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THE RISK MANAGEMENT OF THE BOGOR-SUKABUMI CROSS-RAIL DUAL-TRACK CONSTRUCTION PROJECT ON TIME CONTROL

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ABSTRACT

Background: The implementation of risk management is very important to do to reduce the occurrence of risks in the implementation. In the implementation of work, unmanaged risks can have an impact on not achieving the targets of the completion plan according to the planned time.
Aim: This study aims to find out how to identify the dominant risk of time delays in the implementation of the Bogor-Sukabumi Cross Railway Double Track Construction and its handling strategies.
Method: The research conducted is descriptive research. Primary data were collected by the method of checklist analysis from the literature, risk management of similar activity projects or previous studies, then identified the risks. Meanwhile, the secondary data in the form of a plan map for the Bogor-Sukabumi Railway double-track route is needed as secondary data to obtain information, project descriptions, implementation methods and the time needed to complete the construction obtained from the West Java Railway Engineering Center.
Findings: The dominant risk factors that can affect performance, there are 5 risk factors, namely avalanches in the implementation of work, cost overruns related to changes and additions to work, design not in accordance with field conditions (Planning constraints), constraints related to working hours with residents around the site, and delays in obtaining planning approval.

KEYWORDS

risk management, Bogor-Sukabumi cross-rail dual-track construction project, time control

INTRODUCTION

Indonesia is currently intensively carrying out development, especially related to infrastructure. Infrastructure development has a significant position in supporting economic development, regional development and as a unifying indonesian region (Silondae, 2016). One of the infrastructure developments that is being intensified is railways.

Railways are an important and strategic mode of transportation in achieving and strengthening the resilience of a nation as a regional link (Transportation of people and mass cargo), supporting the improvement of the people's economy, regional economic growth and national stability (Istianto et al., 2019). The strategic function of railways as a modeof transportation in general is the function of driving, driving and supporting, national development while in particular it is one of the driving forces of development and economy at the domestic level (Dwiatmoko, 2018).

West Java, especially Bogor and Sukabumi, has a strategic role, namely as a production and processing line for produce. For this reason, adequate infrastructure development support is needed to support the smooth flow of people, goods, and services. The railway transportation system is the answer in supporting the national transportation system where this transportation

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system has various advantages over other land transportation systems including mass transportation, fast, energy-saving, effective and efficient transportation.

The development of the double track railway between Bogor-Sukabumi was carried out to increase service capacity and facilitate train travel by making the railway road double. Development of railway facilities and infrastructure, especially in areas with dense transportation volumes. The construction of the existing line construction Between Batutulis - Ciomas between Bogor - Sukabumi is part of the Railway Development program between Bogor - Sukabumi which was launched as a form of government responsibility for the needs of passenger and freight transportation to ensure a safe and timely train journey.

Through Law number 23 of 2007 concerning Railways, it is explained that railways as a mode of transportation in the national transportation system have the characteristics of mass transportation and certain advantages, cannot be separated from other modes of transportation, the potential requires development and improvement of its function for regional liaisons, both national and international, to support, urge, and drive national development to improve the welfare of the people. In relation to the implementation of the development of the national transportation network and the National Railway Master Plan, the Directorate General of Railways has a planning for the construction of a railway double track in Bogor-Sukabumi with a total length plan of ± 57,215 km.

The Construction Construction Process of the Existing Line Construction Between Batutulis - Ciomas Lintas Bogor - Sukabumi is carried out with the multiyears contract mechanism financed by State Sharia Securities (SBSN) for the 2019-2022 fiscal year. To support the purpose of implementation, the railway is in accordance with the mandate of law number 23 of 2007 concerning Railways, to reconstitute the implementation of national railways as a whole. The arrangement for the implementation of railways is stated in the National Railway Master Plan (RIPNAS) issued by the Directorate General of Railways of the Ministry of Transportation in 2011. RIPNAS which is the basis and guidelines that underlie all policies in the management and operation of national railways.

Each stage of the project cannot be separated from the risks and uncertainties that can occur and affect both in terms of quality and quantity. The construction of the Double Railway J ulur can occur delays from the contract time limit, if the provider does notanticipate the risks that may occur and good implementation methods to minimize the risks that can occur. Theimplementation of risk management is very important to do to reduce the occurrence of risks in the implementation.

In the implementation of work, unmanaged risks can have an impact on not achieving the targets of the completion plan according to the planned time. Therefore, this study aims to find out how to identify the dominant risk of time delays in the implementation of the Bogor-Sukabumi Cross Railway Double Track Construction and its handling strategies. In addition, this research is also expected to meet the research gap from previous studies as stated in the following table.

