INTERNATIONAL JOURNAL OF INDUSTRIAL MANAGEMENT
ISSN: 2289-9286 E-ISSN: 0127-564X
VOLUME 20, NO. 1, 2026, 1 – 10
DOI: https://doi.org/10.15282/ijim.20.1.2026.11824

RESEARCH ARTICLE

Enhancing the monitoring and evaluation of road construction projects using expert opinion: A case of Uganda national roads authority

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Abstract - Road transport is among the sub-sectors that receive the highest funding in Uganda. Nevertheless, there has been a persistent public outcry on delays, low-quality deliveries, and even project failures in different parts of the country. Existing studies have attributed this to inefficient monitoring and evaluation (M&E) of road construction projects, which remains underexplored at the local scale. Therefore, the purpose of this study was to enhance the M&E of road construction projects in Uganda by establishing key factors of the exercise. Initial key M&E factors were identified through a literature review, and the Delphi technique was later employed to determine the experts' levels of agreement towards these factors using measures of central tendency, such as mean, standard deviation, and coefficient of variation. The levels of consensus among experts were further confirmed by Kendall's *W*, and the relative importance index finally revealed key M&E factors in road construction. The findings are crucial to support planning and decision-making across all stages of road construction projects in Uganda and the execution of targeted interventions in M&E exercises during project implementation. This study can be expanded in the future by focusing on the development of regression modelling, spatial modelling, and machine learning to predict the success and failure of M&E in road construction projects.

Article History
Received : 5th Jan 2025
Revised : 15th Apr 2025
Accepted : 30th Jun 2025
Published : 26th Mar 2026

Keywords
Key factors
Road construction
Road transport
Monitoring and evaluation
Delphi
Relative importance index

1. Introduction

Road transport is the backbone of many global industries and therefore stands as a key driver of both national and international economies (Almashhour et al., 2023; Muzaale & Auriacombe, 2018). Uganda is a landlocked African country whose transportation sector largely relies on road transport (Kayondo-Ndandiko et al., 2014). The local road infrastructure supports a number of sub-sector activities, including the transportation of agricultural and mineral products, enabling tourism activities across various destinations, allowing learners to access different educational institutions, assisting in healthcare deliveries and referrals, facilitating internal security and national defence activities, and general public transport (Almashhour et al., 2023; Muzaale & Auriacombe, 2018). Approximately 21.4% of the national roads, 0.4% of rural roads, and 5.6% of urban roads in Uganda are paved (Ggoobi et al., 2020), with at least 17% of the national budget allotted every year to cater for the development of new roads and the maintenance of existing ones (Byaruhanga & Basheka, 2017). Additionally, road transport is considered a fundamental sub-sector in achieving "Uganda Vision 2040" (Ggoobi et al., 2020; UN Report, 2018). The prominence of road transport towards Uganda's national and international development agenda subsequently results in various road infrastructure projects, many of them running parallel and involving different stakeholders like government agencies, contractors and sub-contractors, consultants, donors, environmentalists, and the public. Although the sector receives among the highest funding in national budgeting, there has been persistent public outcry on project delays, low-quality deliveries, and even failures (Muzaale et al., 2018). These collectively result in high expenditures, numerous roadblocks and diversions, increased risks, frequent maintenance costs, and huge losses to the government (Pant et al., 2022; Muzaale et al., 2018). Many studies have associated these challenges with inefficient monitoring and evaluation of the projects (Akinradewo et al., 2022; Ba, 2021; Pant et al., 2022).

Monitoring and evaluation (M&E) is a systematic and routine collection and analysis of data to assess the progress of a project (Mutua et al., 2020; Musnera & Mulyungi, 2019). According to Oyelami and Dosumu (2021), M&E helps managers and supervisors to track, report, and review how a project is progressing in relation to initially planned goals. Many existing studies have confirmed the significant positive relationship between projects' successes with effective M&E (Oyelami & Dosumu, 2021; Kabonga, 2019; Kissi et al., 2019). Among the benefits of M&E include tracking a project's progress, accountability, conformity to standards, evidence-based reporting and decision-making, timely reporting, and effective communication among stakeholders (Tengan & Aigbavboa, 2018, 2021). This ultimately leads towards high chances of project success (Ba, 2021). Despite its benefits, M&E has been given minimal consideration in road construction projects, especially in the context of developing countries in Africa. Empirical evidence suggests that most project failures in developing countries are associated with ineffective M&E due to poor planning, making it difficult to monitor, evaluate, and track its progress (Ba, 2021; Tengan & Aigbavboa, 2018, 2021). In the context of Uganda, the majority of conventional M&E studies have yet to explore its application in road construction projects (Byaruhanga & Basheka, 2017). Therefore, this study aims to address such gap by exploring the key M&E factors that can enhance the monitoring and evaluation of local road construction projects under the jurisdiction of the Uganda National Roads

