

**Review Article**

Monitoring and Evaluation Data Management and Project Performance: A Review on Infrastructure Projects

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Abstract: This paper assesses the nexus between M&E data management and project performance with a focus on infrastructural projects. The paper examines and critically analyses relevant models, theories and empirical literature on M&E data management and project performance. Through examination and analysis, the paper comes up with a proposition aimed at informing further study on the M&E data management and project performance. In addition, the paper builds theoretical and conceptual ground for further studies on the research variables. From critical assessment of theories, models and empirical literature, the paper established positive relationship between M&E data management and project performance. In addition, the paper recommends two models; the project performance assessment model and the logical framework model and two theories; theory of change and dynamic capabilities theory as relevant in explaining the relationship between M&E data management and project performance. The paper gives a proposition on the nexus between M&E data management and project performance. It identifies significant gap in theoretical foundations for studies on M&E data management and project performance and recommends development of project specific models to enhance operationalized project performance assessment.

Keywords: M&E Data Management, Project Performance, Infrastructure Projects

1. Introduction

Interest in project performance among project stakeholders such as; project beneficiaries, project sponsors, government and the general public cannot be under rated. With the current social, economic, natural, political and technological developments, project environment has become so dynamic, increasing the need to adopt more robust project management practices. Just like other project areas, there is increasing pressure on infrastructure developers to implement projects strictly within pre-determined budget, schedule and standards. Similarly, there is increased pressure that the infrastructural projects comply with international standards on health and safety, environment and socio-economic impact. Monitoring and evaluation (M&E) plays a very important role in ensuring that the building infrastructure projects conform to standards and requirements during implementation. Similarly, M&E ensures that if any deviation occurs, it is identified and rectified in time. M&E data management has been identified as one the critical determinants of M&E. This paper

examines the nexus between M&E data management and project performance with focus on infrastructure projects.

Interest in M&E and project performance is growing among researchers. Similarly, M&E there is growing interest on M&E data management among scholars in various parts of the world. Report by [28] identified the need to have affective M&E data systems. According to UNESCO, data based M&E reports lead to better project decisions. The report recommends adoption of effective M&E data management in the education sector across the globe. Findings [20] in a study based on department of health in South Africa led to recommendation that that M&E should be based on data as this helps in data based assessment of project performance. In Kenya, interest in M&E is growing. However, research on M&E data management is still relatively limited. For instance, while studies such as; [27; 23] focused on M&E practices and performance of infrastructural projects, they study only identified M&E data as input in M&E process but did not evaluate the relationship between M&E data management and project performance. The studies

acknowledged that M&E data management is still not robust in many project environments. It is a challenge to ensure objectivity and robustness in the entire M&E data management process, hence the need for further studies on M&E data management and project performance.

2. Literature Review

2.1. Review on Models and Theories

2.1.1. The Project Performance Assessment Model

The Project Performance Assessment (PMPA) Model was developed to provide criteria for evaluating project performance. According to PMPA, there are six determinant factors of successful project performance. These are leadership, human resource capacity, policy, strategy and project life cycle management [4]. According to [8], the six factors are important at all stages of project implementation. According to Performance Assessment Model, project performance should be assessed starting from project inputs, through the project process all through to the project outcome.

Quality is one of the main areas which project management team should focus on in order to ensure optimal project performance. Project output quality is one of the most important areas of focus in assessing project performance. Project output quality is measured in terms of its ability to satisfy sponsors, internal customers and project beneficiaries [29]. This is assessed in terms of the extent to which the project output conforms to the project specification as set at project planning and design stage. Project management team must focus on all stages of the project life cycle. Close monitoring must be guaranteed on budgeting and cost, schedules and delivery and efficiency of processes [27]. In addition, acceptable health, safety social and environmental must be guaranteed through appropriate policies and guidelines.

In order to achieve optimal project performance, performance assessment model emphasizes on the need to monitor and evaluate all stages of infrastructural projects. The model integrates M&E in project processes and activities, hence creating a seamless checks and balances within the project management process. In the current review, the performance assessment model helps in identification the key performance areas and performance criteria for building infrastructure projects (Tahir et al., 2009). Understanding of critical performance dimensions inform on metrics of project performance and facilitate objective M&E data management. Similarly, understandings of key performance indicators enhance decisions on M&E data management training, tools and approaches. In addition, the model focuses in the need for structured data management on project performance. It emphasizes on the need to understand what M&E needs to measure, which measures to use in various levels of M&E, how to measure and interpret M&E results, and how to disseminate and use M&E results [27].

