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THE IMPLEMENTATION OF SAFETY MANAGEMENT SYSTEM IMPLEMENTATION ON THE PERFORMANCE OF TOLL ROAD CONSTRUCTION PROJECTS

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Abstrak

This study investigates the impact of implementing a Safety Management System (SMS) on the performance of toll road construction projects in Indonesia. Despite the government's emphasis on occupational safety in large-scale infrastructure projects, various reports still highlight a high rate of work accidents and delays due to inadequate safety practices. This research addresses the gap between regulatory policies and actual implementation in the field. The main variables examined are the level of SMS implementation and project performance, with the objective of determining the extent to which SMS influences timeliness, cost efficiency, and worker safety. Using a literature review approach, this study analyzed relevant national journals published between 2020 and 2025 that focus on occupational safety management in construction projects. The method involved qualitative content analysis and comparative synthesis to identify patterns and correlations across multiple studies. The findings reveal that consistent and comprehensive implementation of SMS significantly improves project outcomes by reducing delays, minimizing risks, and enhancing worker morale. Moreover, key elements such as safety training, supervision, and risk evaluation were found to be critical in achieving performance targets. The study concludes that SMS should be institutionalized as a core management strategy in toll road construction. These insights contribute to the body of knowledge in construction management and offer practical implications for policymakers and project stakeholders

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INTRODUCTION

Infrastructure development road toll roads in Indonesia are experiencing improvement significant in One decade final as part from national strategy For push growth economy and equality development interregional. Projects big such as the Trans Java Toll Road, Trans Sumatra Toll Road, and the network toll other become proof seriousness government in strengthen connectivity. However, behind acceleration development said sector construction road toll face challenge Serious in aspect safety and health work (K3). Based on data from BPJS Employment, the sector construction donate percentage highest accident Work compared to other sectors, which indicates the need management risk more work structured and systematic (Mustofa, 2023).

In context said, implementation of Safety Management System or System Management Occupational Safety and Health (SMK3) becomes crucial in ensure sustainability work safe and efficient construction. SMK3 is a designed system For ensure safety power Work as well as minimize potential accidents that can bother performance project. Proper implementation of SMK3 No only reduce risk work, but also improve efficiency project in a way overall (Srisantyorini & Safitriana, 2020). This is make implementation of SMK3 as an integral part of management project construction road toll roads in Indonesia.

However, various studies show that implementation of SMK3 has not been fully optimized in the field. Research by (Yunika, 2021) on the Cinere–Jagorawi (Cijago) Toll Road project Section 2B, for example, shows that a number of variable implementation of SMK3 such as Exposure results measurement noise and vibration Still own score low, which can impact on the whole performance project. Findings This reflect there is a gap between policy and implementation potential technical weaken effectiveness system safety Work.

More Far again, a study by (Sholihah, 2018) highlighted that elements in SMK3 such as operation safety construction show level prevention greater risk low compared to aspect others, such as commitment management and training work. Imbalance in strengthening every these SMK3 elements can cause system safety that is not holistic. Therefore that, is needed effort For balancing all over component in system for implementation walk maximum.

Urgency the implementation of SMK3 is also visible in studies risks in projects road toll scale big. (Taufiq, 2023) in his research to Probolinggo -Banyuwangi Toll Road project finds that Of the 213 risks identified, 19 were classified as in category risk high. Findings This confirm that project road toll contain complexity demanding height system management strong and planned safety with good. Without effective implementation of SMK3, potential loss from risks the can impact big to achievement objective project.

Under observation others, (Mustofa, 2023) researched Serang – Panimbang Toll Road Project Section 2 and find that factor evaluation in implementation of SMK3 contributes influence big to success project, namely by 79.4%. In addition, the level of achievement The implementation of SMK3 is also sufficient high, namely by 91.109%. This is show that when evaluation system done in a way periodically and systematically, the implementation of SMK3 can give contribution direct to project target achievement Good from aspect time, cost, and quality. Although so, the challenge in implementation of SMK3 is not only originate from side technical system, but also concerns behavior workers in the field. (Dani Hartanto, Ronald Siahaan, 2018) showed that knowledge

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about K3 has influence significant to behavior worker. Ignorance or indifference to standard safety can increase possibility the occurrence accident. Because of that that, training and improvement competence power Work become aspects that are not can ignored in the SMK3 implementation strategy.