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Authority (UNRA). The findings hope to assist UNRA in developing relevant guidelines and policies for implementing M&E throughout all phases and activities of road construction projects, thus achieving the project goals and objectives. The study also establishes a foundation for future research on road construction, machine learning, and other artificial intelligence techniques to predict the successes and failures of M&E in road construction projects (Ntulo et al., 2024; Issifu & Agyapong, 2023).

2. Literature Review

2.1 Monitoring and Evaluation in Road Construction

Monitoring and evaluation are among the key elements in every project, including road construction (Oyelami & Dosumu, 2021). According to Rukundo and Kamande (2022), M&E is a systematic assessment of project progress during implementation in relation to planned targets, objectives, and goals. It involves setting clear objectives with indicators, systematic data collection, data analysis, reporting, and feedback. In this process, monitoring generates structured information about the actual work done at any time during project execution based on the planned targets and goals (Bbosa et al., 2023). On the other hand, evaluation explores and gives evidence about the extent to which the targets and outputs have been achieved (Tengan & Aigbavboa, 2018). In practice, evaluation supplements monitoring so that when the set targets have been achieved successfully, the lessons learnt can be applied in other activities to achieve similar successes. When evaluation confirms delays to achieve targets which are likely to affect project duration, causes can be identified and interventions can be implemented in time to bring the project back to schedule (Kabonga, 2019). Experts believe that without evaluation, monitoring may not be helpful because the monitored progress must be analysed to determine the extent of successes or failures in relation to planned targets (Ng"etich & Otieno, 2017). Subsequently, M&E is essential throughout the entire project life cycle, from initiation, planning, and implementation to project closure. In some projects, it even extends beyond project closure to explore the projects' impacts on the overall goals (Tengan & Aigbavboa, 2018). The interplay of M&E and project success has been advocated in a number of past studies (Kissi et al., 2019; Niwagaba & Mulyungi, 2018; Kamau & Mohamed, 2015), with some highlighting its prominence over project planning in the entire project cycle (Oyelami & Dosumu, 2021). Nevertheless, M&E has received little consideration in road construction projects, especially in developing countries across Africa (Ba, 2021). Understanding this aspect is crucial since the majority of project failures reported in developing countries are associated with ineffective M&E due to poor planning, making it difficult to monitor, evaluate, and track progress (Tengan & Aigbavboa, 2018, 2021).

2.2 Benefits of Effective Monitoring and Evaluation

M&E helps to inform supervisors and managers of what is working, what is not working, and where improvement is required to keep the project on budget, quality, and schedule, ultimately increasing the chances of project success (Mutua et al., 2020). It also provides a transparent mechanism of accountability by concerned parties (Tengan & Aigbavboa, 2018). Effective M&E is necessary for checks and balances during project implementation, allowing planning and decision-making to match resources with project progress (Njeru & Kirui, 2022; Nnadi & Onyema, 2023). It also increases efficiency in the entire process of project implementation and is said to be more critical than project planning in achieving project success (Oyelami & Dosumu, 2021). Furthermore, evaluation can be extended beyond project closure to establish the project's impact (outcomes) to the intended beneficiaries and end-users (Tengan & Aigbavboa, 2021). Existing evidence also suggests that effective M&E improves communication amongst stakeholders, quickens evidence-based decision-making, and ensures conformity to standards, all of which are crucial aspects to avoid demolition and re-work during project implementation that can result in high costs, delays, and project failures (Tengan & Aigbavboa 2021).

2.3 Factors Affecting Monitoring and Evaluation in Road Construction Projects

Existing studies have associated inefficient monitoring and evaluation of road construction projects with several factors. According to Tengan and Aigbavboa (2021), poor communication within M&E teams and amongst stakeholders is a key factor hindering M&E performance. Other studies reported that incompetent staff, underfunding, and lack of necessary equipment have a major impact on efficient M&E in road construction projects (Rukundo & Kamande 2022; Irfan et al., 2021; Mwakajo & Kidombo, 2017). Some organisations also lack the establishment of well-organised M&E units with effective information systems that are responsible for all M&E activities, thus rendering M&E ineffective (Tengan & Aigbavboa, 2018). M&E performance can also be affected by the lack of specialised training and expertise as well as sufficient information on project designs, drawings, specifications, milestones, deliverables, and indicators to measure project progress (Nnadi & Onyema, 2023). Additionally, the underutilisation of well-generated M&E reports can also have negative influences on M&E exercise (Tengan & Aigbavboa, 2018). These factors may vary in magnitude across different areas and organisations (Ba, 2021). Therefore, understanding them in a localised context can have a significant impact on both project planning and implementation.