2.1.2. The Logical Framework Model

The logical framework approach to project management was developed in 1969 by Practical Concepts Incorporated to provide a common ground for understanding of projects and project execution. The framework provides a systematic understanding of project management activities right from planning to project M&E and performance reporting. Logical framework model provides scientific approach all the way from preliminary analysis during project planning to project M&E. In addition, the framework recognizes the role of project stakeholders in project implementation and advocates for stakeholders' participation through consultation and active involvement [26].

The logical framework model organizes project activities and information so as to integrate project management, scientific tools, methods and systems approach in project management. The logical framework appreciates that project execution is a logical process with clear objectives. The objectives are viewed in four levels; project inputs, project outputs, project purpose and project goal. Project inputs are the specific project tasks that are executed to achieve the desired project outcomes. Project outputs are the resulting deliverables from execution of project tasks. Purpose is what the project output helps in achieving while project goal is overall performance target the project is intended to achieve [9].

The logical framework model presents that project outputs are delivered through well executed and managed project inputs and activities. The project outcome is achieved through project output that results from project activities. The outcomes of a project are likely to have impacts. For a project to be implemented successfully, the project needs to closely monitor through M&E [26].

In the current review, the logical framework model enhances understanding of implementation building infrastructure projects. This facilitates objective M&E and M&E data management throughout the project. Understanding of various stages in projects informs on when and how to collect, process, manage and report M&E data. Similarly, understanding of project dimensions and stages enhance appropriate post M&E project decisions.

2.1.3. Theory of Change

Theory of Change has been applied in research since 1990s in studies on studies project M&E. Theory of change proposes that change is achieved through continuous data based decisions and strategies that are assessed and evaluated and communicated effectively to facilitate improvement. Then theory is founded on; identification of how to initiate change, identifying individual roles, conceptualization of a change pathway, identifying important assumptions in implementing the change, continuous monitoring of the change and critically analyzing the change process to assess if theory is effective and valid in initiating change [10].

Theory of Change has been applied in monitoring of different types of projects, both in public and private sectors. For instance, [6] applied the theory in M&E of agricultural

project in Malawi. Theory of change is applicable in cases where there are activities implemented in some controlled manner intended to achieve a given outcome. The theory is applicable where cause and effect relationships are expected. Empirical literature in favor of application of theory of change in project M&E presents that the theory creates unity of purpose in project environment enhancing common understanding among project stakeholders. The theory provides a framework that can be used in M&E. The theory advocates for stakeholders' involvement and can be used to enhance communication during the change process. In addition, the theory encourages innovation in handling project changes [10].

Theory of change explains how change happens in work or project environment through involvement of stakeholders. According to [6], theory of change presents that before a project is implemented, all stakeholders should understand the context of operations of the project. Ideally, M&E leads to some change, informed by the M&E report. Post M&E changes should be understood in terms of economic, social, political and environmental dimensions of the project [1]. In this review, the theory of change enhances understanding of the nature and need for post M&E change in infrastructural projects and operationalizes the change process. It also identifies the important ingredients in initiating post M&E changes.

2.1.4. Dynamic Capabilities Theory

The theory of Dynamic Capabilities is applicable in management areas that need to pull together and allocate resources optimally to create processes that respond to changes in the environment (Shao, 2019). The theory has been used by many scholars in study that involve deployment and redeployment of resources to achieve optimality in dynamic environments [3]. The idea behind the theory is that an organization is able to achieve competitive edge by pulling together resources and capabilities and integrating them to achieve a unique capability. Such resources must be acquired and allocated with full understanding of the market in which the firm operates.

Study by [3] defines dynamic capabilities as firm's ability to integrate, pull together and configure internal and external competencies in order to realize optimal performance in a dynamic environment. Dynamic capabilities is the process through which organizations respond to changes in the environment while Chirico and Nordqvist (2010) defines dynamic capabilities as the process of acquiring, exchanging and transforming internal and external resources to achieve optimal and sustainable competitive position.

The theory recognizes that projects are implemented in very dynamic environment. For a project to achieve optimal performance in such environment, it must develop superior capacity by pulling together, integrating and configuring resources and capabilities [14]. The level of performance realized in a project is an outcome of the project organization to pull together, configure and integrate internal and external capabilities. Organizations must be able to sense

opportunities, seize the opportunities by effective allocation of resources and capacity utilization and transform to achieve the best value from the opportunity [7].

