International Journal of Engineering Research and Advanced Technology (IJERAT)

DOI: 10.31695/IJERAT.2021.3743

E-ISSN : 2454-6135

Volume.7, No. 11
November -2021

Study of Risk Analysis of Project Delivery System Design-Bid-Build (DBB) Highway Project in the Middle of Pandemic

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ABSTRACT

Project delivery system Design-Bid-Build (DBB) is a complex project implementation process due to risk and uncertainty, as the Covid-19 pandemic situation progresses, further problems arise, at this stage the pandemic does not generally make the project completely impossible completed but delays its implementation, causes delays, disturbances occur, as well as responses to government regulations related to regional quarantine. This study seeks to identify and analyze the most influential risks on the DBB project delivery system in the implementation phase of a highway construction project in the midst of a pandemic. The research was conducted in 12 (twelve) different projects in Serang City throughout 2020 since the pandemic began. After the literature review, through the Focus Group Discussion (FGD) method, the expert managed to identify 17 risk variables. Then the questionnaires were distributed to expert respondents and analyzed using the Analytical Hierarchy Process (AHP) method. and carried out a risk assessment. The results of the analysis show that there are 4 (four) top risk factors that have the most influence on the DBB project delivery system in the midst of a pandemic, namely: (1) Occupational health and safety; (2) Delays in procuring materials, labor, and equipment; (3) Delay in delivery schedule; (4) Delay in certification of bills.

Key Words: *Covid-19 pandemic, Project Delivery, Design-Bid-Build (DBB), Risk, Highway Project.*

1. INTRODUCTION

Corona Virus Disease 2019 (Covid-19) has been declared by the World Health Organization (WHO) as a pandemic. In Indonesia, specifically for dealing with Covid-19, the government has set 3 regulations as a form of response to the pandemic, namely the Presidential Decree on the Determination of the Covid-19 Public Health Emergency, the Goverment Regulation on Large-Scale Social Restrictions in the Context of Accelerating the Handling of Covid-19 and the Government Regulation in lieu of law on State Financial Policy and Financial System Stability for Handling the Covid-19 Pandemic and/or In Facing Threats That Endanger the National Economy and/or Financial System Stability. As a result, the economy was paralyzed, people's purchasing power weakened, unemployment and layoffs increased. Instead of easing regional quarantine, the government has implemented a new order of life for the community, which is called the New Normal. People are returning to their activities but still implementing strict health protocols.

In response to the above policy, 2 (two) Serang Mayor Regulations were issued regarding Changes in Budget Elaboration and Enforcement of the New Normal Order in Serang City, where procurement and infrastructure development from city budget sources will continue to be carried out but with the Covid-19 health protocol. The strict guidelines refer to the Instruction of the Minister of Public Works No. 02/IN/M/2020 concerning the Protocol to Prevent the Spread of Covid-19 in the field of construction services.

As a transportation infrastructure, roads are an important element in supporting economic growth, especially during this pandemic. The total length of the road network in Serang City is 206.03 km with details of good road conditions along 136.49 km, moderate road conditions 63.19 km, damaged roads along 6.35 km. (BPS Serang city, 2019).

One of the steps taken to improve the transportation system in Serang City is to restore and increase the capacity and quality of the haighway as well as carry out routine maintenance so that road performance can be maximized despite budget constraints in the midst of a pandemic. As one of the new expansion areas, infrastructure growth is very rapid with a large budget, a long time, complex problems and various obstacles that often arise then the Covid-19 pandemic is present increasing the complexity in the system of implementing highway projects.

In its implementation, the DBB project system is still a popular /choice in the Serang city government. This is because the owner can have control over the design and the whole process, this method provides a clear and transparent way to get what is needed and at the lowest cost so that it can be budget efficient while maintaining quality and specifications.

This study attempts to conduct a DBB project delivery risk assessment to see risk factors and then analyze the risk factor ratings at all stages of project implementation until construction handover.

