

Risk Analysis of the Coastal Protection Embankment Construction Project (Revetment Type) in Buol Regency

Tutang Muhtar Kamaludin¹, Setiyawan², Muhammad Zaki³

^{1,2}(Civil Engineering Department, Faculty of Engineering, Tadulako University, Indonesia)

³(Postgraduate Student of Civil Engineering Department, Tadulako University, Indonesia)

Abstract: The dangers that could arise in a production project are, design planning elements, creation safety elements, human useful resource elements, cloth and equipment elements, monetary, market and financial elements, dating and coordination factors, environmental factors, and legality/settlement, settlement and political factors. This study objectives to determine what risks can occur and to determine the evaluation and coping with of risks that have an effect on the development of coastal protection embankments (Revetment kind). The technique used is statistics collection via distributing questionnaires, carrying out information tabulation, descriptive statistics, reliability trying out, risk evaluation, danger response and chance manipulate. The dangers that affect are climate conditions and unsure situations, fabric rate increases, delays in cloth delivery, slim venture vicinity situations and human mistakes. dealing with of the above dangers includes reducing risk, avoiding risk, transferring danger and accepting danger

Keywords: Risk, Factors, Project, Revtment, Conditions

I. Introduction

Management is a unique process. It includes planning, organizing, motivating, and controlling actions[1]. These moves are performed to decide and obtain goals the use of human beings and other assets. threat is the danger of something going on combined with what happens because of it[2], [3]. here can be more than one matters that show up because of a unmarried occasion, and these things can be precise or horrific. Organisation chance control must see the need to consist of technical dangers in schedules and fees. A hazard control process is created and used in order that important people know approximately the risks[4]. Risk consists of steps to: apprehend and locate feasible troubles, discern out how these dangers have an effect on the assignment, and watch and handle risks[5], [6].

hazard control is a way to manipulate danger that entails all and sundry within the mission [7]. It includes identifying, assessing, information, appearing on, and speak me about risks. risk evaluation is figuring out and assessing dangers. risk control is responding to and controlling the risks that have been analyzed. Hazard management is the way you recognize, measure, and manage risks extra surely, using the right equipment and know-how[8]. The intention is to reduce the horrific outcomes of unexpected issues by means of averting dangers or making backup plans. So, chance control is identifying, measuring, and ensuring dangers, and developing plans to handle them. Assignment hazard control goals to find and manage risks that different venture management procedures don't cover[9]. f now not controlled, these risks can reason the mission to go off track and fail to meet its desires. So, how properly project risk control works affects how a hit the project is. each mission has varieties of chance. There are man or woman risks that could have an effect on whether or not the task reaches its goals. it's also crucial to reflect on consideration on the overall assignment danger, which comes from man or woman dangers and different uncertainties[10], [11].

The venture danger management method handles both styles of danger. man or woman venture dangers are uncertain conditions, uncertainties that in the event that they occur, have a positive or terrible impact on one or more production project targets[12].Construction projects are a discipline of labor that includes many risks due to the fact construction tasks comprise uncertainty. even though a construction project has been planned as well as viable, it does no longer rule out the opportunity that the challenge can run according to plot. that is due to the risks contained inside the creation challenge that may affect the productiveness and exceptional of the mission[13], [14].

Risk factors that could arise in a construction venture are planning and layout factors, OHSE factors, human useful resource factors, fabric and gadget elements, monetary, market and monetary elements, courting and coordination elements, environmental factors, and legality / settlement factors, contracts and politics.), There are 8 varieties of threat elements in production projects, particularly: herbal risks, layout dangers, resource dangers, economic dangers, prison and regulatory dangers, Political risks, criminal and regulatory risks, and Environmental risks[15].

Project risks are complicated and involve many sources of employees, device and materials. The definition of a undertaking is a brief attempt or activity that produces outcomes within the form of services or products which are specific or unique, confined through time and sources. assignment work is done to fulfill objectives with the aid of producing a product (deliverable). consequences (deliverable) are defined as products which might be specific or special, consequences, or the capability to carry out services which are needed to be produced in completing the process, project, or phase. results (deliverable) may be tangible or intangible[16].