The process of M&E involves routine assessment of project during implementation to establish performance and identify performance gaps. In order to achieve optimal performance, project organization must react to M&E findings by marshaling available resources and capabilities and allocating these resources optimally (Shao, 2019). Dynamic capabilities theory advocates for logical approach to M&E. Logical approach enhances integration of M&E within the project and can enhance M&E effectiveness. In the current review, the dynamic capabilities theory enhances understanding of project management as well as understanding of how M&E data management can seamlessly be implemented in building infrastructure projects to achieve optimum performance.

2.2. Review on Monitoring and Evaluation and Project Performance.

2.2.1. Monitoring and Evaluation Data Management

M&E is very important in infrastructural projects. Monitoring tracks progress of the project at any given time while evaluation is aimed at establishing the level of performance with respect to targeted level of performance. Evaluation identifies gaps during project execution so as to proactively address the lapses identified. In infrastructural project, M&E therefore plays the role of control and monitoring. It ensures project resources are allocated and used efficiently and the project is delivered in time [17, 24; Tengan & Aigbavboa, 2018].

M&E data management is concerned with how M&E data is gathered, analyzed and reported to guide post M&E project decisions. According to [22], M&E data management assesses the sources of M&E data, qualitative and quantitative data collection methods, participation in data collection, quality assessment around M&E data management practices and dissemination and use of M&E results. According to [23], M&E data management involves data collection, data verification, data analysis and findings reporting. While to [22], M&E data management decisions involves choosing appropriate data management tools and ensuring quality all through data collection, processing and reporting.

2.2.2. Baseline Monitoring and Evaluation Data Management

Baseline M&E involves assessment of project conditions prior to project execution majorly to confirm on the viability of the project [21]. It provides feedback actual state of affairs before the project is implemented to act as a reference points and facilitate future M&E. In his study, [16] identified three areas of baseline M&E. These are economic, social and environmental baseline M&E. Baseline M&E report facilitates formulation of measures to proactively manage project outcomes that may have negative effect on economic, social, and environmental expectations of the project.

Environmental baseline M&E can guide in design and re-design of a project so as to facilitate compliance with project requirements.

Baseline M&E guides on how to initiate the project. Baseline data is collected through baseline survey. The findings of the survey inform on the important project factors. Actually, the initial evaluation of the project is done based on the survey findings. Baseline M&E can help in definition of performance expectations. Effective baseline M&E facilitates proactive project decisions and consequently enhances quality of project implementation and project performance in general [27].

In order to have adequate and informative baseline M&E report, baseline data must be collected and analyzed. The process of collecting, analyzing and reporting baseline M&E data so as to have a baseline M&E report is called baseline M&E data management. Baseline M&E data management involves decisions of data sources, data collection, data analysis models and methods that can be used to arrive at a baseline position against which future M&E reports can be compared [15].

Baseline data should be collected for each outcome and impact indicator. Data can be collected through quantitative baseline surveys [21]. Study by [27] also identified questionnaires as effective tools for baseline surveys. They further argue that baseline M&E should be done early enough to allow for timely analysis and reporting. Baseline M&E data can also be collected through structured observation or stakeholders' dialogues [3]. Baseline M&E information is crucial in project implementation [12].

2.2.3. Compliance Monitoring Evaluation Data Management

Compliance M&E involves assessment of a project to establish if it continues to meet the set requirements in line with the standards and legal regulations (Roehrer, 2013). All projects are expected to be implemented within certain minimum quality and legal framework so as to contain the project outcome. Project compliance should be assessed through the project execution. Consequently, any compliance lapse identified during compliance M&E should be swiftly acted on. This required effective data management process [25].

Compliance data are sometimes very sensitive and confidential. Such data must be handled with utmost care and professionalism [15]. Data on compliance must be collected and handled with high level of professionalism [12]. This implies that data collection; analysis tools must be deliberately selected. M&E staff may have to be trained on effective data management tools [15]. Generally, compliance M&E ensures the project is implemented within the acceptable quality, legal, social and environmental standards [5, 13].

2.2.4. Impact M&E Data Management

Impact M&E assesses the social, economic and environmental impact of project activities. Impact M&E assesses how the changes have affected project stakeholders

and the project environment [5]. It answers three pertinent questions; what has changes, for whom and how significant is the change [3], impact M&E is significant in the success of any project. As such, data and results based approach should be adopted in impact M&E. There is need for proper impact M&E data management.