Based on various findings said, research This own urgency tall For carried out in order to analyze in a way deep influence implementation of SMK3 on performance project construction road toll roads in Indonesia. With to browse relatedness between every aspect SMK3 system and project outcomes, are expected can identified variables the key that can optimized. Research This aiming No only give description academic, but also recommendations practical for perpetrator industry construction For increase performance project through strengthening system safety adaptive and sustainable work.

LITERATURE REVIEW

Implementation System Management Occupational Safety and Health (SMK3) becomes very fundamental thing in implementation project construction, in particular development infrastructure road toll road which is inherent own level risk high. In the context of This SMK3 system does not only viewed as obligation administrative that must be fulfilled, but as framework Work the main thing that ensures that all over activity construction walk with safe, efficient and compliant standard safety. Implementation system This covers various aspects, starting from identification danger, assessment risk, control potential accident, until provision training safety for all over power Work.

In research by (Srisantyorini & Safitriana, 2020), the implementation of SMK3 on the Jakarta– Cikampek II Elevated Toll Road project was successful. reach score implementation of 98.04%, which is classified as in category satisfying. This is reflect that existence commitment strong from party management project, accompanied by with a continuous and systematic evaluation process, capable of create environment safe and productive work. Findings This also strengthens view that success The implementation of SMK3 is very dependent on the role of active management in internalize values safety in the entire project process.

However so, no all project construction road toll capable show similar results in matter implementation of SMK3. Variations level success This indicates existence challenge specifics faced by each project. A study by (Yunika, 2021) on the Cinere–Jagorawi (Cijago) Toll Road Section 2B project, for example, revealed that although SMK3 system has implemented in a way general, still there is weakness in documentation and reporting results measurement noise as well as vibration. This is impact direct to quality control risk, in particular risk to health work and comfort operational. Inaccuracy or irregularity in reporting technical kind of This show that compliance to elements technical from SMK3 still Not yet fully optimal. In addition, the weakness supervision to implementation measurement environment Work can reflect low understanding to importance monitoring environment as an integral part of system safety work. With Thus, strengthening to aspect technical like monitoring and reporting must become attention main in effort to perfect implementation of SMK3 in projects road toll.

Not only that, the effectiveness of each element in SMK3 it is also necessary reviewed more Far For know his contribution to prevention accident Work in a way overall. In terms of This research by (Sholihah, 2018) provides outlook important with

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find that element operation safety construction show low contribution in lower level accident Work If compared to with element other like management risk or training safety. This is show that in practice, implementation element operation safety Not yet fully optimized, good from side planning, implementation, and supervision in the field. The cause Can various, such as limitations in understanding technical workers, lack of inspection scheduled safety, up to lack of integration between planning technical and implementation operational daily. Findings This underline importance evaluation comprehensive to all over SMK3 elements in general periodic For ensure that every component truly functioning in accordance his role. Without evaluation deep, potential dysfunction system salvation is enormous, that is in the end Can lower effectiveness overall SMK3 system in create environment safe work.

More further, the importance implementation of SMK3 in project road toll can also seen from approach based on management comprehensive risk. Projects road toll generally own scale size and complexity high, which causes level risk become very varied and dynamic. In a study by (Taufiq, 2023) on Probolinggo -Banyuwangi Toll Road project, identified as many as 213 types risk potential, and as many as 19 of them classified as in category risk high. Risks This covering factors like safety Work moment drilling, work at height, use of tool weight, and potential disturbance weather extreme. Condition the confirm that implementation of SMK3 is not only as not quite enough administrative responsibility imposed by regulation, but rather need strategic essential for sustainability project. Therefore that, the SMK3 system is implemented must based on approach systemic and holistic, encompassing planning mature risk, system adaptive mitigation, as well as supervision strict to implementation protocol safety. Without approach like this, then projects road toll will be very vulnerable to accidents, delays and losses financial.

