The Influence of Construction Safety and Government Policies on Work Productivity of Flyover Projects

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Abstract

Safety at work is a very important aspect of a flyover construction project. Flyovers involve working at height and with a high risk of falling. Lack of safety factors can cause serious accidents or even death of workers. In an unsafe work environment, workers tend to exercise caution and slow down to reduce risk. This can result in a significant decrease in work productivity. On the other hand, when safety in the workplace is well cared for, workers will feel safe and are motivated to work efficiently, so that productivity increases. The purpose of this study is to analyze the work productivity model of the Flyover bridge construction project which is influenced by government policies related to construction safety on the work productivity of the Flyover construction project. Surveys have been conducted on several bridge construction projects in Palembang City, South Sumatra Province, INDONESIA. The number of respondents in this study was 35 respondents. Data collection techniques were carried out through distributing questionnaires and in-depth interviews. The results showed that construction safety consisted of indicators of physical health, mental health, emotions, preventive efforts, and curative efforts. These five indicators can minimize the risk of accidents or occupational diseases. Workers can complete their work on time with minimal work accidents, meaning that construction safety can affect work productivity. Government policies in the form of laws, government regulations, ministerial regulations, ministerial decrees, and director general decisions can be used as guidelines or references by companies in protecting worker safety so as not to hamper productivity at work.

Keywords
the construction project, construction safety, Government policies, work accidents

1. Introduction

Construction projects are a series of implementation processes that have certain time, goals, and resources, ranging from planning, implementation, and post-construction maintenance activities, the series of activities there is a process that processes project resources into a type of building/construction. These resources have been arranged in a project organization to complete based on time, cost, and quality in accordance with specifications and predetermined quality standards (Cheung et al., 2004). Low productivity is often caused by a lack of good planning before starting a project. If there is no adequate planning, there may be delays, discrepancies in resource allocation, or shortages of necessary materials (Lessing et al., 2017).

The number of accidents on construction projects in Indonesia is the highest compared to its kind sector (industrial sector), the fact states that work accidents (in general) in Indonesia are number 52 out of 53 countries surveyed and the highest of 27 countries with an average of 40 per 100,000 workers per year. As for the construction sector, it increased by 32%. The implementation of construction projects is very prone to the risk of work accidents and occupational diseases (Lemos et al., 2022; Lingard & Rowlinson, 2004; Supriyatna et al., 2020). Open work areas, the influence of climate, weather and work environments that can be said to be dense with tools, workers, and materials can make these risks unavoidable. Other factors such as tending to ignore work safety standards, or the selection of inappropriate work methods can also make existing risks even greater. The occurrence of work accidents and occupational diseases can make the work productivity of workers decrease (Katsuro et al., 2010; Piedrahita, 2006).

The implementation of the Construction Safety Management System (SMKK) certainly requires a benchmark for performance appraisal as an internal and external audit in the form of construction safety performance assessment as a form of project supervision and control in order to provide information on the extent of the implementation of the construction safety management system in the project and spur project implementers to provide safety assurance for workers, the public and the environment so that potential hazards / risks can be reduced as much as possible. Likewise, the role of government policy in the form of regulations in minimizing construction accidents. Several efforts to prevent work accidents can be done, among others, through making laws and regulations and supervision. Rules and regulations are binding provisions for order to occur (Coglianese & Lazer, 2003). The purpose of this study is to build a model of government policy related to construction safety and work productivity of flyover construction projects (Marbun, 2020; Tam et al., 2004).

Bridge construction projects involve various parties, including contractors, consultants, project owners, and governments. Lack of coordination between relevant parties can lead to disruption in the flow of work, confusion regarding responsibilities, and loss of valuable time. If the workforce involved in the project does not have enough skills or knowledge, then labor productivity will be low. Inadequate training or shortage of skilled labor can lead to decreased efficiency and productivity (Cattaneo et al., 2016; KARADAĞ, 2016; Kyvik & Aksnes, 2015; Ogunsiji, 2002; Peters, 1997). A slow and complicated permitting process can cause delays in starting projects or temporary outages of work. If permits are not obtained quickly, projects can stall or face obstacles that affect work schedules and productivity (Coglianese & Lazer, 2003).