Table 1. Relevant Previous Research

Name	Title	Year	Method
Lu et al (2010)	Risk assessment model for the railway reconstruction project in Taiwan	2010	Using FMCDM that combines multiple criteria decision making (MCDM) fuzzy set techniques and theory
Habibie (2017)	Time and Cost Risk Analysis on the Makassar - Parepare route railway construction project	2017	Method research with a cross-sectional or cross-sectional approach
Li Qing et al. (2014)	Quality Risk Management Model for Railway Construction Projects	2014	Metode menggunakan "A Figure and Four Tables" (AFFTM)
Marantika et al. (2017)	Investment Risk Analysis of Jakarta Bandung High-Speed Train Project	2017	Monte Carlo Simulation Methods
Trismara (2011)	Risk management on line construction projects coal railway in Central Kalimantan with private government cooperation scheme	2011	Metode AHP (Analytical Hierarchi Process)

METHOD

The research conducted is a descriptive study, which collects in detail information to explain existing symptoms, identify problems, and investigate applicable conditions and practices (Sugiyono, 2019). In this study, researchers identified the factors causing delays by identifying the risk of delays in railway double-track construction projects and the impact of delays in project construction, understanding the causes and consequences of delays, and conducting risk analysis of the frequency of events and the impact of delays on railway double-track construction.

Primary data were collected by the method of checklist analysis from the literature, risk management of similar activity projects or previous studies, then identified the risks. The results of the literature study were verified and pilot surveyed to experts by means of interviews and questionnaires to identify relevant risks based on assessments by experts and conducting questionnaire tests to respondents. Meanwhile, the secondary data in the form of a double-track route plan map for the Bogor-Sukabumi Fire route is needed as secondary data to obtain information, project descriptions, implementation methods and the time needed to complete the construction obtained from the West Java Regional Railway Engineering Center.

The respondent population is a contractor who carries out the construction work of the Cross Bogor-Sukabumi railway double track. The questionnaire data was processed using a

frequency distribution approach and data processing with AHP (Analytical Hierarchy Process) to produce significant priority factors.

RESULTS AND DISCUSSION

Determination of Dominant Risk

Risk Ranking is the result of time-based data processing carried out during the data analysis phase using the risk factor equation. The risk factor equation is defined as the multiplication between the magnitude of the impact and the probability of occurrence of a risk event (Pusjatan, 2005). Based on the results of the risk of determining the level of risk of work that has a risk category, the level of high probability of occurrence and large impacts according to table 2.

Table 2. High Risk Sequence

No.	Types of Risks	Risk Factors	Category
X6	The design does not match the conditions of the field (planning constraints)	0.6725	High
X8	Delays in obtaining planning approval	0.6615	High
X29	The occurrence of avalanches in the implementation of work	0.6756	High
X30	Cost overruns associated with job changes and additions	0.6754	High
X43	Constraints related to working hours with residents around the location	0.6697	High

Source: Self-Processed Products

1) According to the results of the study, there are 5 dominant risk factors that can affect performance, sorted according to the highest ranking, namely the occurrence of avalanches in the implementation of work (X29);
2) Cost overruns related to changes and additions to jobs (X30);
3) The design does not match the field conditions (planning constraints) (X6);
4) Constraints related to working hours with residents around the location (X43);
5) Delay in obtaining planning approval (X8).

Related to the impact of the dominant risk needs to be managed or mitigated, experts provide opinions and opinions freely and objectively, and can even revise their previous opinions. So that the results of the discussion obtained can be as flexible as possible.

Dominant Risks Discussion

After the dominant risk is obtained, the next stage validates the results that have been obtained. Validation is processed using the Delphi method to get consensus from experts, so that opinions on dominant risks are known that have a negative influence on project time performance.

Before determining the actions that must be taken against the dominant risk is expert input related to mitigating and handling the high risk of research results. The interview was

conducted only on 4 experts which was carried out on March 2, 8, 9 and 21, 2022, the exact results of the interview were obtained in table 7.