2. LITERATURE REVIEW

According to Michael E. Kenig (2011) in the book AGC Project Delivery Systems for Construction defines Project Delivery System as a process comprehensively in assigning contractual responsibilities to design and build a project, then identify four standard project delivery models, namely: Design-Bid-Build (DBB), Design-Build (DB), Construction Management at-Risk (CMR), Integrated Project Delivery (IPD). Although many delivery methods are available, a study by the Construction Industry Institute (1997) determined that there are three basic and popular project delivery methods worldwide: DBB, DB, and CM/GC.

DBB is one of the various project management systems that forms the basis for project contractual relationships and writes the scope and period of responsibility of each party, and identifies various types of contracts that are used to measure how construction contractors will be paid for the completion of their work (Williamson, 2019). DBB is also known as Design-tender-build or traditional method which is a project management method in which the organization or owner contracts with a separate entity for the design, tender and construction of the project. It is called traditional because it has been the process of choice for the owners of most construction projects for a long time.

There are three main phases in a row in the Design-Bid-Build (DBB) project delivery system:

- **Design**
  In this phase the owner has a planner to design and produce bid documents, including construction drawings and technical specifications. To construct projects, the planner will work with the owner to identify the owner's needs, develop a written program, document those requirements and then produce a conceptual and/or schematic design. This initial design is then developed, and the planner will usually bring in other planners including design professionals to help complete the drawings and technical specifications of the completed bidding document which is coordinated by the planner and owner for the general contractor during the bidding phase (tender).
- **Bid**
  Bids can be open, where a qualified contractor can participate, or elect, where a number of contractors are invited to bid. The various general contractors bidding on the project obtain copies of the tender documents, and submit them to the various subcontractors for bidding on the sub-components of the project. During the bidding period (tender), questions may arise and the planner will usually issue a clarification or correction of the bid document in the form of an addenda. The contractor completes the bid and submits it on the specified closing date and time. Bids can be based on the amount of materials under construction that have been completed or as a lump sum fee however, the terms of this offer are made clear in the bid documents. Once bids are accepted, the design organization usually reviews the bids, makes any necessary clarifications to the bidders, checks the contractor's qualifications, ensures all documents are appropriate, and notifies the owner of the bid rating. Owners are not bound to accept the lowest bid, and usually because other factors including past performance and quality of previous work affect the selection process. However, the project is usually awarded to the general contractor who has the lowest bid.
- **Build/Construction Stage**
  Once a contractor has been selected, the bid documents may not be changed. Required permits (eg, building permits) must be obtained from all specialized authorities to initiate the construction process. If a design change is required during construction, whether initiated by the contractor, owner, or as discovered by the planner, the planner may issue a sketch or written clarification. In most cases, almost all project components are supplied and installed by sub-contractors. General contractors can carry out the work in their own power, but general contractors usually limit their role in managing the construction process and day-to-day activities at the construction site. During the construction phase, the planner also acts as the owner's agent to review the progress of work related to payment requests from contractors, and to issue site instructions, amending orders, and other documentation required to facilitate the construction process and certify that the project is constructed to approved construction drawings.

Figure 1 below shows the stakeholders involved in the DBB model, the relationship with each stakeholder, and the different contract flows from other delivery methods. The arrows in the figure represent the formal contractual relationship between the stakeholders:

DOI : 10.31695/IJERAT.2021.3743

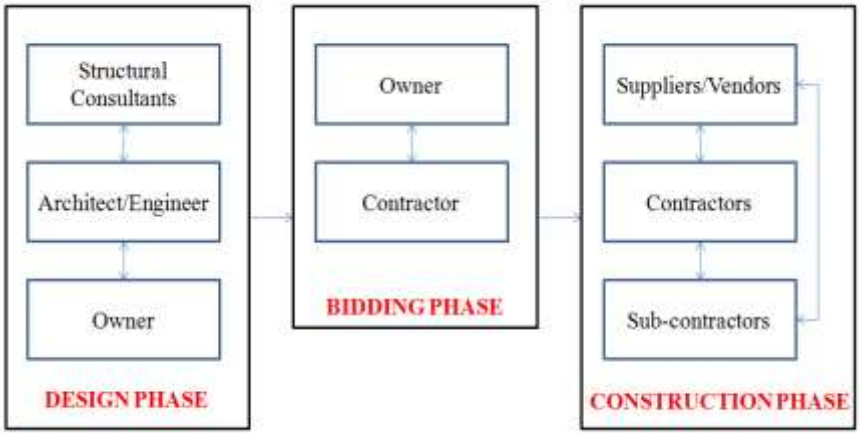

Figure 1. Stakeholders involved in each phase/stage in the DBB project delivery system (source: Meghana et al, 2016)

Choosing the right project delivery method can have a major impact on the achievement of project goals and objectives. Using appropriate project delivery methods can increase the efficiency and success rate of construction projects (Oyetunji and Anderson, 2006).