Safety in the workplace is a very important aspect in flyover construction projects. Overpasses involve work at high altitudes and with a high risk of falling. Less safety factors can lead to serious accidents or even death of workers. In unsafe work environments, workers tend to be cautious and slow down work to reduce risk. This can result in a significant decrease in work productivity. Conversely, when workplace safety is well considered, workers will feel safe and motivated to work efficiently, resulting in increased productivity. Government policies also have a dominant influence on work productivity in flyover construction projects. Good and supportive policies, such as adequate resource provision, prompt licensing, and a clear regulatory framework, can improve project efficiency and productivity. Conversely, inconsistent policies, excessive bureaucracy, and ambiguous regulations can hinder project progress and reduce work productivity. In addition, government support in terms of project financing, investment in infrastructure, and procurement of skilled human resources also plays an important role in increasing work productivity (Grimsey & Lewis, 2007; Mukherjee, 2018; Schneider et al., 2006).

The aim of research examining the effect of construction safety and government policies on the work productivity of flyover projects is to provide a deeper understanding of how these factors interrelate and impact the outcomes of key infrastructure projects. This research will identify construction safety factors that can increase or hinder work productivity in flyover projects. Assess the extent to which government policies affect construction safety practices and, as a result, how these affect work productivity on the project. The novelty of this research lies in a cross-disciplinary approach that combines aspects of construction safety and government policy in the context of work productivity on flyover projects. In scientific literature, research that specifically combines elements of construction safety, the influence of government policies, and work productivity in the context of infrastructure projects has not

been widely found. Therefore, this research makes a valuable contribution in understanding the complexity of the factors that influence the success of important construction projects such as overpasses.

2. Literature Review

2.1. Goal Setting Theory

Goal setting theory states that setting clear, specific, challenging, and measurable goals can improve individual or team motivation and performance. Setting clear and specific goals related to work productivity on flyover projects can increase worker motivation and focus. For example, productivity goals may focus on specific production volume targets or completion time targets. By having clear goals, workers will have firmer guidance on what to achieve and be able to direct their efforts more effectively. Involving workers or teams in the goal-setting process can increase their engagement and commitment to goal achievement. In the context of this study, involving stakeholders, such as contractors, consultants, and workers, in setting productivity goals can motivate them to actively participate in achieving desired results. Providing feedback related to achieving goals is an important component in goal setting theory. Providing timely and relevant feedback on work progress toward achieving productivity goals can help maintain motivation and improve performance. This feedback can also help workers gauge how far they have achieved goals and make adjustments if needed (David & David, 2017).

2.2. Construction Safety

Setting clear and specific safety goals is an important first step in creating a safe working environment on a bridge construction project. Specific safety objectives such as achieving zero accident rates or lowering accident rates to below a certain threshold can provide clear guidance for the entire project team in the effort to achieve a safe work environment. A commitment to safety goals is key to creating a safe work environment. Stakeholders, including contractors, consultants, and workers, need to actively accept and commit to established safety objectives. This includes the adoption of safety practices, adherence to safe work procedures, and the adoption of a proactive attitude towards accident prevention (Batra & Hyde, 2020; Lingard & Rowlinson, 2004; Supriyatna et al., 2020; Tam et al., 2004).

