Critical Path Identification Techniques and Performance of Relief Projects :- Case of Danwadaag IDP in Mogadishu, Somalia

Ibrahim M Warsame[1], Omollo O. Elijah[2], Oluka M Benjamin[3]

[1]Student and Researcher, Kampala International University (KIU).

[2]Lecturer, Department of Political and Administrative Studies (PhD), Kampala International University (KIU).

[3]Supervisor and Ass. Professor, Department of Political and Administrative Studies (PhD) Kampala International University (KIU)

DOI: https://dx.doi.org/10.47772/IJRISS.2025.90400066

Received: 12 March 2025; Accepted: 25 March 2025; Published: 28 April 2025

ABSTRACT

Project **c**ritical path identification techniques are crucial for ensuring projects and programs are effective by providing data-driven insights to identify areas for improvement, track progress, make informed decisions, demonstrate accountability, and ultimately achieve desired outcomes, all while learning from past experiences to optimize future initiatives. The study investigated the influence of Project Critical Path Identification Technique and the Performance of Danwadaag relief project in Mogadishu, Somalia. The purpose of the study was to examine the effects of Critical Path Identification on the Performance of Danwadaag relief project in Mogadishu, Somalia. The study was anchored on Theory of Change (TOC). The study employed descriptive correlation research design. The study population comprised of 260 participants, from which a sample size of 158 was selected. The study used both qualitative and quantitative techniques to collect data. The data was analyzed using SPSS version 22. The findings indicates that Critical Path Identification (CPI) has a significant positive impact on the project performance. The study concludes that proper implementation of Critical Path Identification is necessary to enhance outcomes, impact and ensure overall performance of Projects. The study recommends that Danwadaag relief project management to integrate project Critical Path Identification (CPI) by involving stakeholders in project path identification to improve project performance.

Keywords: Critical Path Identification, Relief, Outcomes, Impacts, Performance, Project

INTRODUCTION

Projects are routinely conceived and executed to operationalize strategic objectives of organizations. Consequently, global spending on projects is increasing exponentially and the project management profession is experiencing rapid growth (PMBOK, 2008). However, many projects fail to meet expectations and there is no easy solution for enhancing project performance (Anantatmula, 2015). According PMBOK, 2018). A project also can be defined as a temporary endeavor, having a definitive beginning and definitive end, undertaken to create a unique product or service. Organizations regularly execute projects to improve their performance (Zwikael & Meredith, 2019). However, there is still no agreement in the literature on how to evaluate their eventual success (Menkham, 2017). As a result, scholars end up using different scales to measure the same outcome variable of project success, thereby causing inconsistency in research results (Kusek & Rist, 2004). Existing project success evaluation models suffer from their inability to apply to all project types and lack of separation of project success measurement from that of project individuals' performance (Zwikael & Meredith, 2021)).

In Africa, in order to enhance project performance in Africa, it is essential to consider various factors that influence the success and sustainability of projects on the continent (Mgendi, et al,2019). Research indicates that critical path identification and consultation with local stakeholders and institutions are crucial aspects that can contribute to improving project outcomes in Africa (Loor 2005). Addressing challenges related to technology transfer and responsiveness to local demand can further enhance the effectiveness and sustainability of projects (Mgendi et al., 2019). Effective project management is crucial for project success. Improving project management readiness among relief project stakeholders can lead to better project outcomes (Ochungo & Odinga, 2019).

In Somalia, Project performance in Somalia has been a topic of interest in recent studies (Krystof et al, 2011). A study on the determinants of project performance in relief projects in Mogadishu highlighted the importance of understanding factors that influence project outcome like critical path identification (Khan,2001). The factors have significant positive relationship with project performance (Abeyrama, et al, 2009). The project managers should be aware of all factors that can threaten the successful implementation of the project to ensure adequate path identification (Msila & Setihako, 2013). The performance reporting should also be carried out at all stages of the project (Ali, et, al ,2019).

To enhance project performance,it is essential to address various determinants that influence the performance and sustainability of projects in the relief sector (Gosling & Edward,2009). The examination of determinants of project performance of relief projects in Mogadishu highlights the significance of identifying the techniques for monitoring and evaluation (Nyonje et al, 2012). The need to involve good project planning with implementation techniques is critical (Wang & Lii, 2022).

However, challenges faced in project performance include appropriate project monitoring and evaluation techniques (Kezner,2017). Others are weak institutional capacity, resource concerns, and limited technical ability that also pose significant obstacles to project performance in Somalia (Serpe et al., 2022).