3. METHODOLOGY RESEARCH

The Covid-19 pandemic can be said to be a new phenomenon that has not much literature, so the methods in this research are:

1. The purpose of the FGD is to eliminate independent variables and take important variables and then group the variables into the same criteria. The intent and purpose is to group them into the most important variables considering the Covid-19 pandemic is a new phenomenon and there is not much literature. Starting from the literature study or previous research, the identification of risk factors was validated by 7 (seven) experts using the Focus Group Discussion (FGD) method to eliminate independent variables and take the most important variables which would later be compiled into a questionnaire I.
2. Questionnaire I was distributed to 15 (fifteen) expert respondents and analyzed using the Analytical Hierarchy Process (AHP) method. The AHP approach is used to perform pairwise comparisons between risk variables for each type of risk. Through a pairwise comparison assessment, the risk weights that have the most influence on the DBB project delivery system for highway construction projects in the midst of a pandemic are obtained. Assessment by distributing questionnaires to expert respondents who are experienced in road construction project activities.
3. Questionnaire II which is the result of Phase 2 validation is distributed to 5 (five) expert respondents for risk assessment. The risk assessment is based on questionnaire 2 data regarding the risks that occur in the DBB project delivery system for highway construction projects in the midst of the Covid-19 pandemic, after the data collection for questionnaire 2 has been completed, then the data that has been obtained are both assessment questionnaire data and data. the results of the interviews were processed through the stages of data processing. Calculation of the level of risk using a matrix relationship between frequency and impact with the AS/NZS 4360 standard.

4. ANALYSIS AND RESULT

4.1. Focus Group Discussion

Based on the identification of variables taken from the study of literature or previous research, a research instrument was developed for expert FGD activities, the purpose of the need for FGD is to eliminate independent variables and take important variables and then group variables into the same criteria. The Covid-19 pandemic is a new phenomenon and there is not much literature in which the FGD results will be used as instruments in questionnaire 1. The results of the FGD are shown in table 1 below.

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Table 1 Variables from the results of the Expert FGD

No	Criteria	Indicator
1.	Management	a. Delays in procuring materials, labor, and equipment
		b. Resources cannot be used effectively
		c. Occupational health and safety
2.	Schedule	a. Construction sequencing/phasing
		b. Unexpected utility encounter
		c. Delays in delivery schedule
		d. Revised drawings during construction
		e. Work cannot be completed according to schedule
3.	Contruction	a. Changes Scope definition
		b. Technology cannot used effectively
		c. Work-zone traffic control
4.	Third party	a. Obtaining approval from other institutions
		b. Third-party delays during construction
		c. Delays in completing utility agreements
5.	Complexity	a. Project complexity
		b. Delay in certification of bills
		c. Delays in right-of-way (ROW) process

4.2. Analysis with AHP Method

The criteria used are divided into main criteria, sub-criteria and alternative criteria, then the criteria are processed using the Analytical Hierarchy Process (AHP) method so that the results of the identification of criteria can be seen in pairwise comparisons, priority weights, Consistency (CI), Consistency Ratio (CR). The purpose of this AHP model is to find out how important the sub-criteria are in the criteria and how influential are the parts in the sub-criteria. The criteria in this study are divided into 5 namely Project Management, Implementation Schedule, Project Construction, Third Parties and Complexity which have their respective sub-criteria and have their respective alternatives that will be used as pairwise comparisons that will be used as a matrix. , and the weighting where the buyer is dominant.

Based on the relationship between the data taken from the questionnaire and the validation, it is found that the value of the consistency ratio for each risk variable is obtained, the weight of each risk variable is acceptable because it has a consistency ratio value of 0.1. The final result of the risk weighting that has the highest priority weight for each type of risk can be seen in Table 2 below.