Goal setting theory also emphasizes the importance of measuring and monitoring the achievement of goals. In the context of construction safety in bridge construction, it is important to conduct regular monitoring of accident rates, safety incidents, and compliance with safety procedures. Through this measurement and monitoring, areas that require improvement can be identified and corrective actions taken as needed to achieve the safety objectives set. Relevant and timely feedback related to achieving safety objectives is important in creating a safe working environment. Feedback can be used to reward actions that are consistent with safety practices, as well as identify and correct behaviors or situations that could potentially compromise safety. Awards or incentives can be given in recognition of achieving significant safety objectives, which can reinforce commitment and motivation to maintain safety in the workplace. Through specific goal setting, strong commitment, participation and involvement of all stakeholders, and appropriate measurement and feedback, a positive safety culture and increased productivity on construction sites can be created.

2.3. Government policy

Government policy is essentially a policy aimed at the public in the broadest sense, whether it is carried out directly or indirectly, which is reflected in various dimensions of public life (Cheung et al., 2004; Lemos et al., 2022; Lingard & Rowlinson, 2004; Schneider et al., 2006; Supriyatna et al., 2020). While the Government Policy regarding construction safety is all engineering activities to support construction work in realizing the fulfillment of security, safety, health and sustainability standards that ensure the safety of construction engineering, labor safety and health, public safety and the environment (PUPR Regulation No.10 of 2021).

Government policies can be designed and implemented with a more structured and measurable approach (Bae & Yoo, 2015). With clear goal setting, strong commitment, preparation of action plans, periodic measurement and monitoring, and related feedback and evaluation, government policies can achieve desired results and increase

effectiveness in achieving established social, economic, or environmental goals. It is important for governments to have a strong commitment to the policy objectives set. Within the framework of goal setting theory, this commitment includes the government's commitment to allocate the necessary resources, adopt a consistent policy approach, and ensure continuity of efforts in achieving the goals that have been set.

Government policies related to infrastructure can include budget allocation, planning, and management of bridge construction. This policy can set priorities for infrastructure development, direct resource allocation, and establish a regulatory framework that governs the construction process and supervision of bridge projects. Government policy in the field of transportation has direct implications for bridge construction. This includes transportation network planning, tariff policy setting, regulations related to traffic and road safety, and policies related to bridge operation and maintenance. Government policies in terms of construction can influence the construction of bridges through technical regulations, construction standards, contractor qualification requirements, auction procedures, and project supervision. This policy can help ensure that bridge construction is carried out with high quality standards, good efficiency, and complies with construction safety requirements. This policy creates a framework that affects aspects such as planning, financing, supervision, and environmental protection in the context of bridge building (Brown & Mazzarol, 2009; Grimsey & Lewis, 2007; Gultom et al., 2020; Moon & Sproull, 2001).

2.4. Work Productivity

Effective planning is one of the important elements in increasing work productivity in flyover projects. Good planning includes proper identification and allocation of resources, realistic scheduling, accurate calculations, and efficient organization. With careful planning, work can be carried out systematically, reducing wasted time, and minimizing the risk of failure. The qualifications and expertise of the workforce also play an important role in the productivity of work on flyover projects. Skilled and experienced workers in overpass construction have the proper knowledge and skills necessary to carry out tasks with efficiency and accuracy. Good training and competency development also contribute to higher work productivity. Efficient project management involves good coordination between project teams, monitoring progress, and making timely decisions. Effective project management can identify and overcome obstacles that may arise, optimize the use of resources, and manage risks well. With good project management, work productivity can be increased (Cattaneo et al., 2016; Darr et al., 1995; Hossain, 2018; KARADAĞ, 2016; Katsuro et al., 2010; Kyvik & Aksnes, 2015; Ogunsiji, 2002, 2010; Peters, 1997).

3. Methods

The research method used in this study is a quantitative descriptive method that aims to see the influence between independent variables on dependent variables. The analytical method used in this study is quantitative descriptive. Research instruments are developed from operational definitions as in Table 1.