3. Materials and Methods

In this study, expert opinion was conducted via the Delphi technique to determine experts' opinions, judgements, and consensus regarding the factors of M&E. The method utilised a questionnaire survey to reach the required expert consensus in multiple rounds (Henning & Jordaan, 2016). It began with expert consultation and identification, which assisted in the preparation of the questionnaire. All views, suggestions, and recommendations from the experts were taken into consideration to revise and improve the questionnaire (Willar et al., 2023). The experts' consensus level was tested using statistics at the end of each round. The process was repeated for multiple rounds until the required level of expert consensus was reached to communicate the final results of the group (Franc et al., 2023). Subsequently, the Relative Importance Index (RII) was employed to determine the key factors of M&E. Figure 1 which was adapted from Habibi et al. (2014) summarises the research methodology used in this study.

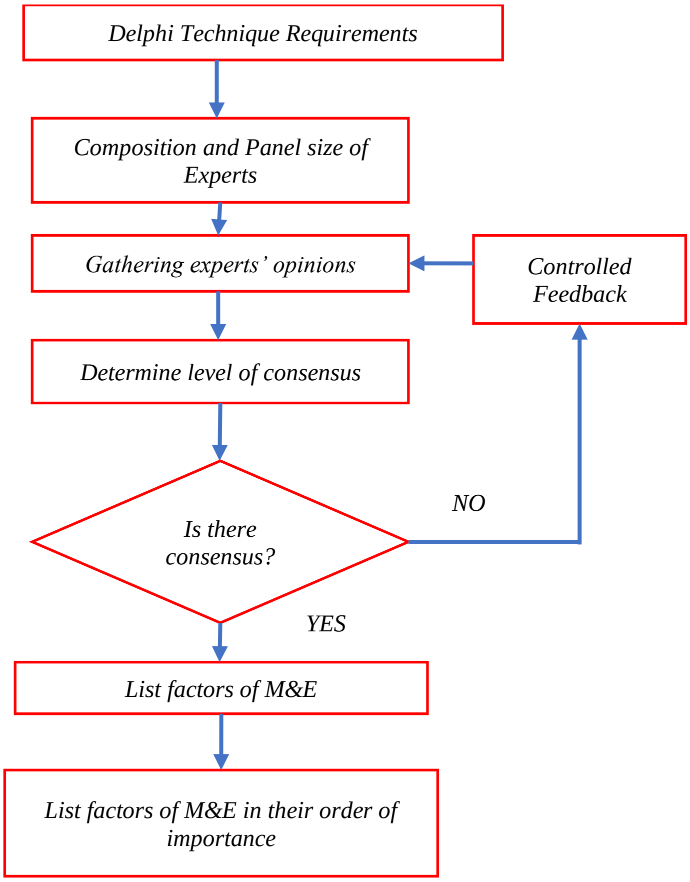


Figure 1. Summary of the research methodology

The following section explains further details regarding the different stages of the research process.

3.1 Delphi Technique Requirements and Panel Size

The major requirements of the Delphi method are judgement of experts, anonymity during the data collection process, and the consensus of the group (Habibi et al., 2014). Therefore, a sample of size 30 was used in this research, as recommended by the central limit theorem (Franc et al., 2023). An expert was defined as anyone with an academic qualification, working in a road construction company in Uganda, and attached to the M&E department with at least five years of experience. The experts' anonymity was ensured throughout the data collection process. Purposive sampling was used to select 15 experts from UNRA and three contractor companies, making a total of 30 participants. This was done upon the completion of a pilot study.

3.2 Gathering Experts' Opinions

All experts were identified and contacted during locus visits. The initial version of the questionnaire contained 17 factors that could influence M&E in road construction. These factors were identified from a thorough review of past literature. Following the experts' review and recommendations, three factors were added to the questionnaire, making a total of 20 factors. The review process was repeated until a required level of consensus was achieved. Table 1 presents the list of factors explored during the three rounds of expert review.