Table 2. Priority weighting of risk variables

No	Criteria	Potential Priorities	Risk Factor	Potential Priorities	Comulative Potential Priorities
X1.	Management	0.3779	X1.1. Occupational health and safety	0,7662	0,2895
			X1.2. Delays in procuring materials, labor, and equipment	0,1579	0,0597
			X1.3. Resources cannot be used effectively	0,0759	0,0287
X2.	Contruction	0.2739	X2.1. Changes Scope definition	0,7089	0,1941
			X2.2. Technology cannot used effectively	0,1786	0,0489
			X2.3. Work-zone traffic control	0,1125	0,0308
X3.	Schedule	0.1666	X3.1. Delays in delivery schedule	0,4448	0,0741
			X3.2. Revised drawings during construction	0,2643	0,0440
			X3.3. Work cannot be completed according to schedule	0,1342	0,0224
			X3.4. Construction sequencing/phasing	0,0797	0,0133
			X3.5. Unexpected utility encounter	0,0769	0,0128
X4.	Complexity	0.1192	X4.1. Delay in certification of bills	0,6928	0,0826
			X4.2. Project complexity	0,2199	0,0262
			X4.3. Delays in right-of-way (ROW) process	0,0873	0,0104

DOI : 10.31695/IJERAT.2021.3743

X5.	Trird-Party	0.0625	X5.1	Obtaining approval from other institutions	0,6571	0,0410
			X5.2	Third-party delays during construction	0,1963	0,0123
			X5.3.	Delays in completing utility agreements	0,1466	0,0092

The identification of risk factors is grouped into 5 (five) criteria based on previous literature reviews and expert discussions that have been carried out previously, each group of criteria has the most important variables which are then analyzed using the AHP method approach. In the analysis of the Analytical Hierarchy Process (AHP) obtained a processed data in this study, where sequentially from the highest percentage is project management 37.79%; contruction 27.39%; schedule 16.66%; complexity 11.92%; and the lowest is third parties at 6.25%. For each risk factor variable, it can be seen in table 2 above based on each group of criteria, it shows the priority weight value of each criterion and sub-criteria as well as the ranking of each risk variable.

4.2.1. Management

In the occupational safety and health project management group, the first rank contributed 76,62%; delays in the procurement of materials, labor and equipment accounted for 15,79%; and resources cannot be used effectively accounted for 7,59%. Of these variables, it shows that the problem of implementing the project management system is still a priority as work risks increase due to the Covid-19 pandemic, which has recently increased the transmission tension. The special circumstances caused by the COVID-19 pandemic demand flexible project management and coordination skills to scale up appropriate and effective response strategies. In line with the findings of Wang et al (2020) that in the situation and difficulties of limited workers, materials and equipment during the COVID-19 pandemic, special project management and coordination skills are required, in which the project management team must devote full efforts to facilitating worker travel, communicating with suppliers, and stimulate project progress. Furthermore, Wang et al (2020) also stated that the special circumstances caused by the COVID-19 pandemic required flexible project management and coordination skills to improve appropriate and effective response strategies, while local governments made a major contribution in solving difficulties. Although these measures have resulted in higher project costs, their effectiveness in pursuing the project schedule deserves to be acknowledged. The findings of this study enrich the risk categories of highway construction and risk response strategies from a global pandemic perspective. This implies that future construction schemes including design, budget, supply chain and project management must take into account the possible effects of the epidemic and worker safety.

4.2.2. Construction

Whereas in the project construction group, it is more about technical problems in project implementation that occur as a result of government policies in the form of recufusing / reallocation of budgets and social restrictions during the pandemic. This group was ranked second with the results of each variable as follows: changes in the definition of the scope of work accounted for 70,89%, technology that could not be used effectively accounted for 17,86%, work zone traffic control accounted for 11,25%. As such, construction risks which include the above-mentioned risks have a major impact on project outcomes. In line with the findings of Tran & Molenaar (2016) stated that in the DBB project delivery method, contractors are not involved until construction begins, thus, construction risks, which include risks related to site conditions, construction QC/QA, traffic control, and environmental impacts, have a major impact on project outcomes. Under pressure from the lowest bid approach, contractors may be aggressive in estimating production or employ marginal subcontractors who may have problems performing the work. In addition, unforeseen job changes or conditions during a pandemic often lead to changes in scope and litigation that can increase costs. This finding is consistent with the literature of Rubin & Wordes (1998) which shows that DBB project risks occur at the construction stage due to the assumption that the complete design and specifications describe the project accurately and adequately.