Several donors has been actively involved in projects and operations in Somalia conducting country portfolio performance reviews to assess the performance of interventions (Marren,2016). The Government's collaboration with donors in managing the portfolio has not been strong and effective, due the huge capacity gap. (AFDB REPORT,2021).

Past Studies focusing on the performance of relief projects in Mogadishu emphasizes the importance of factors like appropriate monitoring and evaluation techniques (Green & Jennifer, 2016). Others include project planning techniques, communication techniques, risk management techniques, among others (Armstrong & Baron, 2013). Additionally, the impact of insecurity in Somalia has led to the adoption of 'remote programming' or 'remote management' systems by humanitarian actorsb (Marren, 2916). This has affected project implementation and control (Kezner, 2017). Climate variability and associated challenges further exacerbate project performance issues in Somalia, especially when combined with existing conflict and governance limitations (Nicholus & Steyn, 2020).

THEORETICAL REVIEW

The study was anchored on the management theory of constraints. The "management theory of constraints" by Goldratt (cited in Goldratt, 1990). This theory is used by the organizations to improve their control of activities in an effort to achieve the set goals (Goldratt, 1990). The assumption of theory of constraints (TOC) is the presence of constraints within any manageable system such as an organization's monitoring and evaluation system and technique which limits the successful achievement of organization's goal (Watson, Blackstone & Gardner, 2007). A constraint is anything internal or external to the system such as a problem, element or factor that works as a bottleneck to prevent the system from achieving its goal.

According to Blackstone (2001), TOC suggests that in order for organizations to improve its systems goal achievement, the most important limiting factor (constraint) within the system have to be identified and then systematically managed by first determining "what should be changed" and then "how to cause the change". "TOC is a systemic way to identify constraints that hinder system's performance and to effect the changes to remove them" (Goldratt, 1990).

Monitoring and evaluation technique is an action employed by management and the stakeholders to collect data on specified indicators which data is then used to determine the extent of objective achievement including the how the allocated resources have been utilized (Bartle, 2017, Okeyo et al, 2021, Crawford & Bryce, 2023;). Thus, it helps organizations and projects in particular in tracking of inputs, activities, outputs, outcomes and impacts of projects activities and thus helps in determining the worth or significance of a project activity to achieved objectives in terms of efficiency, effectiveness, impact and sustainability (Uitto, 2022; Stufflebeam & Shinkfield, 2017). Thus, M&E technique can be defined as those actions used in acquiring, analysing and making use of information that is affordable, relevant, timely and accurate for performance improvement (Stufflebeam & Shinkfield, 2017).

This study therefore refer to critical path identification technique, critical task scheduling and critical resource allocation. Monitoring is seen as a continuous function that uses a technique,systematic collection of data on specified indicators to provide management and main stakeholders of an on-going organization with indications of the extent of progress and achievement of objectives (OECD, 2022).

The critical path technique (CPT) is a project modelling technique developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley, Jr. of Remington Rand. Kelley and Walker related their memories of the development of CPM in 1989. Richman (2002) defines the critical path as the path through the network that takes the longest total time, and therefore determines the earliest possible time the project can be completed. White (2006) concludes to say that CPT plays more roles than the issue of time completion, it can also be used to monitor and evaluate project activities. Bragadin (2016) noted in his publication on the scheduling assessment of construction projects that, several factors can contribute to the success of construction projects.

Project performance refers to the success or effectiveness of a project in meeting its objectives, delivering its intended outcomes, and satisfying stakeholders' expectations. It encompasses various aspects of project management, execution, and delivery. Performance continues to be a contentious issue in the management research circles (Dubin, 2022). Measuring an organization's performance involves comparing its actual outputs or results with the intended ones (Manzoor et al, 2021). This comparison helps organizations determine if they're achieving what they set out to do.