Effective M&E data management involves gathering of data on predetermined and emerging impact areas across the project. Participatory approach is effective in impact M&E data gathering as it promotes the feeling of ownership and belonging among project stakeholders. While impact M&E generally tends to focus on the negative outcomes of a project, [2] observe that data should be gathered on both negative and positive project outcomes. Impact M&E data needs to be properly analysed and comprehensively reported in order to give the accurate extent and nature of impact. According to [5], report from impact M&E is crucial in informing during and post project decisions and significantly influences the general performance of a project.

2.2.5. Project Performance

Project performance measures generally revolve around the project features that are important to project sponsors, beneficiaries and stakeholders [30]. In a related study, [19] argue that project performance can be measured at project level and at organizational level. According to [8], project level performance measurement is done in terms of input/process measures or in terms of output/outcome measures. While project performance at organizational level focuses on final outcome of the project implemented by an organization, project level performance largely focuses on performance of the specific tasks and stages of the project [27].

Most of the conventional Key Performance Indicators (KPIs) applied in other projects can be adopted for infrastructural projects. Using EVM method, Mohammed, Sarhan and Sameer (2014) identified budget, scope and schedule as KPIs for infrastructural projects while [11] identified cost, quality and time through factor model of project success. According to Ofori-Kuragu et al. (2016), client satisfaction, within budget implementation, within schedule implementation, achievement of acceptable quality and health and safety standards, and achievement of acceptable social and environment standards are key indicators of a well performing infrastructural project. Similarly, Cost, quality, efficiency, flexibility, project safety, social and environmental performance and donor and beneficiary satisfaction were identified by [30] as KPIs.

There is need for multidimensional approach that include project sponsors, project team, project beneficiaries and other stakeholders in measurement of project approach. They identified seven perspectives that are important in project performance measurement [8]. The perspectives include; clients/beneficiary perspective, financial perspective, project team perspective, health and safety perspectives, social and environmental perspectives and innovation perspectives. Cross examination of performance indicators identified in

empirical literature [30]; Ofori-Kuragu et al., 2016; Takim & Akintoye, 2002) indicates that cost, schedule, quality, safety, social and environmental performance are the popularly used indicators for project performance, including building infrastructure projects. In this paper, the researcher proposes six performance areas (see table 1) for building infrastructure projects.

Table 1. Key Performance indicators for Infrastructure Projects.

Key Performance Area	Performance Indicators
Quality Performance	Minimum rework
	Project innovation
	Delivery per specification
	Predictable project cost
Cost Performance	Efficient processes
	Within budget expenditure
	Effective project cost control
Safety Performance	Sustainable project risk management
	Project health and safety management
Schedule Performance	One time resources availability
	On schedule completion
	Beneficiaries' satisfaction
Delivery Performance	Contractors' satisfaction
	Financiers satisfaction
Project Information Management	Efficient project communication
	Efficient record maintenance

2.2.6. Monitoring and Evaluation Data Management and Project Performance

Baseline M&E data management is important as it determines the quality of baseline M&E reports. M&E data management training, use of modern and appropriate data management tools enhance project M&E process and consequently project performance (Wambua, 2019). [27] reported significant and positive association between baseline M&E and performance of infrastructure projects. The study also noted that M&E is only effective if the reports are arrived at through a participative and scientific M&E data management. The study recommends that M&E personnel should be trained and capacitated and M&E data management well financed to ensure objective M&E results.

According to United States Agency for International Development (USAID, 2010), baseline M&E assists in determining baseline project outcomes for all project indicators. M&E report informs decision early enough during the project implementation. The report suggests that baseline M&E data should be collected at the initiation stage of the project. Baseline M&E report helps in making proactive decisions towards achievement of optimum project performance. Similar findings were reported by [31] in their study in infrastructural projects implemented by the constituency development fund (CDF).

Examination of empirical review indicates that Baseline M&E inform on project decisions towards achievement of planned project outcomes (Save the Children, 2020) and enhances of quality of M&E reports (Wambua, 2019) hence leading to realistic and objective post M&E action plans. Baseline M&E report informs on proactive decisions towards optimum project performance [31]. Similarly, baseline M&E facilitates proactive and timely capacity assessment leading

to timely corrective measures and consequently, enhanced project performance. From the cross-examination of existing literature, the study makes a proposition that baseline M&E is a significant determinant of M&E effectiveness and subsequently, project performance.