4.2.3. Schedule

For the next group, the criteria for the project implementation schedule are filled in where this group consists of risk factors related to the time of project implementation affected by the pandemic. The order from the highest is the delay in delivery schedule 44,48%; revised drawings at the time of construction 26,43%; the work is not completed according to schedule 13,42%; construction sequence/stages 7,97%; unexpected utility confluence 7,69%. As with the results of research by Hanna et al (2015) that in highway projects, changes in conditions are often caused by differences in site conditions, additional or extended work, significant changes in the character of work, or a combination thereof. Contractors are usually required to perform additional work not specified in the original contract. This led to a change in habits that affected project implementation schedules during the pandemic and is relevant to the results of the previous literature Bordat et al. 2004; Ahler 2007 who argues that in general, changing conditions are experienced on a project when the original information provided by the owner differs from the conditions experienced by the contractor on site.

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4.2.4. Complexity

The group of project complexity criteria is next, with each ranking from the highest percentage being billed certification delays accounting for 69,28% in line with Trost & Oberlender (2003) that the accuracy of this estimate will be improved by improving the quality of cost information. The next ranking is project complexity accounted for 21,99%; and delays in the right-of-way (ROW) process of 8,73%. According to Baccarini (1966), all construction projects can be categorized as complex projects. This is due to the direct relationship between complexity and involves various interrelated parts that must be managed regarding the conditions of differentiation and interdependence. New technologies and methods are used in various types of construction. Each type of construction project has its own characteristics and complexities that lead to the specific ambiguities associated with it. This explains that being successful in this type of project requires a managerial solution that is chosen and adapted to its complexity. Any lag or lag in payments can lead to delays in work and project progress leading to more time and cost overruns and more complex management.

4.2.5. Trird-Party

The presence of third parties, especially in road construction projects, can be detrimental to the success of the project as can changes in conditions during a pandemic. In this group of criteria consists of the following rankings: third party delays 65,71%; obtain approval from other institutions 19,63%; delay in completing utility agreements 14,66%. Given the linear nature of highway construction schedules, contractors and owners can easily be affected by third party delays that occur and the costs associated with these delays. This is in line with the results of previous research by Hanna et al (2015) that third party delays are delays experienced by certain owners and contractors caused by other contractors or utilities. This type of delay is one of the most important components of delay risk (Ghosh and Jintanapakanont 2004).

So far, however, there appear to be no reports of the highway construction projects in this study being canceled, suspended, or interrupted in their implementation. However, the problems and complexity increase during the pandemic, where obstacles that often arise range from limited number of workers and their effectiveness, third party delays, transportation disruptions, budget changes, supply chain disruptions to restrictive government policies, such as travel bans, Work From Home Program and quarantines. mandated.

Then all the risk factor variables from each of these criteria are accumulated in order to obtain an overall risk rating. Table 3 below shows cumulatively the ranking of risk factor variables.

Table 3. Cumulative ranking of potential priorities and risk weights

Kode	Risk Factor	Score
X1.1.	Occupational health and safety	0,2895
X2.1.	Changes Scope definition	0,1941
X4.1.	Delay in certification of bills	0,0826
X2.4.	Delays in delivery schedule	0,0741
X1.2.	Delays in procuring materials, labor, and equipment	0,0597
X2.2.	Technology cannot used effectively	0,0489
X2.5.	Revised drawings during construction	0,0440
X5.1.	Obtaining approval from other institutions	0,0410
X2.3.	Work-zone traffic control	0,0308
X1.3.	Resources cannot be used effectively	0,0287
X1.1.	Project Complexity	0,0262
X3.3.	Work cannot be completed according to schedule	0,0224
X3.4.	Construction sequencing/phasing	0,0133
X3.5.	Unexpected utility encounter	0,0128
X5.2	Third-party delays during construction	0,0123
X4.3.	Delays in right-of-way (ROW) process	0,0104
X5.3.	Delays in completing utility agreements	0,0092