In each pastime, of path, there's an element of hazard, the more the value of the challenge, the greater the danger. uncertain activities can bring about blessings/opportunities or damage the assignment or chance.[17]uncertainty this is probably to be profitable is referred to as an possibility, while uncertainty that outcomes in losses is referred to as a hazard. All initiatives are volatile due to the fact initiatives are particular endeavors with various ranges of complexity that purpose to supply benefits. this is additionally because tasks have constraints and assumptions further to projects should respond to stakeholder expectancies that can be conflicting and converting. groups have to pick out to take project risks in a managed and deliberate manner to create fee at the same time as balancing hazard and reward.[18]

within the implementation of the assignment, individual task risks after they arise can have a wonderful or terrible impact at the objectives of the development undertaking. In this example, venture threat management pursuits to take advantage of or enhance nice dangers (opportunities) and reduce or keep away from and manage negative risks (threats). Unmanaged threats can result in problems or problems consisting of delays, price overruns, poor overall performance, or lack of popularity. possibilities which can be captured can provide benefits including lowering time and prices, enhancing performance, or reputation[19].

Normal task hazard can be high-quality or negative, universal undertaking risk management aims to keep task hazard exposure inside an appropriate range via reducing bad variation drivers, selling effective version drivers, and maximizing the probability of reaching universal project goals[20].

Risks will preserve to emerge all through the mission lifestyles, so the challenge chance management procedure must be finished iteratively. dangers are initially addressed in the course of challenge making plans by using growing a mission approach. risks should also be monitored and managed throughout the assignment to make certain that the task stays on the right track and that emergent dangers are addressed. to be able to successfully manage risk on a project, the assignment group desires to recognise what level of danger publicity is appropriate in reaching the project goals. that is defined with the aid of a measurable risk threshold that reflects the hazard urge for food of the enterprise and mission stakeholders. The hazard threshold describes the extent of variation this is perfect around the assignment goals. This threat threshold is explicitly said and communicated to the challenge team and is pondered inside the definition of the danger effect level. for the mission[21]

Coastal environmental issues in Indonesia inclusive of abrasion, erosion and tidal flooding are one of the essential tasks for the authorities and society due to the fact they threaten residential areas[6]. disaster mitigation efforts in coastal areas and small islands are indexed in PP No. sixty four of 2010.Buol Regency is a Regency that has many beaches. along the shoreline of Buol Regency, precisely in Leok Village, there are tidal waves that can threaten public centers and infrastructure as well as residential areas placed at the coast. therefore, coastal control is needed within the shape of sea walls (KAK PUPR, 2022). the development of the embankment in Buol Regency is also now not loose from risks which can purpose the undertaking to no longer run as anticipated.[22]

For this reason, risk analysis is very important for a company to do before implementing a project. By conducting a risk analysis, hazard analysis is very important for a employer to do before imposing a venture. by accomplishing a threat evaluation, the organisation can limit the dangers that will occur and conquer the dangers a good way to arise. this is vital to do because by undertaking a hazard analysis, it is was hoping that the development of the construction venture can run on time, fee and function as it should be[23].

Revetment is a constructing in the shape of a wave resistance wall located alongside the area to be blanketed. Revetment has sorts, specifically the big type (rigid) & the non-big or flexible kind[24]. The styles of revetment are: Quarystone revetment, this shape includes a flexible structure using natural stone materials that could offer superb safety & can face up to minor consolidation or subsidence without inflicting structure. in keeping with Revetment is a coastal safety shape this is built parallel to the shoreline and capabilities to defend the coast from abrasion due to sea waves[24]. Revetment is commonly constructed in areas which have skilled erosion or to guard important facilities close to the coast. This shape includes layers of cloth, such as stone, concrete, or gabion, which might be designed to take in wave electricity and save you erosion of the soil at the back of it[25].