3.3 Determination Level of Consensus

Past studies have used different ways of measuring the level of consensus in a group of experts. Pélabon et al. (2020) recommended the use of two or more independent measurement processes to reduce uncertainty in the interpretation. Such recommendation was adopted in this study to determine the level of consensus among the experts.

3.3.1 Percentage of agreement

According to Barrios et al. (2021), the level of consensus agreement (consensus) can be determined by the sum of "Strongly Agree" and "Agree" scores on each factor in the analysis, with a threshold of 70% and above is considered an acceptable agreement. Figure 3 shows the agreement level of each factor for all Delphi rounds.

3.3.2 Mean ranks, standard deviations, and coefficient of variation

According to Franc et al. (2023), consensus level can be measured by the mean ranks of a given factor, with those remaining similar for two consecutive rounds are considered an agreement by the raters. Previous research has recommended a standard deviation (SD) of less than 1.0 (Barrios et al., 2021), with SD > 2, SD = 1.01 to 1.49, and SD = 1.5 to 2.0 implying no, reasonable or fair, and low level of consensus among experts (Henning & Jordaan, 2016). This is followed by calculating the Coefficient of Variation (CV) using the ratio of SD to the mean rank. It describes the degree to which the different values are spread around the mean. According to Henning and Jordaan (2016), a CV value exceeding 0.8 or ranging from 0.5 to 0.8 implies a poor or less satisfactory degree of consensus and the need for additional rounds. Meanwhile, a CV value less than 0.5 indicates a good degree of consensus, and it is expected to be at its lowest if monitored for different rounds of specified factors (Henning & Jordaan, 2016). Table 2 lists the mean ranks, SD, and CV values of all factors in each Delphi round.

3.3.3 Kendall's coefficient of concordance

Another statistical method used to measure the level of consensus in this study was Kendall's coefficient of concordance (*W*). It assesses the degree to which the experts come together in agreement on a given item using Likert scale ranks (Moslem et al., 2019). According to Edyta (2017), Kendall's coefficient of concordance (W) can be calculated using Eq. (1).

$$W = \frac{\sum_{j=1}^{n}\left(R_j - \frac{m(n+1)}{2}\right)^2}{\frac{1}{12}m^2(n^3-n)} \tag{1}$$

where n is the number of ranked items (i.e., the M&E factors), m is the number of experts, and R_j is the sum of ranks obtained by the j-th item for all experts (raters). Any tied ranks (an expert giving the same rank to more than one item) will require correction (*T*), as shown in Eq. (2).

$$T = \sum_{k=1}^{g}(t_k^3 - t_k) \tag{2}$$

where t_k is the number of tied ranks in each k of g groups of ties in the rankings. The computation of the corrected Kendall's W (W') is presented in Eq. (3).

$$W' = \frac{\sum_{j=1}^{n}\left(R_j - \frac{m(n+1)}{2}\right)^2}{\frac{1}{12}m^2(n^3-n) - mT} \tag{3}$$

The values of W or W' range from 0 to 1. In practice, 0 means no agreement, 0.1 means weak agreement, 0.3 means moderate agreement, 0.6 means strong agreement, and 1 means perfect agreement (Edyta, 2017). In this study, ties existed among different experts, therefore W' was used and the values are presented in Table 2.

3.3.4 Determination of key factors of M&E in road construction projects

After achieving expert consensus on the different factors of M&E (see Figure 1), the study employed the Relative Importance Index (RII) to rank all factors according to their degree of importance. This was achieved by computing the average RII values of all factors *(RII_{AV})*, with RII values above the average *(RII_{AV})* indicating a higher degree of importance. According to Seninde et al. (2021), RII can be computed using Eq. (4).

$$RII = \frac{\Sigma\Theta_j}{AN} \tag{4}$$

where Θ is the weight of each factor between 1 to 5 on the Likert scale, A is the maximum weight, and N is the total number of experts. Table 2 presents both the RII and *(RII_{AV})* values of different factors in each Delphi round.

4. Results and Discussion

4.1 Demographic Characteristics of Experts

The gender factor was considered during the study, as evidenced by the inclusion of both male (73%) and female (27%) among the team of 30 experts (see Figure 2(a)). Many of them had a Master's degree (53%), followed by Bachelor's degree (27%), PhD (3.7%), and Diploma (3%) (see Figure 2(b)). All participants worked in a road construction company and their experience of dealing with M&E ranged from more than 20 years (60%), 10 to 20 years (37%), and 5 to 10 years (3%) (Figure 2(c)).