Table 1. Variable Operational Definition

Variable	Variable Concept	Indicator	Scale
Construction Safety (CW)	All engineering activities support construction work in realizing the fulfillment of security, safety, health and sustainability standards that ensure the safety of construction engineering, labor safety and health, public safety and the environment. (Permen PUPR No.10 Tahun 2021)	1. Physical health 2. Mental health 3. Emotion 4. Preventive Efforts 5. Curative efforts	Ordinal Ordinal Ordinal Ordinal Ordinal
Government Policy (GP)	A set of measures chosen by the government that have important influence on large numbers of people.	1. Government Programs 2. Government Targets 3. Government Planning 4. Government Implementation 5. Government Evaluation	Ordinal Ordinal Ordinal Ordinal Ordinal
Work Productivity (WP)	A concept that shows the relationship of output with the input needed by a workforce to produce a product.	1. Job Education and Training	Ordinal Ordinal

	2. Working Environment Conditions	Ordinal
	3. Diversity and Work Support Facilities	Ordinal
	4. Job Satisfaction	

4. Data Collection

The population in this study is *workers* of the Sekip Ujung Palembang Flyover, INDONESIA which amounts to 100 workers. Questionnaires have been distributed to 100 workers, but there are 35 data that are returned and can be processed. The low rate of return of this questionnaire is due to the very limited research time and limited workers answering the instruments distributed.

5. Results and Discussion

5.1 Description of Respondents

The survey has been conducted on 35 respondents of flyover project workers in Palembang City, South Sumatra Province, Indonesia. The characteristics of respondents in this study are presented in Table 2.

Table 2. Characteristics of Research Respondents

Characteristic	Category	Number (of people)	Percentage (%)
Gender	Male	30	85,71 %
	Female	5	14,29 %
Age of Respondents	21-30	10	28,58 %
	31-40	20	57,14 %
	41-50	5	14,28%
Education Level	SMA	3	8,57 %
	D3	7	20 %
	S1 / S2	25	71,43 %

Table 2 shows that most respondents were predominantly male (85.7%), respondents' age was mostly between 31-40 years old (57.14%), and their education level was mostly undergraduate (71.4%).

5.2 Testing using *Structural Equation Modelling* (SEM)

Structural Equation Modeling (SEM) is a statistical modeling technique that is very cross-sectional, linear, and general, including factor analysis, path analysis, and regression analysis. SEM is also a multivariate analysis technique used to build and test statistical models that are usually in the form of causal models. In contrast to PLS which is an alternative method of analysis with variance-based SEM. Research methods experts group SEM into two approaches. The first approach is referred to as Covariance Based SEM (CBSEM) and the other approach is Variance Based SEM better known as (Partial Least Square / PLS). In this study, hypothesis testing used the Partial Least Square (PLS) analysis technique with the Smart PLS 3 program. The inner model, commonly called the influence test and hypothesis test (bootstrapping) aims to predict the relationship between latent variables by looking at the probability value and t-statistics. The following are the results of the outer model test, inner model, and hypothesis test (bootstrapping) with the SmartPLS3 program (Gunarto, 2018).

5.2.1 Construct Testing (*Outer Model*)

The results of the evaluation of the measurement model to see the validity and reliability of the research instrument use convergence in validity with the loading factor, namely PLS Algorithm outer loadings (Figure 1).