II. Methodology

Qualitative evaluation is an analysis this is done based on instinct, level of information in assessing the amount of threat that could occur and its ability damage. Qualitative analysis is performed by using figuring out the opportunity as visible within the desk and the impact as visible from the table of dangers that have been recognized. This technique is executed with the aid of figuring out how crucial it's far to be aware of sure risks and how the response could be given. meanwhile, quantitative evaluation is completed based totally on real numbers (monetary value) of the amount of loss that happens. Grouping of hazard tiers, expressed within the shape of a chance matrix (threat Matrix), is a combination of the extent of chance of the possibility of an occasion happening and the significance of the impact.

Table 1: Likelihood Level (Modified from AS/NZS 4360:2004)

Level	Likelihood	Deskripsi
A	<i>Almost Certain</i>	Definitely happens, more than once a year
B	<i>Likely</i>	Often happens, once a year
C	<i>Possible</i>	Usually happens more than once in 3 years
D	<i>Unlikely</i>	Possibly happens, once in 3 years
E	<i>Rare</i>	Almost never happens, once in 5 years

Table 2: Consequences Level (Modified from PMI, 2017)

Level	Consequences	Impact on project objective		
		Time	Cost	Quality
1	Very low	1 Week	<\$100	Minor impact on secondary functions
2	Low	1-4 Week	\$100 - \$500	Minor impact on overall functionality
3	Medium	1-3 Months	\$501 - \$1k	Some impact in key functional areas
4	High	3-6 Months	\$1k - \$5k	Significant impact on overall functionality
5	Very High	>6 Months	>\$5k	Very significant impact on overall functionality

Table 3: Risk Matrix (AS/NZS 4360:2004)

Likelihood	Consequence				
	1	2	3	4	5
A	Medium	High	High	Very High	Very High
B	Medium	Medium	High	High	Very High
C	Low	Medium	High	High	High
D	Low	Low	Medium	Medium	High
E	Low	Low	Medium	Medium	High

Nature has typically furnished a scientifically effective coastal defense mechanism. If there is no natural coastal protection, or it's far no longer effective because it's miles broken/extinct, then synthetic safety is achieved. There are five tactics in making plans synthetic coastal protection, specifically: regulating the rate of sand transport alongside the coast (groin creation), decreasing the power of waves hitting the coast (breakwater creation), strengthening coastal cliffs so that they resist wave assaults (revetment or sea wall construction), growing the deliver of sediment to the coast (sand through passin or beach nourishment), reforesting coastal areas (mangrove timber, api-api, or nipah)

This form of studies is survey studies. The studies technique starts offevolved with a literature assessment to determine the quantity of the take a look at of the hassle to be studied, the next method is to search for initiatives so one can be used as a medium for implementing the problem. the specified information is received from parties associated with the project. After all of the required statistics is acquired, the subsequent method is to technique the data. The consequences of facts processing are analyzed and discussed to then be concluded.

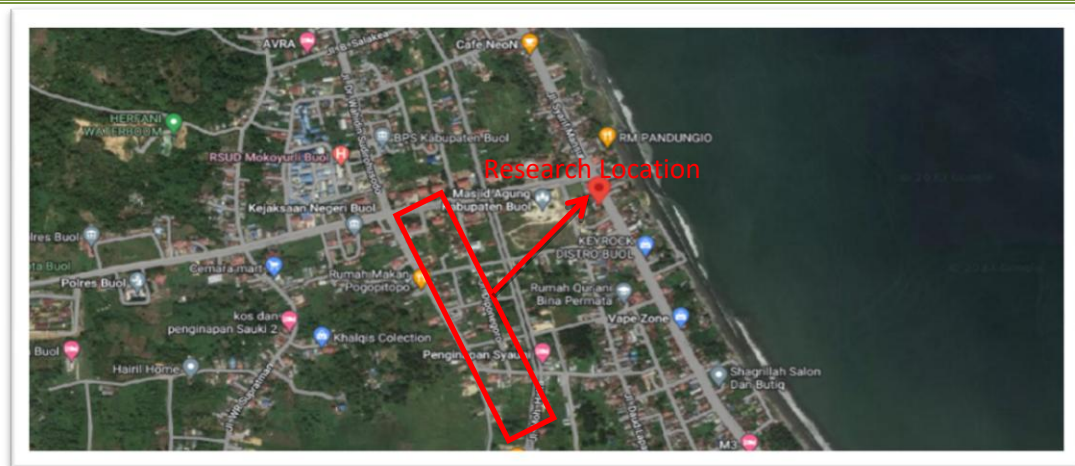


Figure 1: Research location

III. Results and Discussion

Data obtained from the results of distributing questionnaires filled out by 10 respondents involved in the Coastal Protection Embankment Construction Project in Buol Regency (revetment type).