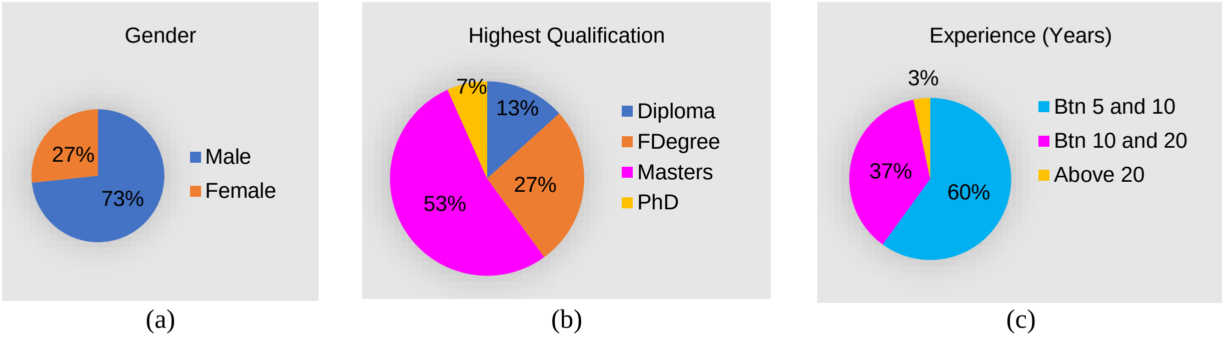


Figure 2. Proportion of gender, highest qualification, and experience

4.2 Gathering Experts' Opinions

The process of gathering experts' opinions began by identifying important M&E factors that were reported in existing literature. All 17 factors were included in the initial questionnaire, which was administered to the experts during the pilot study in Round 1. Their feedback and opinions were considered to further improve the questionnaire, leading to the addition of another three factors. The final questionnaire consisted of 20 factors, as illustrated in Table 1.

Table 1. List of factors generated from the literature and supplemented by the experts

Code	Factors Influencing Monitoring and Evaluation (M&E) in Road Construction Projects
C1	Funding is important in the M&E of road construction projects.
C2	Adequate staff is important in the M&E of road construction projects.
C3	Training staff in M&E is important in the M&E of road construction projects.
C4	Time is important in the M&E of road construction projects.
C5	Record keeping is important in the M&E of road construction projects.
C6	Effective planning is important in the M&E of road construction projects.
C7	Effective communication amongst M&E staff is important in the exercise.
C8	Availability of tools is important in the M&E of road construction projects.
C9	Project description is important in the M&E of road construction projects.
C10	Cooperation of M&E staff and supervisors is important in the M&E of road construction projects.
C11	Information system is important in the M&E of road construction projects.
C12	Feedback is important in the M&E of road construction projects.
C13	Information sharing amongst stakeholders is important in the M&E of road construction projects.
C14	Staff competency is important in the M&E of road construction projects.
C15	IT skills is important in the M&E of road construction projects.
C16	Proper organisation of M&E staff is important in the M&E of road construction projects.
C17	Geographical Information System (GIS) is important in the M&E of road construction projects.
C18	Management support towards M&E
C19	Availability of equipment
C20	Organisational structure of M&E in an organisation