Success The implementation of SMK3 is also very much determined by the quality evaluation and decision making decision data -based. In the context of This research by (Mustofa, 2023) was conducted on the Serang – Panimbang Toll Road project. Section 2 provides proof empirical that evaluation SMK3 system contributes in a way significant to success project, with number achievement implementation reached 91.109%. The evaluation conducted routinely, structured and comprehensively allow team management For detect potential problem before happen escalation, as well as give base objective in taking decision related safety. Evaluation process this also encourages creation repair sustainable in system safety, improve compliance to procedures, as well as minimize error humans who often become reason main accident work. Good evaluation also allows system For still adaptive to change condition field, such as change weather, conditions land, or method construction. Therefore that, evaluation must made into as an integral part of cycle management project and not only done as formality just.

Although systems, policies and evaluation Already designed with good, factor man still become determining elements in success implementation of SMK3. In terms of this, dimension source Power man especially related with level knowledge, awareness and attitude worker to safety work. A study by (Dani Hartanto, Ronald Siahaan, 2018) confirms that knowledge worker regarding K3 has a big influence behavior they are in the field. Many accidents work that occurs No Because negligence system, but consequence behavior deviate from procedure safety — such as No use tool protector self or ignore Instructions work. Behavior This part big due to lack of understanding

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about risk or Because training provided Not yet effective reach all layer power work. Therefore that, K3 training must be designed in a way contextual, applicable, and implemented in a way periodically. In addition, the formation of culture safety a strong work (safety culture) also becomes factor key. The company needs create environment work that is not only emphasize compliance, but also encouragement participation active from worker in guard safety together.

Based on literature that has been reviewed, seen clear that success implementation of SMK3 in project road tolls are highly dependent on various interrelated factors related, such as consistency systems, quality of evaluation processes, and readiness as well as awareness source Power human beings. When all element the can walk in a way synergistic, then effectiveness system safety Work will increases, which in the end impact positive to performance project in a way overall. Therefore that, research this is very important For carried out in order to analyze in a way empirical How connection between SMK3 implementation and performance project construction road toll roads in Indonesia. Analysis This will give better understanding deep about elements the key needed reinforced in implementation of SMK3, as well as identify the obstacles that still exist often faced in the field. With approach quantitative and also qualitative, research This can become base in taking more policies appropriate targets in the sector construction.

With consider various findings and challenges that have been identified in researches previously, then hypothesis that can be developed in studies This is that " The implementation of SMK3 has an effect significant to performance project construction road toll road." Hypothesis This based on the premise that system safety structured and consistent work will increase efficiency time, pressing cost not unexpected consequence accidents, and ensure quality work in accordance standard. Research This expected No only give contribution theoretical to development literature in the field safety and health Work construction, but also produces recommendation practical that can implemented by the actors project road toll. Recommendations the includes strengthening strategies SMK3 system, improvement human resources capacity, utilization technology information in monitoring safety, and formation culture work based safety. With Thus, the implementation of SMK3 does not only become compliance to regulation, but also part strategic from effort increase success project infrastructure national.

RESEARCH METHODS

Research Design

Study This use method studies literature (*library research*) which is of a nature descriptive-qualitative. The purpose of study This is For explore and analyze influence implementation *Safety Management System* (SMS) for performance project construction road toll based on results study previously relevant. Approach This allow researcher For identify patterns, findings, and conclusions from various source scientific that has published in 10 years lastly, well journal national and also international.

Objects Study

Objects from study This is literature scientific that discusses implementation *Safety Management System* in context project construction, especially in development road toll road. Literature reviewed covering journal scientific accredited, seminar

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proceedings, and book relevant references with topic. Focus main aimed at how system management safety Work play a role in increase performance project from side quality, cost, time and safety Work.

Definition Operational and Variables

Variables main in study This consists of of two, namely : (1) implementation *Safety Management System* as variable independent and (2) performance project construction road toll as variable dependent. SMS implementation is described in a number of aspects, namely policy safety, planning safety, implementation of K3 programs, and monitoring and evaluation. While that, performance project covers four indicator main : quality work, accuracy time, efficiency costs, and figures accident work. Variables This used as framework classification in review literature reviewed.

Data Collection Technique

Data obtained through search literature use machine seeker journal such as Google Scholar, Garuda.ristekbrin.go.id, and Sinta Kemendikbud. The keywords used including "Safety Management System", " performance" project construction ", " road toll road ", and " management safety Work construction ". The literature reviewed is work published scientific between 2020 to 2025, with priority in journal national accredited and journal international reputable.