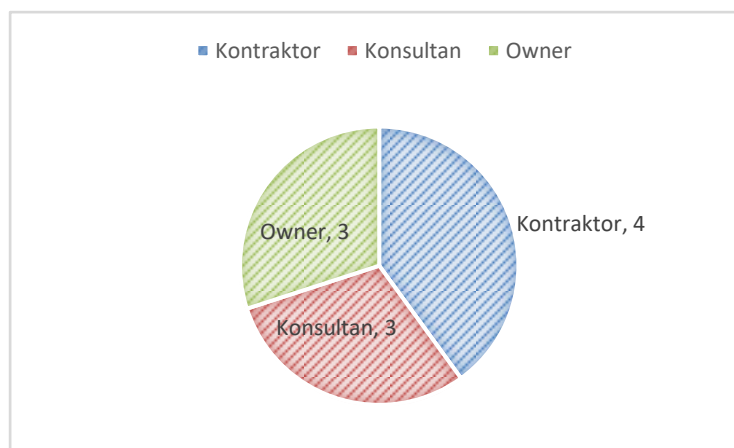


Figure 2: Respondent Classification Diagram Based on Parties Involved

Based on Figure 1, respondents who filled out the questionnaire consisted of 3 people (30%) representing the service users, 4 people (40%) from the contractors, and 3 people (30%) from the consultants. Meanwhile, Figure 2 shows the distribution of respondent data based on work experience.

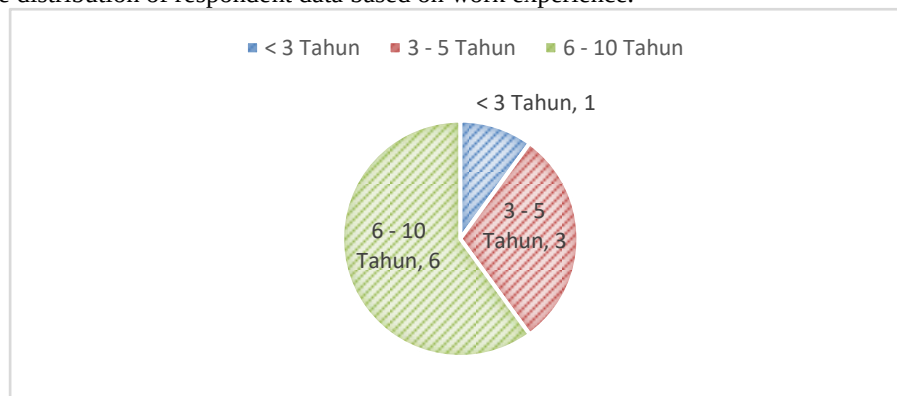


Figure 3: Respondent Classification Diagram Based on Work Experience

Figure 3 shows that 10% of respondents have less than 3 years of work experience, 30% have between 3 and 5 years of experience, and 60% have between 6 and 10 years of work experience.

From the data that has been obtained, a reliability test is then carried out. The results of the reliability test using the SPSS program can be seen in Table 4.

Table 4: Reliability Test Results

Risk Criteria	N of Items	Koefisien Cronbach's Alpha	Information
Frequency	27	0,740	Reliabel
Impact	27	0,744	Reliabel

Table 4 shows that the the effects of the reliability test the use of the SPSS application produced a Cronbach's Alpha fee of 0.740 for the risk frequency scale, and zero.744 for the threat impact scale. each values indicate that the devices on each scales may be usual or declared dependable due to the fact they have a Cronbach's Alpha price above 0.600. The education of the threat matrix ambitions to discover and organization 27 predetermined danger variables into numerous chance level classes, particularly low threat, medium danger, high threat, and really high risk. This grouping is performed with a purpose to provide a clearer photo of the level of urgency of dealing with every risk inside the project. earlier than the chance matrix is compiled, a risk analysis manner is first achieved, that is finished with the aid of calculating the average value of the frequency scale and effect scale for each variable. these values are obtained based totally on the outcomes of filling out the questionnaire by way of respondents concerned inside the undertaking, so that they replicate the perceptions and reviews of undertaking actors regarding the opportunity of incidence and the importance of the impact of each recognized threat..