4.3. Risk Assesment

The risk assessment is based on questionnaire 2 data regarding the risks that occur in the DBB project delivery system for highway construction projects in the midst of the Covid-19 pandemic, after the data collection for questionnaire 2 has been completed, then the data that has been obtained are both assessment questionnaire data and data. the results of the interviews were

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processed through the stages of data processing. Risk is formulated as a function of likelihood and negative impact. Or risk index = Probability (Likelihood) X Impact (Consequency). Potential risks are risks that need to be considered because they have a high probability of occurring and have large negative consequences. The following is table 4 of the results of the calculation of the risk index.

Table 4. Risk assesment index

LIKELIHOOD	CONSEQUENCY				
	Insignificant	Minor	Moderate	Major	Catastrophic
	1	2	3	4	5
5(Almost certain)					
4 (Likely)			X1.1; X1.2		
3 (Possible)		X3.2	X3.1; X5.2		
2 (Unlikely)		X2.1; X2.2; X3.3; X5.1	X1.3; X3.4; X4.2; X5.2		
1 (Rare)		X2.3; X3.5; X4.3 X5.3			

Note :
E : Extrime Risk
H : High Risk
M : Medium Risk
L : Low Risk

Calculation of the level of risk using a matrix relationship between frequency and impact with the AS/NZS 4360 standard. the results show that there are 4 (four) risk factors with a high level of risk, namely: (1) Occupational health and safety; (2) Delays in procuring materials, labor, and equipment; (3) Delay in delivery schedule; (4) Delay in certification of bills. Meanwhile, for the Medium risk level, there are 5 (five) risk factors, namely: (1) Resources cannot be used effectively; (2) Contruction sequance/phasing; (3) Revised drawings during construction; (4) Third party delays; (5) The complexity of the project. Furthermore, there are 8 (eight) risk factors that are included in the Low risk category, namely; (1) Unexpected utility encounter; (2) The work is not completed according to schedule; (3) Changes in the definition of the scope of work; (4) Technology cannot be used effectively; (5) Work zone traffic control; (6) Obtaining approval from other institutions; (7) Delays in completing utility agreements; (8) Delaying the right-of-way (ROW) process.

5. DISCUSSION

The following is a discussion of the risk factors that are included in the 4 (four) high risk in the DBB project delivery system for highway construction projects in the midst of a pandemic.

Table 2 is a ranking of cumulative risk factors, please note that these risk factors are distributed differently for each group of criteria. For example, a change in the definition of the scope of work was ranked first in the project construction group, second in the cumulative risk factor but included in the moderate risk in the DBB of project delivery in the midst of a pandemic.

Meanwhile, table 3 shows that each risk variable has different levels based on the possibilities and impacts that can be caused and becomes the dominant priority risk in the implementation of DBB-based project delivery on highway projects in the midst of a pandemic. The following is a discussion of the results of the risk analysis ranked in the top five and those included in the high risk assessment. For example, the risk factor for changes in scope based on the analysis of the AHP method which ranks second but in the risk assessment based on the AS/NZS 4360 standard it is only at a moderate risk level, this finding shows that although the change in scope is included in the high-frequency risk but the impact is moderate on the implementation of DBB-based highway construction projects during the pandemic, this could be because the project management has carried out alternative work plans and or risk mitigation earlier during the pandemic. .

5.1. Occupational health and safety

During the pandemic, OHS was at the top of the cumulative risk factor for the implementation of DBB-based construction projects with a percentage of 28.95%, which is an important key to the sustainability of construction activities and worker protection in the context of preventing and overcoming Covid-19. Construction health is one of the cores of OHS and the attention should be as

DOI : 10.31695/IJERAT.2021.3743

great as construction safety. Materialnon (2020) reveals that overall, companies in all regions implement the same basic policies that adhere to guidelines set by local governments, these include social distancing, increased sanitation efforts, additional sanitation stations, COVID-19 signs, and employee screening. Construction contests and labor campaigns with limited numbers while maintaining health protocols are effective motivations for frontline workers. This finding is in accordance with the literature of Hinze (1997) which shows that although the biggest cause of death in a construction project is accidents (falls), it is very difficult to observe the consequences of health hazards because the disease can have a long period. Likewise, Martin & Walters (2001) emphasized that the function of the OHS program is to avoid accidents and diseases, protect workers, property, and the surrounding environment, control or reduce losses, provide management and workers with an intention to ensure safety and health, and to fulfill legal interests. .