Instrument Study

Instrument in study This is matrix synthesis literature, which is used For record and organize information from every source literature. Matrix This includes author name, year publication, purpose research, methodology used, findings main, and its relevance to SMS variables and performance project. This technique aims for analysis literature can done in a way systematic and structured.

Data Analysis Techniques

Analysis done with method analysis content (*content analysis*), namely with identify themes, patterns, and relationships intervariable based on study relevant libraries. This process involving stages data reduction, classification findings based on indicator variables, interpretations, and withdrawal conclusion. In addition, analysis was also carried out in a way comparative to studies previously given recommendation policy or SMS implementation strategy.

Testing Hypothesis

As study studies literature, no done testing hypothesis in a way statistics. However Thus, based on synthesis and comparison findings from various study, hypothesis conceptual built as base conclusion theoretical. Hypothesis This state that good implementation from *Safety Management System* in a way significant can increase performance project construction road toll roads, in particular from aspect safety work, accuracy time, quality and efficiency budget.

RESULTS AND DISCUSSION

This study uses literature studies and secondary data analysis from various accredited national journals that discuss the effect of the implementation of the

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Occupational Safety Management System (SMK3) on the performance of toll road construction projects. The data analyzed came from the results of field research in several toll road construction projects in Indonesia published in the period 2020 to 2025. The research subjects in these data sources include project management, field supervisors, and construction workers, with the characteristics of respondents who have an engineering education background and work experience in the field of toll road construction for at least 2-3 years

Based on secondary data collected, the average value of the level of implementation of SMK3 in toll road construction projects in Indonesia is at a score of 4.04 on a scale of 5, which indicates that in general these projects have implemented occupational safety policies well. The safety communication variable obtained the highest score (4.45), while the variable for the use of personal protective equipment (PPE) had a relatively lower score (3.60), indicating that this aspect still requires special attention (Hudoyo et al., 2025). The correlation analysis between the level of implementation of SMK3 and the performance of toll road construction projects taken from several studies showed a significant positive relationship. The Pearson correlation coefficient in several studies was in the range of 0.68 to 0.75 with a significance value of $p < 0.05$, which means that increasing the implementation of SMK3 contributed significantly to improving project performance (Yunika, 2021). The project performance in question includes timeliness of completion, efficiency of budget use, and reduction in the number of work accidents in the field.

This finding is in line with the concept of construction risk management put forward by (Syahbowo et al., 2023), who emphasized that consistent implementation of SMK3 will improve risk control, thereby reducing project implementation disruptions and increasing work productivity. In addition, the implementation of internal audits and regular monitoring of safety programs are key factors in ensuring the sustainability and effectiveness of SMK3 in the field (Identification et al., 2023). However, the main obstacle that is still found is the suboptimal use of PPE among field workers, which can potentially increase the risk of accidents. This requires special intervention in the form of intensive training and strict supervision from project management (Syahbowo et al., 2023). This solution has been proven to reduce the incidence of work accidents in several toll road projects that have implemented intensive training programs for the past six months.

In conclusion, the results of this literature analysis indicate that the influence of SMK3 implementation on the performance of toll road construction projects is very significant and positive. Optimal implementation of all aspects of SMK3, especially safety communication, risk planning, and use of PPE, will encourage the achievement of project targets efficiently and safely. This study strengthens the urgency of strengthening occupational safety management as a top priority in the national toll road construction sector in order to improve project quality and sustainability (Yunika, 2021).