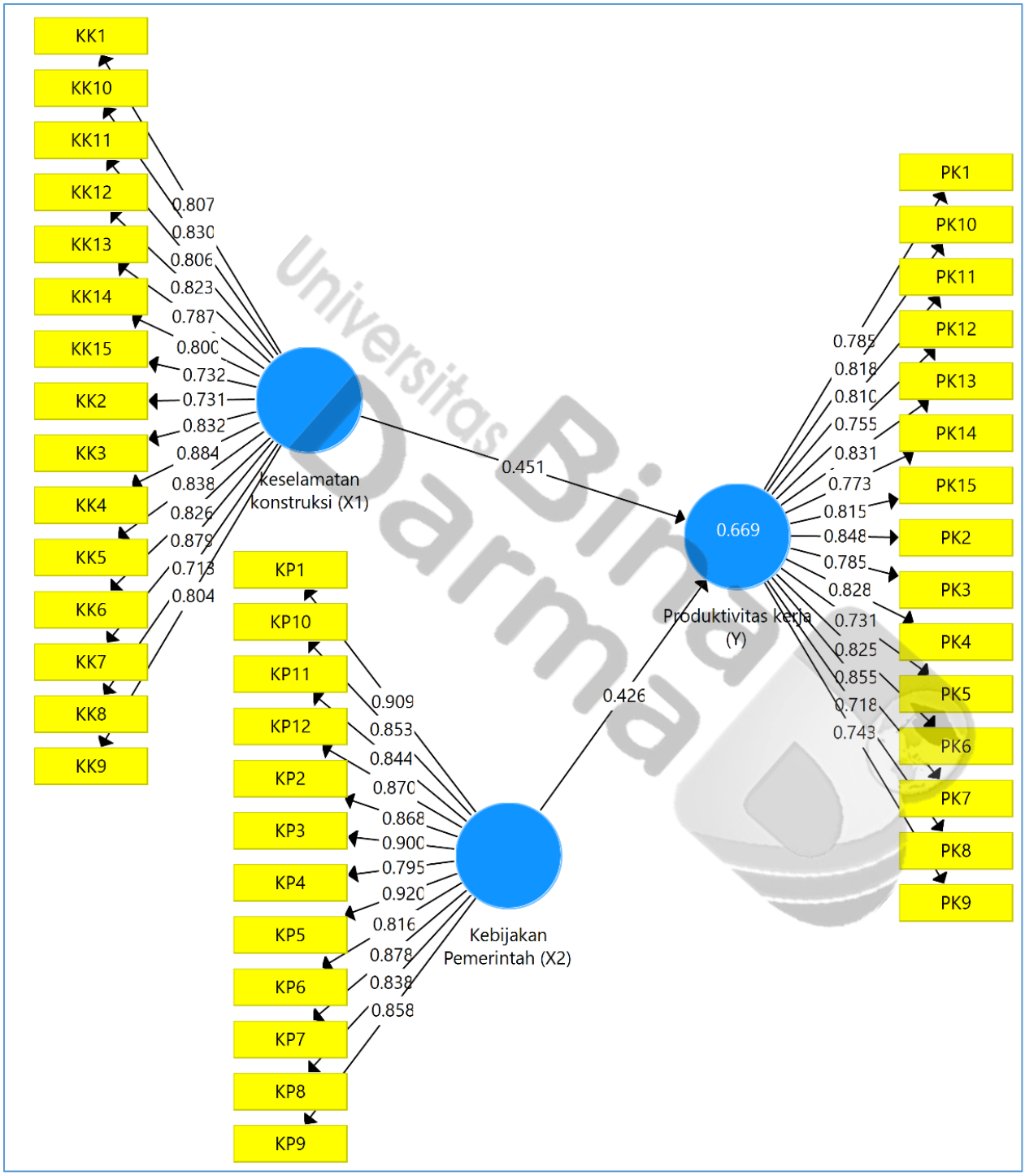

Figure 1. Measurement model estimation results

a. *Convergen Validity*
Loading factor value, outer loading factor criterion with a value of ≥ 0.7. To measure the variables of this study, and from the results of outer loading obtained the following data.

Tabel 3. Nilai Loading Factor pada Model Pengukuran

Indicator	Kebijakan Pemerintah (X2)	Work productivity (Y)	Construction Safety (X1)
KK1			0,807
KK10			0,830
KK11			0,806
KK12			0,823
KK13			0,787
KK14			0,800
KK15			0,732
KK2			0,731
KK3			0,832
KK4			0,884
KK5			0,838
KK6			0,826
KK7			0,879
KK8			0,713
KK9			0,804
KP1	0,909		
KP10	0,853		
KP11	0,844		
KP12	0,870		
KP2	0,868		
KP3	0,900		
KP4	0,795		
KP5	0,920		
KP6	0,816		
KP7	0,878		
KP8	0,838		
KP9	0,858		
PK1		0,785	
PK10		0,818	
PK11		0,810	
PK12		0,755	
PK13		0,831	
PK14		0,773	
PK15		0,815	
PK2		0,848	
PK3		0,785	
PK4		0,828	
PK5		0,731	
PK6		0,825	
PK7		0,855	
PK8		0,718	
PK9		0,743	