Table 5: Highest Risk Ranking

No	Risk Identification	Risk Value	Risk Category	Ranking
1	Unpredictable weather and conditions	15,84	High Risk	1
2	Increased material prices	14,72	Medium Risk	2
3	Delays in material delivery	10,85	Medium Risk	3
4	Narrow project site conditions	10,08	Medium Risk	4
5	Human error	9,36	Medium Risk	5

Primarily based on the information provided in table five, it is able to be seen that the danger with the very best risk cost is the risk of weather conditions and uncertain situations during the mission implementation technique. This hazard has a risk value of 15.eighty four which is categorized as high chance and is ranked first in the danger ranking listing that has been compiled. This indicates that the danger has a extensive impact and a reasonably high opportunity of occurrence, so it requires unique interest in managing and mitigating it. alternatively, the hazard with the bottom fee of all of the variables analyzed is the threat of human mistakes. This risk has a fee of 9.36 and is included inside the medium hazard category, and is ranked 5th inside the danger rating. of the 5 chance variables indexed inside the desk, they're selected based on the highest threat fee and might be discussed in extra depth inside the following sub-chapter discussion, to pick out the causes, influences, and suitable manage strategies for each chance.

Discussion of the dangers which have the best risk value in the coastal protection embankment production undertaking in Buol Regency (revetment type) can be mentioned underneath: unsure weather conditions and situations arise for the duration of the implementation of the undertaking, which has a risk value of 15.eighty four in the high danger class and is ranked I. This danger occurs due to worldwide climate alternate that occurs in Buol Regency and the dearth of historical weather data and accurate forecasts. unsure climate situations and situations confer with conditions where the climate is risky, hard to predict, and can alternate rapidly in a quick time, as a way to have an effect on the loading/unloading time table on the jetty and purpose delays. for the duration of awful climate/rain, the barge will automatically now not decrease/open the ramdor if this situation occurs, demurrage applies to the size of the 250-foot ship with a capacity of two,500m3, that is ± Rp. 15,000,000, - / day, for 270 ft with a capacity of 3,500m3, that's ± Rp. 20,000,000,-/Day and 300feet ability 5,000m3 which is ± Rp. 30,000,000,-/Day. The situations on the paintings location will no longer be carried out due to the fact there may be a high water level.

There was an boom in cloth prices at some point of the implementation of the venture with a threat cost of 14.72 within the medium danger class and changed into ranked II. This risk takes place due to accelerated transportation and distribution expenses and the dearth of material procurement techniques by way of the contractor. The boom within the charge of task materials is a condition in which the price of production materials needed within the implementation of a mission has expanded from the previous price. this can have a enormous impact on the overall budget, time, and feasibility of the project. The boom in cloth prices has passed off considering the fact that the problem of the central Sulawesi Provincial government (Sulteng) actively supporting the development of the Indonesian Capital metropolis (IKN) in East Kalimantan by means of appearing as a strategic buffer location. The boom in the price of boulder stone substances and the provision of barges could be very hard and the out of control rate at that point the price boom reached 30% of the quarry fee. gasoline price growth In 2022, there have been several will increase in gas expenses in Indonesia, both for sponsored and non-subsidized kinds. the following are info of the time and sorts of gasoline that skilled charge changes. Date. March 1, 2022, This increase became triggered via the spike in international crude oil prices, specially due to the Russia-Ukraine disaster. Date. July 10, 2022, This growth changed into because of the hovering Indonesian Crude fee (ICP) which reached USD 117.sixty two according to barrel in June 2022, round 37% better than January 2022. Date. September three, 2022, This increase was introduced by way of President Joko Widodo and precipitated Indonesia's annual inflation in 2022 of 5.51%, with the most important contribution coming from the gas group. Date. November 1, 2022, On November 1, 2022, PT Pertamina again adjusted the price of non-subsidized gas, standard, 2022 witnessed several increases in gasoline fees in Indonesia, which have been stimulated by way of fluctuations in international oil charges and authorities guidelines. (google.2022)