It is clearly shown that business owners, strategic partners, and managers typically conduct this performance evaluation, and the process includes recognizing and implementing processes that can help improve the company's performance (Richard et al, 2019). Significant reasons managers or business owners evaluate an organization's performance are to justify the use of capital, identify problem areas to direct managerial decision-making, and ensure the effective use of organizational resources. An organization's interpretation of success can vary according to its purpose (Javier, 2022). It can however be asserted that according to Huges (2017), evaluating performance can help organizations improve their processes and procedures. Performance reviews can help projects identify areas of opportunity for improvements and provide insights regarding current employees' capabilities and skills (Mpume, 2017). Thus, learning how to measure and improve an organization's performance can help you leverage your available resources to achieve set goals

Somalia, as an emerging economy, is faced with a countless of project management challenges both technical and managerial sides (Msila, & Setlhako, 2013).. First, there is a shortage of empirical studies on the importance of critical path identification techniques on the project management and performance in Somalia,

thus leaving no documentation on the best practices in that field. Secondly, whereas projects in general have their challenges regarding implementation and consequently success, relief projects in particular are plagued by a unique set of problems and challenges (Ali, A., Dalmar, M., Ali, A. (2019)). Projects can have high performance and success by applying sound monitoring and evaluation techniques, good planning and effective communication techniques, (Marren, 2016). Despite of that, the absence of the factors could also lead the project to fail (Ali, A., Dalmar, M., Ali, A. (2019))

Objective

To examine the effects of critical path identification and the performance of Danwadaag relief project in Mogadishu, Somalia.

LITERATURE REVIEW

Critical Path Identification and project performance

The identification of critical paths is a fundamental aspect of project management, as it directly influences the overall project performance by highlighting the essential tasks that must be completed on time to meet the project's deadlines (Abeyrama,2008, Brignall et al, 2010). The Critical Path Techniques is a widely used in identifying these essential tasks and determining the sequence of interdependent activities that form the longest path in a project, known as the critical path (Kerzner, 2017). This path dictates the minimum time required to complete a project and provides project managers with crucial insights into where delays can occur without affecting the overall project timeline (Klastorin, 2021).

According to Meredith and Mantel (2020), identifying the critical path begins with developing a comprehensive project schedule that outlines all the tasks, their dependencies, and the estimated duration for each task (Cleland & Ireland, 2021). The project manager then applies CPM computations to map out the longest sequence of tasks that directly impact the project's final completion date (Harley & Sorgentrei,2009). This sequence of tasks is referred to as the critical path (Kohli & Chirkara,2008). The tasks on the critical path have zero slack or float, meaning any delay in these tasks will result in a corresponding delay in the entire project (Larson & Gray, 2021). This underscores the importance of properly identifying and managing these tasks to ensure timely project completion (Mackay,2007).

Once the critical path has been identified, project managers can focus their efforts on these high-priority tasks, which are crucial to the project's success (Baniberger, 2010). The critical path method allows managers to allocate resources more effectively, schedule tasks efficiently, and monitor progress in real-time (Nicholas & Steyn, 2022). This focus on the most critical elements of the project helps minimize delays and avoid disruptions that could negatively affect the project's overall performance (Armstrong & Baron,2013).. Moreover, the proactive management of risks associated with critical tasks ensures that potential issues are addressed before they lead to significant delays (Gido et al., 2018).

The continuous review and updating of the critical path are essential for maintaining project performance, especially in dynamic environments where project conditions can change frequently (PMI, 2021). Unforeseen changes, such as resource shortages or unexpected task dependencies, may alter the critical path over time (Alcock, 2014). Therefore, project managers must regularly reassess the critical path and adjust the project schedule accordingly to ensure that any changes are accounted for and that the project remains on track for timely completion (Nicholas & Steyn, 2022).

Furthermore, critical path identification is not just about ensuring timely completion but also plays a role in enhancing the overall quality and performance of a project (. By concentrating on tasks that directly impact project delivery, project managers can enhance both efficiency and effectiveness. This focus allows for better

management of project risks and improved decision-making regarding resource allocation, thus contributing to higher project performance outcomes (Kerzner, 2017). The ability to anticipate potential delays and bottlenecks through the use of CPM ensures that projects are not only completed on time but also within budget and to the desired quality standards (Klastorin, 2021).

The timely and effective identification and scheduling of critical tasks is a vital practice in project management (Okeyo, Ombachi, & Mogusu, 2021). This process allows project managers to ensure that key tasks are completed within the allocated time frame and budget, which is crucial for the overall success of a project (Kerzner, 2017). Critical task scheduling involves recognizing which tasks lie on the critical path, understanding the resources required to complete them, and developing a timeline for their efficient execution (Frankel & Gaga,2011) . Effective scheduling not only enhances the chances of meeting deadlines but also mitigates the risk of cost overruns (Larson & Gray, 2021). When critical tasks are well-managed, project performance improves significantly due to better time management, resource allocation, and risk mitigation (Davis,2014).