Based on the data in Table 3. The outer loading of all indicators is more than 0.7, so that convergen validity meets the validity test.

b. Discriminant validity.

Table 4. Discriminant validity

Variable	Government Policy (X2)	Work productivity (Y)	Construction Safety (X1)
Government Policy (X2)			
Work productivity (Y)	**0,777**		
Construction Safety (X1)	**0,759**	**0,787**	

The results of the discriminant validity test on the Heterotrait-Monotrait Ratio (HTMT) obtained a correlation value between variables of no more than 0.9 or less than 0.9 so that the variable is valid.

c. *Cronbach alpha*, *Composite reliability*, and *Average Variance Extracted* (AVE)
The results of reliability testing and the average variation extracted in each variable can be described in Table 5.

Table 5. Uji Reliability

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Government Policy (X2)	**0,969**	**0,972**	**0,972**	**0,745**
Work productivity (Y)	**0,958**	**0,959**	**0,963**	**0,633**
Construction Safety (X1)	**0,962**	**0,963**	**0,966**	**0,652**

Table 5 shows the results of reliability tests using cronbach alpha, an instrument is said to be reliable if it has a cronbach alpha value of > 0.7 (Gunarto, 2018). The results of the analysis in the table show that each variable has a value of Cronbach's alpha > 0.7 So it is concluded that all variables are reliable. The results of composite reliability testing where each variable reliabilit composite value greater than 0.7 can be concluded that all variables meet the composite reliability requirements. The results of the Average Variance Extracted (AVE) test were obtained that each variable had an AVE value of > 0.5, so it met the Average Variance Extracted .

5.2.2 Hypothesis Test Results (*Bootstrapping)*

The significance of the estimated parameters provides very useful information to determine the relationship between variables in this study. Hypothesis testing is done by looking at the probability value and t-statistics. For probability values, the p-value with a α of 5% is < 0.05. The t-table value for α 5% is 1.960 so the hypothesis acceptance criterion is when the t-statistic value > t-table. Hypothesis testing with the Smart PLS 3.0 method is carried out by bootstrapping, so that the relationship between the influence of exogenous variables on endogenous variables is obtained as in Table 6.

Table 6. *Boostrapping* Results Direct Influence

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Government Policy (X2) -> Work productivity (Y)	0,426	0,407	0,139	3,069	**0,004**
construction safety (X1) -> Work productivity (Y)	0,451	0,475	0,142	3,174	**0,003**

Table 6. Showing the results of the *bootstrapping* test can be formulated as follows :

1. The coefficient of the construction safety variable is 0.451 if the value of other variables in the state is fixed and there is an increase of 1 point in the construction safety variable, work productivity will increase by 0.451 points.

2. The coefficient of government policy variables is 0.426 if the value of other variables in the state is fixed and there is an increase of 1 point in the government policy variable, work productivity will increase by 0.426 points.

Based on the output results in table 6, known hypothesis testing (*Boostrapping*) for structural equations is shown as follows: :

1. The effect of construction safety on work productivity
   The t-statistic value for the effect of construction safety on work productivity of the original sample value of 0.451 is positive and t is calculated at 3.174> t-table (1.960) and p-value *is 0.004* < 0.05 and the original value of the sample is positive. Thus, the hypothesis in this study is accepted. That is, there is a positive and significant influence between construction safety and work productivity.
2. The effect of government policies on work productivity
   The t-statistic value for the effect of government policies on work productivity is 0.426 positive and t-calculated is 3.069> t-table (1.960) and the p-value is 0.004 < 0.05 and the original sample value is positive. Thus, the hypothesis in this study is accepted. That is, there is a positive and significant influence between government policies on work productivity.