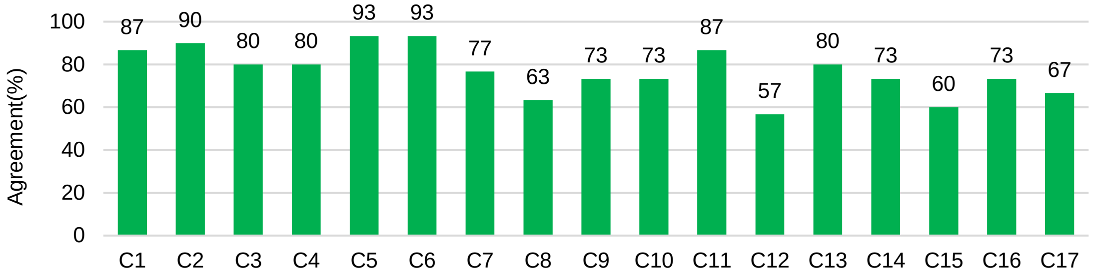
4.3 Determining Level of Consensus

4.3.1 Percentage agreements

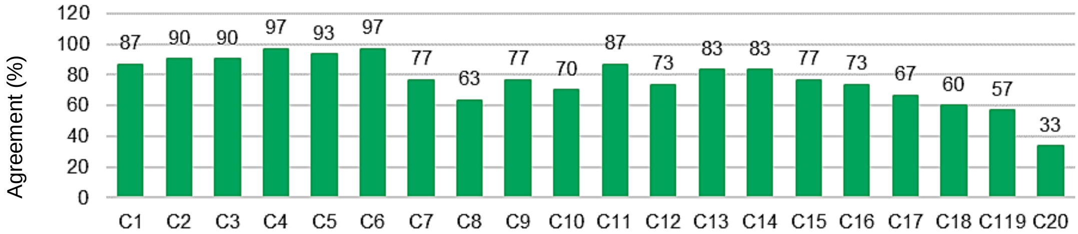
Percentage agreements and measures of central tendency were used to determine the level of consensus in each of the Delphi rounds. Figure 3 presents the percentage agreements for Rounds 1, 2, and 3. The results in Figure 3(a) show that 13 out of 17 factors attained the required level of agreement by experts, while the remaining 4 factors did not surpass the 70% threshold. Following Round 1, three more factors were added (C18, C19, and C20) and the questionnaire was re-administered to the experts in Round 2. The results in Figure 3(b) denote an increase in the level of agreement for most factors; however, 8 factors did not attain the 70% threshold, therefore necessitating another round of Delphi. The results for Round 3 (see Figure 3(c)) indicate that all factors achieved the 70% threshold, suggesting that all experts agreed with all factors. The experts' level of consensus was further analysed using the statistical measures of central tendency.

4.3.2 Mean ranks, standard deviations, and coefficient of variation

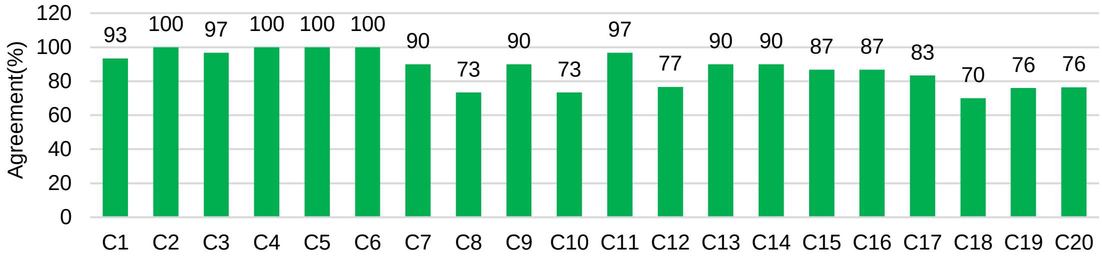
Table 2 presents the values of different parameters for Rounds 1, 2, and 3. Between Rounds 1 and 2, some consecutive mean ranks differed in one decimal place, while other measures (SD and CV) were in acceptable ranges of agreement after Round 2. In Round 3, all mean ranks were almost similar in one decimal place with SD of less than 1 and CV less than 0.5, thus implying acceptable levels of consensus among experts. This was further confirmed by the increase in Kendall's W', from 0.44 (slightly insignificant, $p > 0.05$) in Round 1 to 0.67 (significant, $p < 0.05$) in Round 2 and 0.72 (highly significant, $p = 0.02$) in Round 3. These results suggest the levels of consensus among experts.