There is positive association between compliance M&E and Project performance, as compliance M&E ensures projects are implemented in line with set standards and requirements [1]. The study identified legislative requirements, quality standards, environmental conservation guidelines and social ethics requirements are important ingredients towards successful project execution. Wambua (2019) established that much attention is now given to public infrastructural projects to ensure that are implemented within the timelines, budget and in accordance with regulations and standards. It is a requirement that building projects are implemented in accordance with government regulations and that quality, social and environmental requirements are complied with. Consequently, public projects must be assessed through continuous M&E to ensure compliance with all relevant regulations and standards which requires effective compliance M&E data management.

Yan et al. (2013) in a study in infrastructural projects in China established that M&E significantly affects performance of infrastructural projects. Compliance M&E provides framework within which project compliance can be assessed. The study developed a result-based M&E model that can arguably be adopted in emerging and transition economies. The model proposes that M&E should an inclusive process bringing together project beneficiaries, sponsors and other stakeholders. Based on existing empirical evidence, this paper makes a proposition that compliance M&E is a critical determinant of project performance.

In a study conducted by [8], continuous impact assessment was identified as one of the critical determinants of project success. The study established that building infrastructure project performance measurement should be multidimensional, participatory and should focus on input and output processes. The assessment should be project wide so that all stages of the project are assessed. The same approach is recommended by [11] in his study that focused on infrastructural projects in Nigeria. The study reported that projects that rely on post implementation performance measurement are more likely to experience cost, quality and time overruns. Therefore, there is need for continuous impact assessment. While the study identified cost, time and quality as the main indicators of project performance, cost and time were reported as direct parameter while quality was considered a subjective measure of infrastructure projects.

Study by [17] focused on how M&E practices can be used to design success criteria for infrastructural projects in Ghana. The study collected data through structural questionnaires with research items formulated through critical review of empirical literature. Research data was analyzed through partial least square structural equation modeling. The study established that impact M&E of infrastructural projects enhances project performance with respect to quality, timeliness and health and

safety. Effective analysis and use of M&E data enhances ensures sustainable project execution. The study recommends that impact M&E should be adopted in infrastructural projects to increase productivity and to accelerate completion rate.

Study by [18] on M&E and performance of road infrastructural project in Kenya collected data on 41 road projects through structured questionnaires. The study established that routine collection and analysis of M&E data provides timely and objective tracking of infrastructural projects. Through such reports, projects outcomes and implications can be assessed in terms of cost, quality and schedule delivery.

While most studies indicate positive relationship between M&E data management and project performance, Mutekhele et al. (2017) established that dissemination and use of M&E data does not have significant effect on project performance for infrastructural projects. The study was based on educational building infrastructural projects and collected data from project stakeholders as well as project implementers. A total of 110 respondents took part in the study. The study relied on both qualitative and quantitative data.

3. Methodology

This paper relied on empirical evidence to make logical conclusions on the relationships sought in the study. Systematic analysis of literature on M&E data management with focus on M&E data management practices and levels was conducted. Similarly, the paper examined literature on models and theories relevant in the study on M&E data management and project performance in infrastructure projects.

4. Conclusion and Recommendations

This paper identifies three levels of M&E data management; baseline M&E data management, impact M&E data management and compliance M&E data management. The paper concludes that baseline M&E data management influences project performance. Baseline M&E data management enhances credibility of baseline M&E reports, hence leading to more informed post M&E decisions and consequently better project performance. Impact M&E data management is identified as a significant determinant of project performance. Impact M&E establishes the actual and possible impact of the project during and post implementation. Impact M&E data management enhances soundness of impact analysis therefore leading to more effective post M&E decision and courses of action. The paper also concludes that compliance M&E data management facilitates establishment of actual state of compliance of a project with respect to regulations and requirements. Credible post compliance M&E evaluation report facilitates informed decisions leading to enhance project performance.

The paper concludes that while the available theories and models are relevant in conceptualization of research variables and explaining the relationship between the research

variables, the paper acknowledges the need to develop models and theories that can be adopted in explaining exact relationship between M&E data management and performance of building infrastructure projects.

This paper recommends that future studies can focus on developing models for successful implementation of infrastructural projects as well as measure project performance. Project specific models can be developed for logical implementation and project assessment. Surveys can be conducted on M&E data management and performance of building infrastructure projects in context contexts to assess whether the propositions made in this paper can be generalized across different project environments.

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