5.2. Changes Scope definition

The second rank is the change in the definition of the scope which accounts for 19.41%, the response to the pandemic resulted in recofusing and reallocation of the budget so that it had a direct impact on the scope of work in construction activities. Therefore, the risk of changing the scope seems to be a critical risk in the DBB delivery project during the pandemic. In line with the results of research by Gransberg et al (2006), it shows that scope risk is the main risk and is directly related to the successful use of project delivery. Under DBB-based project delivery, the owner determines the scope and requirements of the project through initial design documentation in the request for proposals and then procures the final design and construction through evaluation of technical and/or price proposals. Similarly, Tran and Molenaar (2012) in their findings reveal that a well-defined project will be able to minimize the number of contingencies and offer owners competitive prices and high quality work.

5.3. Delay in procuring materials, labor, and equipment, delivery schedule and certification of bills

The domino effect that occurred as a result of the pandemic that emerged next was that contractors had to restrain themselves with the budget constraints needed for a longer period/invoice, but had to maintain construction specifications and quality, raising the risk of cumulative bill delays being in the third position with a large proportion 8.26%, this is exacerbated by regional control which then raises the next 2 (two) risk factors, namely delays in delivery which includes 7.41% and delays in the procurement of materials, manpower and tools based on 5.97%. In addition to the project's financial problems, the government's COVID-19 prevention policy has also disrupted the supply of materials, manpower and tools and hampered their delivery. Similarly, Bohannon (2020) states that due to uncertainty, while some companies are experiencing a shift in risk due to the pandemic, one common theme of risk before the pandemic is the lack of a skilled workforce. Furthermore, Wang et al (2020) in their research found that in summary, the risks posed by the COVID-19 pandemic to development projects include human risk, material risk, machine risk, method risk, and environmental risk, among these risk factors are availability. workers, site accessibility, shortage of building materials, and insufficient epidemic prevention materials caused by the lockdown policy are the most basic challenges faced by the project, social panic and epidemic prevention policy requirements are the main issues that need to be addressed before the start of construction work. In their findings Wang et al (2020) also found construction materials and supply shortages due to supply chain supply also facing insufficient staff and materials due to lockdown policies, blocking of transportation in cities and villages made shipping materials more difficult for projects. project. development project. The COVID-19 pandemic will cause a severe aggregate supply slump globally, shocked by production shocks across economies including China (Fornaro & Wolf, 2020). Projects must meet epidemiological standards (eg, medical materials, plans, and measures) and deal with panic among residents in the vicinity of the site before their work can resume. Under the circumstances of insufficient resources and tight schedule pressures, coordination skills and management schemes such as optimal resource allocation and job contests are very important in the progress of the construction work.

6. CONCLUSION

Analytical Hierarchy Process (AHP) method obtained 5 (five) major priority rankings of risk variables sorted with the highest weight, namely: (1) Construction work health and safety; (2) Changes in the definition of the scope of work; (3) Delay in sertification of bills ; (4) Delay in delivery schedule; (5) Delays in the procurement of materials, labor and equipment.

The results of the risk assessment contained 4 (four) dominant risk factors, namely: (1) Occupational health and safety; (2) Delays in procuring materials, labor, and equipment; (3) Delay in delivery schedule; (4) Delay in certification of bills.

Risk assessment and risk management play an important role in the success of a highway project. This study is one of the first attempts in the literature to investigate the risks of DBB project delivery using empirical data, in which the ranking of each risk factor is based on projects completed in the midst of the Covid-19 pandemic. The findings of this study will encourage public

DOI : 10.31695/IJERAT.2021.3743

bodies to carry out risk assessments early in the project development process. The findings also encourage a better understanding of risk management culture and can be used to improve collaboration among project participants.

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DOI : 10.31695/IJERAT.2021.3743