(a) Agreement levels for Round 1



(b) Agreement levels for Round 2



(c) Agreement levels for Round 3

Figure 3. Agreement levels of Rounds 1, 2, and 3

Table 2. RII, Mean, SD, and CV for Delphi Rounds 1, 2, and 3

Factor	Round 1					Round 2					Round 3				
	RII	Mean	SD	Cv	Rank 1	RII	Mean	SD	Cv	Rank 2	RII	Mean	SD	Cv	Final Rank
C2	0.887	4.43	0.67	0.15	1	0.913	4.57	0.67	0.15	1	0.940	4.63	0.46	0.10	1
C4	0.840	4.20	0.75	0.18	6	0.887	4.43	0.56	0.13	2	0.920	4.40	0.49	0.11	2
C11	0.867	4.33	0.70	0.16	2	0.880	4.40	0.61	0.14	3	0.900	4.42	0.56	0.13	3
C5	0.860	4.30	0.59	0.14	3	0.880	4.40	0.49	0.11	3	0.893	4.42	0.50	0.11	4
C6	0.853	4.27	0.57	0.13	4	0.873	4.37	0.55	0.13	5	0.887	4.43	0.50	0.11	5
C16	0.847	4.23	0.92	0.22	5	0.860	4.30	0.90	0.21	6	0.887	4.34	0.72	0.17	6
C17	0.813	4.07	0.93	0.23	11	0.840	4.20	0.91	0.22	9	0.873	4.19	0.84	0.20	7
C7	0.827	4.13	0.76	0.18	7	0.847	4.28	0.67	0.16	8	0.860	4.30	0.64	0.15	8
C3	0.820	4.10	0.70	0.17	9	0.853	4.27	0.57	0.13	7	0.860	4.30	0.53	0.12	8
C13	0.827	4.13	0.81	0.19	8	0.840	4.27	0.79	0.19	9	0.853	4.27	0.73	0.17	10
C14	0.800	4.00	0.73	0.18	12	0.833	4.29	0.58	0.14	11	0.853	4.27	0.63	0.13	11
C1	0.820	4.10	0.60	0.15	10	0.833	4.17	0.52	0.13	11	0.842	4.20	0.54	0.13	12
C9	0.787	3.93	0.68	0.17	14	0.800	4.06	0.63	0.16	14	0.820	4.10	0.54	0.13	13
C12	0.747	3.73	0.89	0.24	16	0.793	3.97	0.75	0.19	15	0.820	4.01	0.83	0.16	14
C10	0.800	4.00	0.73	0.28	13	0.813	4.07	0.77	0.19	13	0.813	4.07	0.77	0.17	15
C15	0.720	3.60	0.71	0.20	17	0.787	3.93	0.57	0.15	16	0.807	4.03	0.55	0.14	16
C8	0.760	3.80	0.79	0.21	15	0.780	3.90	0.83	0.21	17	0.793	3.97	0.80	0.20	17
C18	-	-	-	-	-	0.760	3.80	0.75	0.20	18	0.780	3.90	0.70	0.18	18
C19	-	-	-	-	-	0.700	3.56	0.72	0.21	19	0.720	3.60	0.66	0.18	19
C20	-	-	-	-	-	0.667	3.46	0.75	0.22	20	0.700	3.50	0.72	0.21	20
RII_{AV}											0.841				
Kendall's W′	*W′ = 0.442, Pvalue = 0.0516*					*W′ = 0.668, Pvalue = 0.0412*					*W′ = 0.723, Pvalue = 0.0251*				

4.3.3 Key factors of M&E in road construction projects

Following the consensus by experts, both *RII* and average RII (RII_{AV} = 0.841) were computed and used to rank the factors, with those achieving RII > 0.841 were considered key factors in the study (Seninde et al., 2021). The results in Table 2 indicate that C2, C4, C11, C5, C6, C16, C17, C7, C3, C13, C14, and C1 were key factors in the M&E of road construction projects in Uganda.

4.4 Discussion

In this study, 12 factors were revealed as key in M&E ($RII > RII_{AV}$). Understanding these factors is crucial for the success of road construction projects (Issifu & Agyapong, 2023). Adequacy of staff (C2), staff competency (C14), and training of staff (C3) are crucial for M&E staffing. This implies that inadequate staffing, together with the lack of required competency and training, can have negative consequences on project performance. The finding agrees with Bbosa et al. (2023), who found that human capacity is one of the major components in M&E. Adequate time and timely reporting (C4), availability of a reliable information system (C11), and information sharing amongst stake holders (C13) are also vital in M&E. Timely reporting allows the sharing of information about various milestones and deliverables amongst stakeholders to support quick decision-making. It also expedites evaluations for enhanced decision-making and timely planning of subsequent activities and phases. This aligns with existing findings whereby effective information sharing influences project performance (Li et al., 2022). Meanwhile, the lack of a reliable information system can make information sharing by stakeholders difficult, thus resulting in negative consequences that may lead to delays or project failures (Harviainen et al., 2022). Therefore, the M&E team must establish proper communication and information sharing through a reliable information system alongside timely reporting and information sharing amongst stakeholders for quick decision-making. This will support effective planning for subsequent activities and phases of the project (Bbosa et al., 2023).

Other key factors of M&E include record keeping (C5), proper organisation of staff (C16), and effective planning and adequate funding (C1). The findings suggest that the success of a project requires excellent record-keeping for quick referencing, timely reporting, and benchmarking. It aligns with past research, which advocates proper organisation of staff in different ranks, roles, and duties as crucial for a project's success (Irfan et al., 2021). This is because insufficient funding may result in delays, staff misbehaviour, scanty reporting, and discouragement (Mwakajo & Kidombo, 2017). The findings of this study also underscore the use of GIS technology for the effective M&E of road construction projects. GIS involves location-based data collection, processing, and visualisation that is supported by maps to improve communication, accuracy, and efficient data handling for proper planning and decision-making (Akindele et al., 2023). It allows the collection of real-time data through satellite images, drones, planes, sensors, and high-resolution cameras. Past evidence suggests that using web GIS to collect and analyse spatial data offers great benefits to M&E in road construction (Hochmair et al., 2023) as it supports the visualisation of various projects on a geographical scale, thus enabling neighbouring sites to share resources (e.g., expensive equipment) and staff for improved reporting. This will ultimately foster efficient M&E to achieve project success (Whyatt et al., 2022).