there has been a put off in the shipping of substances for the duration of the implementation of the venture with a risk fee of 10.85 in the medium danger class and became ranked III. This risk takes place because of restrained stock from the supplier, inflicting delays in the shipping manner. Delays within the delivery of substances by means of deliver are situations wherein the system of transporting substances or materials using sea transportation does not arrive in step with the planned agenda or time. horrific weather, excessive waves, storms, or fog can put off the departure or arrival of barges.

Technical troubles with ships, engine damage, navigation, or loading and unloading structures can sluggish down the journey and fuel.

Administrative manner, Delays in delivery files or lets in from the harbor grasp. this will have an immediate impact at the continuity of the venture, especially the ones which can be fantastically depending on the timeliness of material components. one of the substances of material stock, due to the fact the area of the stone extraction is on the cliff and ravine in order that the region is restrained with a maximum of 4 excavators running inside the quarry. Jetty stock, because the marina vicinity with a place of 1.5 ha can simplest accommodate approximately three, 000m³.



Figure 3: Quarry and Jetty Conditions

The narrow project location conditions during the project implementation have a risk value of 10.08 in the medium risk category and are ranked IV. This risk occurs due to land limitations so that the availability of

material storage areas is inadequate, So that the ship unloading is carried out by shunting with a barge pattern to the jetty and jetty to the work location, reducing the accumulation of dump trucks and avoiding demurrage.

Human error occurred in the implementation of the project, which has a risk value of 9.36 in the medium risk category and is ranked V. This risk occurs due to the lack of understanding of workers in reading drawings and technical documents, resulting in the work being carried out not being in accordance with the plan.



Figure 5: Work Accidents

Based on totally on the consequences of the identity and threat assessment which have been completed previously, it is very essential to right now design and implement suitable mitigation measures to reduce the ability bad influences that can be because of each risk. without good enough coping with, those risks can become extreme issues that hinder the smooth implementation of the task. This has the ability to motive deviations from the planned schedule, improved fees, decreased great of labor, and disrupted the achievement of average assignment goals. consequently, a scientific and proactive risk management strategy is prime to making sure that undertaking implementation keeps in step with the hooked up plan. If the threat of human errors is taken into consideration no longer totally avoidable, then the closing strategy is to simply accept the danger with the aid of persevering with to put together an emergency plan or fast correction machine if an blunders happens. This consists of offering an inspection and satisfactory manipulate crew that is ready to enter the sector to identify and accurate errors early on before they've a wide impact on the project.

Table 6: Risk Response Strategy for Human Error Risk

Strategi	Penjelasan dan Tindakan
Avoid	Conduct strict selection of workers from the start, ensuring they have adequate competence and training before working on the project.
Reduce	Provide regular training on safety and work procedures, implement SOPs and daily checklists, conduct briefings before work, and limit working hours to avoid fatigue.
Transfer	Hand over complex or high-risk work to expert subcontractors or third parties with full responsibility for their work results.
Accept (	Accept the possibility of errors by continuing to prepare a strict quality control system and field inspections so that errors can be identified and corrected immediately before they have a major impact.

Actively involve local stakeholders in the planning phase to anticipate social risks and strengthen support for the project. Allocate risk contingency budget proportionally, not only for technical risks, but also for external risks such as natural disasters and government policies.

IV. Conclusion

The maximum influential risks on this examine are the threat of climate situations and unsure situations, the danger of growing cloth costs, the threat of overdue delivery of materials, the threat of slim challenge area conditions and the hazard of human blunders handling accomplished from the above risks includes decreasing the danger (risk Recution), avoiding the danger (risk Avoidance), shifting the risk

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