One of the most commonly used techniques for critical task identification and scheduling is the Ghantt chart, which provides a visual identification and representation of project tasks, including their dependencies, duration, and timelines (Meredith & Mantel, 2020). These techniques are particularly useful in illustrating how critical path identification tasks depend on one another and how delays in one task may impact the project timeline (Larson & Gray,2020). By using techniques , project managers can easily track progress, adjust task timelines, and reallocate resources as necessary to ensure that critical tasks are completed on time (Goshing, 2022). The Project Management Institute (2021) points out that Gantt charts also provide flexibility in moving start and end dates of tasks, thereby allowing for smoother transitions and resource management when task schedules need adjustments (Marton,2016).

In addition to task identification and scheduling techniques, resource smoothing is an essential element of critical task management (Estrella & Gaventa,2010). Resource smoothing ensures that the demand for resources remains relatively constant over the course of the project, minimizing fluctuations that could cause delays or inefficiencies (Klastorin, 2021). Techniques such as task identification and fragmentation, task swapping, or resource identification and swapping allow project managers to redistribute resources and labor across tasks in a manner that maximizes productivity while keeping the project on schedule (Heerkens & Baker, 2017). This approach ensures that critical tasks receive the attention and resources they need to be completed on time without overburdening certain resources or personnel at specific points in the project (Hogger et al, 2011).

However, effective critical task identification and scheduling is not a static process (.Crips, 2018) Project schedules must be regularly monitored and updated to adapt to changing circumstances. As Nicholas and Steyn (2022) emphasize, projects are often subject to unforeseen challenges such as resource shortages or delays in task completion. These issues require project managers to revisit the project schedule, reallocate resources, and possibly revise task timelines to maintain overall project performance (Okeyo et al, 2021). This process of continuous monitoring and adaptation is crucial for ensuring that critical tasks are completed on schedule, despite the dynamic nature of project environments (Gido et al., 2018).

The importance of critical task scheduling extends beyond simply meeting deadlines; it also plays a central role in improving overall project performance (Okeyo et al, 2021). By identifying the tasks that are most crucial to project success and scheduling them effectively, project managers can prevent bottlenecks, manage risks, and optimize resource utilization (Mackay,2017). Furthermore, the regular updating of the schedule ensures that the project remains aligned with its objectives, even as external conditions change. (Action - aid,2008). This proactive approach to path identification, scheduling and path management ultimately leads to higher efficiency, lower costs, and better project outcomes (Kerzner, 2017).

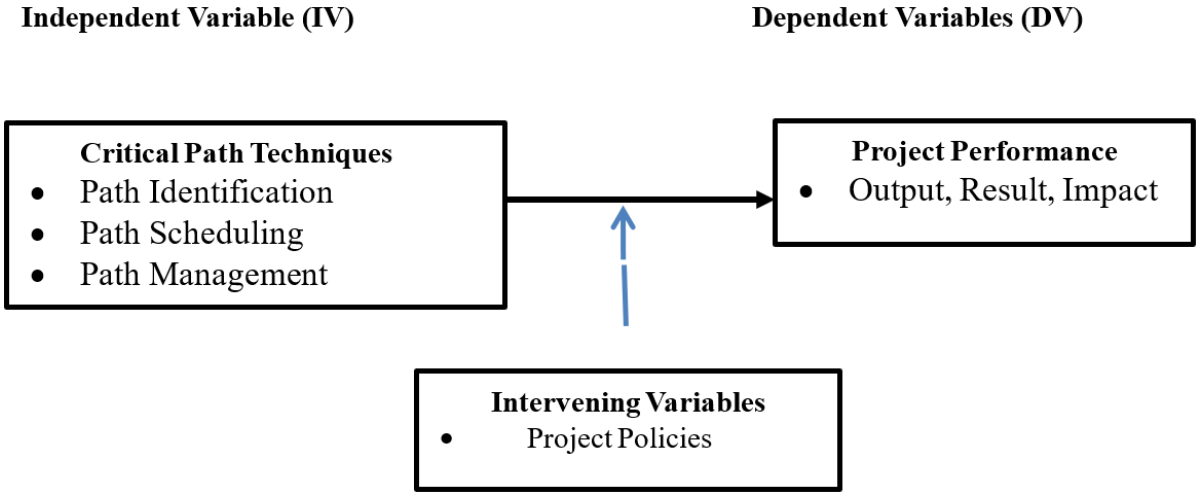

Figure 2.1: Conceptual framework

Source: Researchers, 2024.