Table 3. Dominant Risk Mitigation

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
			Preventive	Corrective		
The occurrence of avalanches in the implementation of work	1) Nature where the intensity of rainfall is high during the implementation causes the cliff soil to become soft and unstable with a fairly steep slope angle. According to morphological data, soil types include young rocks that are prone to landslides; 2) Extreme weather conditions and field situations and high groundwater levels cause unstable soils and landslides; 3) Poor water management of residential drainage channels resulted in	1) Gives a bad image of how the planning and execution of the work is carried out; 2) Delayed implementation of the work because a study must be carried out to find the source of the problem of avalanche; 3) For the contractor, there is an overhead because it will make a replacement if the results of the study are an error of the contractor's implementation method	1) The contractor supervises and sterilizes the area where there is cladding and the installation of *safety lines* and signs prohibited from passing through the work area; 2) The contractor has relocated 5 houses of the affected residents by providing temporary residential facilities to avoid the risk if there is a landslide again until the land protection is completed and declared safe by	1) The contractor closed the structure and cliffs temporarily in Cipaku by using a tarpaulin to reduce the ingress of water in the avalanche area; 2) The contractor erected a temporary steel sheet pile on the DPT and CCSP landslide cliffs in Cipaku as a soil treatment to minimize soil movement; 3) The contractor	1) The contractor will bear the work that has failed construction if the planning and drawings are in accordance with the implementation but the implementation is wrong. Meanwhile, if there is an error in the design, it will be borne by the Owner (PPK) and PPK conducts a technical study for handling the avalanche area with the help	1) Apart from construction work, coordinating with ppk land related to land limitations with the aim of reducing the burden of slopes due to residential areas and invetarization of areas that are included in landslide-prone areas that need to be relocated permanently by purchasing residents' property so that the burden from settlements can be removed and reduced;

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
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	soft slope soils; 4) Factors caused by the implementation of the work in the form of vibrations from the borpile equipment used can cause avalanches to occur.	and if the fault of the owner will be an increase in the cost of carrying out the work; 4) The landslide had an impact on the collapse of the soil barrier in the form of a 20-meter-long CCSP; 5) The CCSP installation work in Cipaku is not in accordance with the schedule of the installation plan because it is waiting for the results of a study from a planning consultant related to the construction that will be used along the	the planning consultant; and 3) PPK has assigned the task of an Independent consultant to make a technical study of the further handling of landslide incidents in Cipaku.	carried out security and evacuation of residents whose homes were at the location where the cliff avalanche occurre.	of an Independent consultant; 2) If the work has been signed by the executing party of the work, then the responsibility is by the executing party.	2) Related to construction requires input and opinions from independent consultants for avalanche handling; 3) Carry out avalanche prevention by mapping and identifying locations that have soil conditions prone to avalanches; 4) The executor of the work must identify all risks that will occur, and establish preventive measures, implemented and supervised and evaluated periodically.

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
			Preventive	Corrective		
		ava-lanche.				
The de-sign does not match the con-ditions of the field (plan-ning con-straints)	1) The target time for complet-ing a short planning document (lack of time) the planning consultant conducts a survey in the field so that the topo-graphical data, mor-phology, utilities and func-tions are located (cultural heritage data) so that the data ob-tained are incom-plete and also result in limita-tions in consulting with the owner and related parties; 2) Availabil-ity of costs to accommo-date the number of expert personnel in accord-ance with	1) PPK con-ducts de-sign re-views re-lated to designs that are not in ac-cordance with the condi-tions in the field with re-lated par-ties such as PDAM so that rail work can be known to remain or shift its position, so that the pro-vider re-sched-ules; 2) The oc-currence of addi-tional costs and time due to changes in design or con-struction due to shifts in job posi-tions; 3) Changes in imple-menta-tion	1) PPK en-sures from the begin-ning of the con-tract by lowering the meas-urement team from the initial KM to the final KM to obtain data and ensure that plan-ning doc-uments such as DED, technical drawings, *bill off quantity* are in accord-ance with the con-ditions in the field; 2) PPK be-fore the imple-mentation of the work coordi-nates with the design consultant to cross-check the existing data by conduct-ing a field survey	1) The con-tractor coordi-nates with PPK, supervisor y consult-ants with planning consult-ants to re-plan the changes that oc-cur be-cause the design does not match the current field con-ditions and changes in the work schedule ; 2) The con-tractor checks or checks the data that will be used as the basis for the design by	1) The con-tractor bears the risk of time be-cause it has to wait for the inap-propriate design to be re-viewed again until it is ap-proved; 2) It affects the con-tractor and KDP and can involve planners as well because there is a possibil-ity that design changes will change the vol-ume, cost and draw-ings. If changes to the de-sign are deemed major then the contrac-tor will coordi-nate with	1) Conduct-ing a pre-liminary examina-tion of the docu-ment by conduct-ing MC 0 and fo-cusing on primary data and second-ary data as docu-ments in the prep-aration of planning for the Direc-torate of Infra-structure to recruit the Con-stitu-tional Court to carry out special designs; 2) Conduct-ing test-ing and re-meas-urement by re-drilling by sam-pling at the work location to ensure the con-struction design is

