. (2021). Modernization through capitalization: The hidden costs of Ethiopia's Gibe III Dam and NESTown initiative. *Human Geography*, 14(3), 381–395.

Nzioka, (2020). Adoption level of a proactive safety program within the construction phase of olkaria's geothermal power stations of nakuru county, kenya luka musembi nzioka.

Odilova, S., Sharipova, Z., & Azam, S. (2023). Investing in the future: a systematic literature review on renewable energy and its impact on financial returns. *International Journal of Energy Economics and Policy*, 13(4), 329–337.

Olatunde, T.M., Okwandu, A.C., and Akande,D.O., (2024). Reviewing the impact of energy-efficient appliances on household consumption. *International Journal of Science and Technology Research Archive*, 06(02), 001–011

Parikh, J., Sharma, A., Singh, C., Gupta, M.K., Vaish, S., (2021). Impact of Quality of Electricity Access on Health and Education Delivery –JHARKHAND. *Integrated Research and Action for Development (IRADe)*; Accessed online on 15/5/2026 from https://www.researchgate.net/publication/365233941_Impact_of_Quality_of_Electricity_Access_on_Health_and_Education_Delivery_-JHARKHAND#fullTextFileContent

Raji, T., Allee, A., Williams, N., (2024). Productive use of electricity in agriculture in sub-Saharan Africa: a systematic review. *Progress in Energy*, 6(4); DOI: 10.1088/2516-1083/ad6c9e

Rak, T., & Wrześniowski, W., (2023). Cronbach's alpha - what makes it really good? Some advice for planning and criticizing psychological questionnaires. *Przegląd Psychologiczny*, 66(4):151-167; DOI: 10.31648/przegldpsychologiczny.9467

Raucci, D., Tarquinio, L., Rupo, D., & Loprevite, S. (2020). Non-financial performance indicators: The power of measures to operationalize the law. In Sustainability and Law: General and Specific Aspects (pp. 275–291). Springer.

Sadikin, M.A., (2023). Defect Reduction in The Manufacturing Industry: Systematic Literature Review. *International Journal of Industrial Engineering and Engineering Management*, 5(2):73-83, DOI: 10.24002/ijieem.v5i2.7495

Salem, M.A., Hasnan,O., & Osman,N.H., (2012). Balanced scorecard: weaknesses, strengths, and

Sati, S. P., Sharma, S., Sundriyal, Y. P., Rawat, D., & Riyal, M. (2020). Geo-environmental consequences of obstructing the Bhagirathi River, Uttarakhand Himalaya, India. *Geomatics, Natural Hazards and Risk*, 11(1), 887–905.

Shaktawat, A., & Vadhera, S., (2021). "Risk management of hydropower projects for sustainable development: a review," Environment, Development and Sustainability: A

Multidisciplinary Approach to the Theory and Practice of Sustainable Development, *Springer*, vol. 23(1), pages 45-76; DOI: 10.1007/s10668-020-00607-2

Singh, P., Singh, S., Vardhan, S., Patnaik, A., (2020). Sustainability of maintenance management practices in hydropower plant: A conceptual framework, Materials Today: Proceedings, Volume 28, Part 3, Pages 1569-1574, https://doi.org/10.1016/j.matpr.2020.04.842.

Taherdoost, H., (2016). Validity and Reliability of the Research Instrument; How to Test the Validation of a Questionnaire/Survey in a Research. *SSRN Electronic Journal*, 5(3):28-36; DOI: 10.2139/ssrn.3205040

Tilahun, Z. A., Bizuneh, Y. K., & Mekonnen, A. G. (2023). The impacts of climate change on hydrological processes of Gilgel Gibe catchment, southwest Ethiopia. *Plos One*, 18(6), e0287314.

UBOS. (2021). Uganda bureau of statistics 2021 statistical abstract. www.ubos.org.

UMEME. (2023). Umeme-2023-Annual-Report-1.

Uwihirwe, J., Uwamwezi, B., Fashaho, A., Munyandamutsa, P., Bapfakurera, E. N., Uwamahoro, P. C., Musabwayire, C., & Nyagatare, G. (2024). Hydro-geological and meteorological behaviors of typical landslide prone hillslopes in North-western Rwanda. *Rwanda Journal of Agricultural Sciences*, 3(1), 125–141.

van de Ven, F. H. M., Zevenbergen, C., Montezuma, M. A., Ding, Z., Veerbeek, W., & Chen, S. (2024). The Three-Points Sponge Policy.

Vinci, S., Kwong, L.H., Miles, S.B., McCord, R., Cady, G., Tang, K., Ye,W., Hande, H.,, Mbacke, B.,, Adair-Rohani, H., Clasen, T., Kammen, D., (2026). Reliable electricity to advance quality health care in low-resource settings. *The Lancet Global Health*, Volume 14, Issue 4, Pages e626-e639

Virtanen, I., Pham, M. P., & Pham, T. D. (2024). Data-driven decision-making system for hydropower plant in Vietnam.

Vysokikh, D.D., (2026). Improvement of the preventive maintenance system at hydroelectric power plants through the use of diagnostic algorithms for assessing the actual technical condition of equipment. *Safety and Reliability of Power Industry*, 19(1):25-31; DOI: 10.24223/1999-5555-2026-19-1-25-31

Wabukala, B. M., Bergland, O., Mukisa, N., Adaramola, M. S., Watundu, S., Orobia, L. A., & Rudaheranwa, N. (2024). Electricity security in Uganda: Measurement and policy priorities. *Utilities Policy*, 91, 101844. https://doi.org/10.1016/J.JUP.2024.101844

Wan, J., Wang, Q., and Miao, S., (2024). The Impact of Urbanization on Industrial Transformation and Upgrading: Evidence from Early 20th Century China. *Sustainability*, *16*(11), 4720; https://doi.org/10.3390/su16114720

West, J., Siddhpura, M., Evangelista, A., and Haddad, A., (2024). Improving Equipment Maintenance—Switching from Corrective to Preventative Maintenance Strategies. *Buildings*, 14(11), 3581; https://doi.org/10.3390/buildings14113581

Zacharias, M., (2022). The Importance of Quality Control for The Success of A Company. *Asian Journal of Logistics Management*, 1(2):99-106; DOI: 10.14710/ajlm.2022.16787

Zhang, L., Pang, M., Bahaj, A. S., Yang, Y., & Wang, C. (2021). Small hydropower development in China: Growing challenges and transition strategy. *Renewable and Sustainable Energy Reviews*, 137, 110653.