6. Conclusion

Based on the results of research that has been done, it can be seen that construction safety consists of indicators of physical health, mental health, emotions, preventive efforts, and curative efforts. These five indicators can minimize the risk of accidents or occupational diseases. With the lack of work accidents, workers can complete their work on time, meaning that construction safety can affect work productivity. Based on the results of research on the Sekip Ujung Palembang *Flyover* Development Project, it is known that there is a positive and significant influence between government policies on work productivity. Government policies in the form of laws, government regulations, ministerial regulations, ministerial decrees, and director-general decrees can be used as guidelines or references by companies in protecting worker safety so as not to hamper productivity at work.

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Subject: Letter of Acceptance – 4th Asia Pacific IEOM Conference in Ho Chi Minh City, Vietnam
ID 211: The Influence of Construction Safety and Government Policies on Work Productivity of Flyover Projects
Dear Authors:

On behalf of the organizing committee, we are delighted to inform you that your paper has been accepted for oral presentation and publication at the 4th Asia Pacific Conference on Industrial Engineering and Operations Management in Ho Chi Minh City, Vietnam during September 12-14, 2023. Host and venue is CFVG-HCM, University of Economics Ho Chi Minh City. Co-Hosts are University of the West of England, UK, Birmingham City University, UK and Universitas Sebelas Maret (UNS), Indonesia. The conference will provide an opportunity for academics, researchers, and practitioners to exchange ideas and explore recent developments in the field of Industrial Engineering and Operations Management. The conference is also expected to foster networking, collaboration, and joint effort among the conference participants to advance the theory and practice as well as to identify major trends in Industrial Engineering and Operations Management.

The IEOM Society International, a nonprofit professional organization, is a premier global platform dedicated to the advancement of industrial engineering and operations management discipline for the betterment of humanity. IEOM is a global platform for academics, researchers, scientists, and practitioners to exchange ideas. Most importantly, it provides insights into the latest technologies, tools and advancements in the fields of Industrial Engineering and Operations Management. The IEOM Society has successfully planned and organized international conferences around the world including Dhaka (2010), Kuala Lumpur (2011), Istanbul (2012), Bali (2014), Dubai (2015), Orlando (2015), Kuala Lumpur (2016), Detroit (2016), Rabat (2017), Bristol, UK (2017), Bandung (2018), Paris (2018), Washington DC (2018), Pretoria (2018), Bangkok (2019), Pilsen (2019), Toronto (2019), Riyadh (2019), Dubai (2020), Detroit (2020), Harare (2020), Singapore (2021), Sao Paulo (2021), Haiti (2021), Harbin (2021), Rome (2021), Bangalore (2021), Indonesia (2021), Monterrey (2021), Istanbul (2022), Nigeria (2022), Orlando (2022), Paraguay (2022), Rome (2022), India (2022), Sydney (2022), Manila (2023), Zambia (2023), Peru (2023) and Houston (2023). The IEOM Society currently has 217 student chapters in 54 countries. There are 151 countries from six continents participating in various IEOM Society activities. The IEOM Global Community has more than 20,000 members.

IEOM is expecting another exciting event in Vietnam. Some of the events and activities that are planned include: outstanding keynote speakers, plenaries, global engineering education speakers, global supply chain & logistics, data analytic, AI & ML, Industry 4.0, industry solutions, various student competitions, panels, workshops, senior design competition and awards.
You will see the IEOM 2023 Asia Pacific Vietnam Conference as a great value-added event. Your participation is highly appreciated. If you have any question, please contact Dr. Mizanur, Associate Operations Manager at info@ieomsociety.org.
We look forward to seeing you at the event.

Regards,

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