Meanwhile, several factors were revealed as important but not key in M&E ($RII < RII_{AV}$), namely project description (C9), feedback (C12), cooperation of M&E staff (C10), IT skills (C15), availability of tools (C8), management support of M&E (C18), availability of equipment (C19), and organisational structure of M&E (C20). Nevertheless, these factors should not be ignored during planning and decision-making as they also exhibit relative importance values. The establishment of key factors in M&E serves as essential knowledge for the success of road construction projects in Uganda, particularly as such studies have been limited on the local scale. These valuable insights shall guide and support concerned stakeholders during the M&E exercise, thus improving project implementation efficiency, M&E risk assessments, optimisation of resources, and effective planning and decision-making. This study also forms a foundation for further research in related areas, such as designing models and frameworks for M&E, regression and spatial modelling in M&E, machine learning, and various artificial intelligence technologies to predict M&E successes and failures at either the planning or implementation stage of road construction projects (Ntulo et al., 2024; Issifu & Agyapong, 2023; Wasike et al., 2023).

5. Conclusions

Delays and failures in road construction projects in Uganda have caused serious challenges, including financial losses, risks and public outcry. Numerous theories and empirical evidence suggest that the issue is largely attributable to inefficient M&E. This study responded to the problem by investigating the key factors of M&E in road construction projects in Uganda. A total of 20 potential factors were identified through a comprehensive literature review and experts' opinions, with the RII highlighting 8 factors that were key in the M&E of road construction projects. Such insights are crucial across all stages of road construction projects, particularly in the planning and decision-making process. Therefore, it is recommended for relevant stakeholders, such as UNRA, to develop M&E guidelines and policies that will enhance the probability and chance of project success. The findings also serve as a foundation for future research to explore other areas, such as the development of models and frameworks to predict the success and failure of M&E in construction projects.

The findings highlight inadequate staffing as one of the hindering factors of M&E in road construction projects. Therefore, UNRA should consider recruiting more staff for its M&E unit to ensure a holistic involvement across all phases and activities of road construction projects. Regular training on technical competency should also be conducted for M&E staff to keep up with rapid technological advancements. Furthermore, UNRA may consider developing M&E guidelines and policies to ensure that M&E reports are generated on time and fully utilised to track projects' progress. This will support timely and evidence-based decision-making, ultimately resulting in project success. Finally, UNRA can explore and make full use of the web GIS technology in M&E activities to support real-time remote data collection, integration, processing, retrieval, and dissemination. This will facilitate information sharing within M&E teams and among stakeholders for quick decision-making.

This study used purposive sampling to form a team of 30 M&E experts, which comprised an equal number of members from both UNRA and contractors. Including other M&E staff with divergent views and insights might benefit the results of this study. Furthermore, the limited generalisability of the Delphi results can be improved in the future through more general quantitative studies with large representative samples, thus widening the scope of the findings.

Acknowledgements
The authors wish to thank the management of Kyambogo University for the provision of financial support to this study. Similar appreciation also goes to the Uganda National Roads Authority for their support and cooperation, and UNRA contractors in the Bunyoro sub-region for allowing us to interact with their staff.

Funding
This work was fully funded by Kyambogo University under Call 8 of the competitive Research Grants.

Declaration of Competing Interest
The authors declare no conflicts of interest.

CRediT Authorship Contribution Statement
Ismail Kamukama (Formal analysis; Project administration; Writing - original draft)
Ismail Wadembere (Resources; Methodology)
Denis Ssebuggwaawo (Conceptualisation)

Availability of Data and Materials
The data supporting this study's findings are available on justified request from the corresponding author.

Ethics Declarations
Although the study did not involve human or animal subjects, it was conducted in accordance with the research policies of Kyambogo University and the organisations.

Generative Artificial Intelligence Declarations
The authors claim that artificially intelligent-assisted technologies in the form of generative AI were not used to generate content, ideas, or theories. We have just utilised AI to enhance readability and refine the language. This was used with extreme human control and oversight. The authors take full responsibility for reviewing and approving the content.

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