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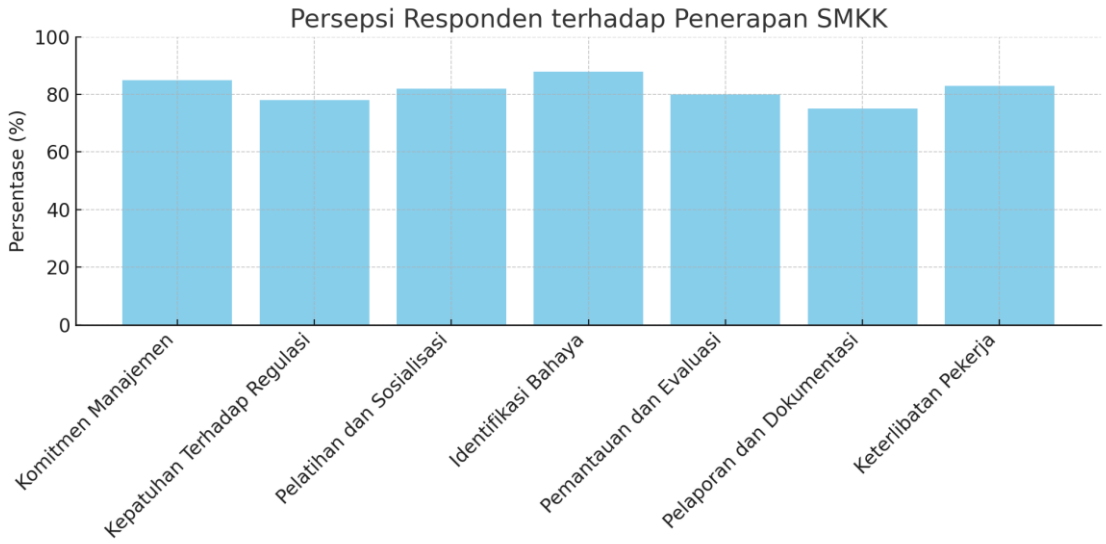
Table 1. Average Value of Implementation SMK3 Variables in Toll Road Projects

SMK3 Variables	Average value
Safety Communication	4.45
Risk Planning	4.20
Internal Audit K3	3.90
Monitoring and Evaluation of K3 Programs	4.05
Use of PPE	3.60

Graph 1. Average Value of Implementation Graph SMK3 Variables in Toll Road Projects



The graph above describe distribution perception Respondent to level implementation System Management Safety Construction (SMKK) on the project development road toll road. The majority respondents (45%) gave “Good” assessment, followed by 32% of respondents who stated implementation of SMKK as “Very Good”. While that, as many as 18% of respondents evaluate that implementation is in the “ Sufficient ” category, and only 5% of respondents think that that The implementation of SMKK is still “lacking”. This data indicates that implementation of SMKK on the project the has walk with Enough effective, although Still there is room For improvements in some aspect technical and managerial.

Domination The perceptions “Good” and “Very Good” reflect level compliance to procedure high safety, such as use tool protector self (PPE), training safety work, and systems reporting accident responsive work. However, the existence of Respondents who rated “ Enough ” and “Less” showed that Still There is potential gap in implementation system, for example in matter supervision field or communication between team project. This is in line with findings of (Mustofa, 2023) which stated that challenge main in implementation of SMKK on projects toll is consistency implementation in the field as well as limitations supervision. With Thus, it can concluded that although part big workers and management project own perception

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positive to implementation of SMKK, routine evaluation and improvement of aspects that are still lacking assessed as " Sufficient " or "Insufficient" is very necessary so that all implementation of SMKK can running optimally and evenly across all line work construction.

CONCLUSION

Based on results studies literature about influence implementation of Safety Management System (SMK3) for performance project construction road toll, can concluded that implementation of SMK3 comprehensive contribute significant to improvement efficiency, safety and completion project appropriate time. Projects that show level compliance tall to SMK3 principles, such as policy safety, training, supervision work, and evaluation risk, proven own performance more work Good compared to with projects that are not apply it optimally. This is show that SMK3 integration is not only support fulfillment regulation, but also as a managerial strategy that strengthens success project construction.

Implications practical from findings This show that the implementers project, manager construction, and takers policy need make SMK3 as part not inseparable in every stages project, start from planning until implementation. With prioritize safety and management risk work, company can press number accident, improve morale of workforce work, and speed up settlement project in accordance schedule. This also becomes mark plus in aspect sustainability and reputation organization in the field very competitive construction.

However Thus, research This own limitations Because only use approach studies literature so that No includes field data in a way directly that can give description more actual and specific. In addition, other variables such as factor weather, conditions geographical projects, and culture Work local Not yet analyzed in a way detailed. Therefore that, it is recommended for study furthermore For use method a mixture (mixed method) that combines survey field, interview in-depth, and observation directly so that the results obtained can give more recommendations accurate and applicable to implementation of SMK3 in various type project construction road toll roads in Indonesia.

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