RESEARCH METHODOLOGY

The study used a qualitative approach with a descriptive study method, to explain the approaches and methods applied in the form of CPM techniques in a relief project. This is based on efforts to obtain scientific truth (methodologically based) which is based on post-positivism philosophy, so that natural truths are scientifically revealed with the position of the researchers as the key instrument (Sugiyono, 2011). Retrieval of data sources in the form of samples was done possessively. Obtaining data through observation techniques, questionnaires, interviews and document analysis. Research data analysis techniques using data reduction, data presentation and drawing of conclusions.

Research design

The study employed descriptive correlation research design to describes the situation as it is,.and correlation design measured the correlation between the variables.

Target population

The targeted population for this study was 260 Project stakeholders drawn for both internal and external stakeholders, primary, secondary and tertiary stakeholders as guided by to Amin (2005), who avers that a target population is the population to which the researcher ultimately wants to generalize the results.

Sample Size

The sample size from the target population of study was made of 158 respondents , was selected based on a formula for determining Sample size by Yamane, 2010). Respondents are shown in the table below.

Table 1: Sampling Procedure

SN	Category	Population	Sample	Sampling procedure
1	Top authorities of Project organizations managers,	25	15	Purposive sampling
2	Project Organizations staff	20	12	Purposive sampling
3	Project beneficiaries	215	131	Random sampling
	Grand Total	**260**	**158**	

Source: (Primary data,2024)

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue IV April 2025

Data Sources

The Primary data was collected from the respondents through interviews, and self- administered questionnaire. Secondary data included review of project documents and organization policies.

Data Collection Instruments

Questionnaires and Interview guide

The main instrument of data collection was a questionnaire. Self-administered questionnaires were distributed. The questionnaire also aimed at getting responses from the respondents about their views on project performance and how it could be improved. The interview was used to collect data. From top management and authorities. The questions for the interview were both open-ended and closed.

Reliability of instruments

The reliability of the questionnaire was tested using the Cronbach's alpha coefficient. A Cronbach's alpha value of 0.70 and above was considered to be the criteria for demonstrating internal consistency of new scale and established scales respectively.

Data analysis

The quantitative data was analyzed using the Statistical Package for Social Science (SPSS) to generate descriptive and inferential statistics Descriptive analysis was applied to describe the primary variable and associated indicator items related to the study objectives. The frequency and regression analysis was for all the objectives.

Results

Table 2: Response Rate

Research Instrument	**Planned/targeted**	**Actual**	**Percentage**
Questionnaire	131	105	80%
Interview guide	27	23	85%
Total	158	128	
Over all percentage response rate			**81%**

Source: (Primary data,2024)

Table 2 indicate the response rate for both the questionnaire and interview components of the research. Questionnaire: Out of the planned 131 respondents, 105 individuals completed the questionnaire, resulting in an 80% response rate. Interview guide: Of the 27 individuals targeted for interviews, 23 participated, yielding an 85% response rate.

Table 3: Gender Distribution of Respondents

Gender	**Frequency**	**Percentage (%)**
Male	75	71.5
Female	30	28.5
Total	**105**	**100**

Source: (Primary data,2024)

The Table 3 above indicates that (71.5%) were male while (28.5%) were female respondents. This suggests that most respondents were men, reflecting societal beliefs that they are more capable than women in the area of monitoring and evaluation and its impact on project performance.

Table 4: Age Distribution of Respondents

Age category of respondents	**Frequency**	**Percentage (%)**
20-35 years	45	42.8
36-51 years	35	33.3
51 and above	25	23.9
Total	**105**	**100**

Source: (Primary data, 2024)

Table 4 above indicates the ages, (42.8%) were in age ranging 20-35 years. This was followed by respondents aged between 36-51 years with (33.3%) while the minority group was of respondents aged above 51 years with a (23.9%).

Table 5: Education Level of Respondents

Educational level of Respondents	**Frequency**	**Percentage (%)**
Primary level	7	6.7
Certificate	20	19
Diploma Level	22	21
Secondary Level	10	9.5
Bachelor’s Degree Level	36	34.3
Master’s Degree	10	9.5
Total	**105**	**100**

Source: (Primary data,2024)

Table 5 above regarding the data on educational levels indicates that the majority of respondents held a Bachelor degree (34.3%), followed by Diploma (21%), Primary level (6.7%) and Certificate (19%). Those with secondary school education accounted for (9.5%), while Master's degree holders (9.5%). This suggests that most respondents were relatively well-educated, which aligns with the belief that individuals with higher educational qualifications are better equipped to manage tasks related to monitoring and evaluation on project performance

Table 6: Effects of Critical Path Identification on the Performance of project

Effect of the Critical Path Identification on Project Performance,	**Strongly Disagree (%)**	**Disagree (%)**	**Not Sure (%)**	**Agree (%)**	**Strongly Agree (%)**	**Mean**	**Std. Dev**
The overall efficiency of project task scheduling and coordination since the implementation of the Critical Path Identification	3.8	15.4	23.1	37.5	20.2	3.15	1.519
The change in project deadlines and milestones since adopting the Critical Path Identification	1.9	6.7	18.3	46.2	26.9	2.68	1.402
The Critical Path Identification influenced the identification and management of project bottlenecks or critical activities	3.8	7.7	17.3	49.0	22.1	2.74	1.262
The Critical Path Identification has contributed to the overall success of the Project	6.7	7.7	18.3	39.4	27.9	3.55	1.096
Critical Path Identification takes care of all aspects that need to be in place so that there is early detection of progress or lack there of	4.8	9.6	15.4	34.6	35.6	3.89	.944
Average Mean						**3.2**	

Source: (Priamary data,2024)

The findings from Table 6 indicate that Critical Path Identification (CPI) has positively influenced the Project's performance.. The first finding shows that CPI improved task scheduling and coordination, with 37.5% of respondents agreeing and 20.2% strongly agreeing, resulting in a moderate mean score of 3.15 and a standard deviation of 1.519. The second finding highlights that CPI positively affected project deadlines and milestones, with 46.2% agreeing and 26.9% strongly agreeing, leading to a mean score of 2.68 and a standard deviation of 1.402. The third finding reveals that CPI significantly enhanced the identification and management of project bottlenecks, as 49.0% of respondents agreed and 22.1% strongly agreed, producing a mean score of 2.74 and a standard deviation of 1.262.

The fourth findings reveals that CPI contributed substantially to the overall success of the Project, with 39.4% of respondents agreeing and 27.9% strongly agreeing, resulting in a higher mean score of 3.55 and a standard deviation of 1.096. Lastly, the fifth finding underscores that CPI accounted for necessary early detection of project progress, as 35.6% of respondents strongly agreed and 34.6% agreed, achieving the highest mean score of 3.89 and the lowest standard deviation of 0.944. These findings collectively indicate that CPI has had a generally positive impact on the project, enhancing coordination, addressing bottlenecks, and ensuring effective task, resource, and timeline management, with an overall mean score of 3.2 reflecting moderate to strong.

DISCUSSIONS ON THE FINDING

The Critical Path Identification (CPI) significantly enhances the performance of the project, respondents agreed that CPI improves task scheduling and coordination (mean score: 3.15) and positively influences project deadlines (mean score: 2.68). CPI's effectiveness in managing bottlenecks was acknowledged by 49.0% of respondents, with a mean score of 2.74. The overall contribution of CPI to project success had a

mean score of 3.55, while its capability for early detection of project progress achieved the highest mean score of 3.89. These findings suggest CPI is vital for improving task coordination, managing bottlenecks, and monitoring progress proactively, thereby ensuring efficient resource and timeline management and contributing to the success of the project. This findings agrees with (Kerzner, 2017). who suggest that Critical Path Identification helps clarify essential tasks and determine the sequence of interdependent activities or tasks to be a accomplished for the success of the project.. The findings further supports Meredith and Mantel (2020), who avers that identifying the critical path begins with developing project schedule that outlines all the tasks, their dependencies, and the estimated duration for each task. However the finding is contrary to Larson & Gray (2021). who emphasizes that managing the tasks to ensure timely project completion is the key to success of the projects.

Critical path identification is not just about ensuring timely completion but also plays a role in enhancing the overall outcome, impact quality and performance of a project. By concentrating on critical paths that directly impact project delivery, project managers can enhance both efficiency and effectiveness of projects. This focus allows for better management of project outcomes and improved decision-making thus contributing to higher project performance.

CONCLUSION

The study concludes that implementation of Critical Path Identification is necessary to enhance outcomes, impact and ensure overall performance of Projects

RECOMMENDATION

The study recommends that Project management team integrate Critical Path Identification (CPI) by engaging stakeholders in project critical path identification to improve project outcome and performance.

FURTHER RESEARCH

Need for further research to assess the role of technology in enhancing the project critical path identification while focusing on the adoption of project critical path identification management software and digital dashboards in improving project path identification in line with project set performance standards.

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