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	the qualification needs for the preparation of planning documents; 3) Often planners do not see the location and only receive data on previous site surveys, where the data used has not *updated the* latest field conditions; 4) The validity and reality of the data are less trustworthy as inputs in the preparation of the design.	methods and the addition of new material items such as sheetpile to hold soil slides on the PDAM line above the track, during the installation of CCSP; 4) The work cannot be done because it is not in accordance with field conditions so that it must be reviewed or redesigned and related to the design will take a long time where the construction design needs to be checked and recalculated based on	whether the data obtained is in accordance with the construction design; 3) Primary and secondary data in the preparation of the design must be valid and reliable where the design is tested first before being applied.	comparing the conditions in the field. For track work carried out, it can be done testing the taking per 25 to 50 m; and 3) Triangulation, namely by using a dual design or multi method to overcome planning obstacles	the supervisory consultant to ask the KDP to call the planning consultant to redesign the planning. As for PPK, there will be many proposals for design changes from users who want to implement new activities where the role of PPK determines the design according to the results of the consultant's review; and 3) The owner of the work, but if the work has	3) Conducting a field review, then analyzed and evaluated all the plans that have been determined, to find out the existing biases. If it is found that there are very significant differences, then make improvements or revisions to all the plans that have already been drawn up.

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
			Preventive	Corrective		
		field conditions.			been signed the contract by the executing party of the work, then the responsibility is on the side of the job manager	
Constraints related to working hours with residents around the location	1) The construction site of the railway close to the settlement became an obstacle when carrying out overtime work; 2) Citizen protests related to the noise of borpile machines, vibration pollution and air pollution for the installation of CCSPs; and 3) Lack of socialization and approach to local residents	1) The limited hours of work adapt to the culture of the residents around the location; 2) The occurrence of compensation costs that must be given to affected residents, for example, there are residents' houses that are cracked due to vibration due to the use of heavy equipment;	1) Take persuasive actions by socializing and coordinating by involving officials together with the village, and the community around the location of the construction of the railway line which has an impact to get input related to working hours in the project using heavy equipment;	1) Rescheduling by carrying out each stage of work correctly and accelerating CCSP work by adding borpile equipment and stake tools; and 2) Compensation and socialization by involving community institutions and residents around	1) The owner and executor of the work; 2) PPK coordinates with contractors, consultants and community institutions (RT, RW) and the surrounding community to conduct mediation. Contractors related to equipment work time cannot	1) Before the work is contracted to a third party, the owner of the work must carry out socialization and approach the community and the government apparat at the job location about the work implementation plan including the working time. Likewise, after the work is handed

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
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	and officials.	3) The implementation of the work was late implemented with the plan.	2) Socialize with residential residents around the job site and involve influential residents to be part of the work to reduce social impact; 3) Permits from local governments, socialize the community and local officials about the work to be carried out	the work to obtain agreement on working hours.	be maximized at the time of implementation of overtime changing work methods; and 3) The contractor was accompanied by the owner for socialization activities at the beginning of the work in coordination with the Police, Koramil, community institutions and residents.	over to a third party, the implementing party takes the same approach and socialization; 2) Conducting socialization and coordination at the beginning of work related to the use of boorpile equipment used in the implementation of work and agreements on time; and 3) Write to the Police, Koramil, Kelurahan and residents to socialize and coordinate at the beginning of the work to

Risk	Cause	Impact	Recommendations		Risk Division	Risk Mitigation
			Preventive	Corrective		
						get an agreement on working time.
Delays in obtaining planning approval	1) The data used is incomplete and the accuracy of the data is not precise so that the approval is too late; 2) The study of the proposed topic or material is less valid and requires sharpening; 3) There has been no delegation from the Directorate regarding planning approval or levels such as the plan to demolish the warehouse at STA. 4 + 350 and the redesign of the Batu Tulis station emplacement that has not	1) The implementation of activities will be late and may affect the increase in the cost of activities; 2) The implementation of activities on the slate station emplacement has not been able to be carried out pending the results of the redesign approved by the Technical Directorate; and 3) The work that will be carried out becomes backwards and schedule	1) Discussions are carried out with contractors and consultants after the results of the study are obtained, the contractor is allowed to make material acquisitions and simultaneous presentation of the design results with the Directorate of Infrastructure to obtain design review approval; 2) The contractor coordinates with the planning team regarding the work to be carried out	1) The contractor coordinates with the KDP to obtain certainty of the results of the redesign when approval can be obtained to carry out other work in parallel with the work that has received approval; 2) The contractor coordinates with the KDP regarding the valid data of the work to be used in the implementation of the	1) The Owner or assignor of the Job. Throughout the responsibility of the owner, an extension of time is carried out and the Contractor has to reschedule and for redesign work. PPK coordinates with planners, contractors and consultants to accelerate the completion of *the redesign*; and 2) The contractor	1) The contractor coordinates with the KDP ensuring the completion of planning approvals to rearrange the work schedule; 2) As soon as possible, ask the Directorate of Infrastructure for time to be able to receive the KDP for an expose to get suggestions and input for the acceleration of Design approval; 3) Prepare a complete and valid planning document, explain

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	been included in the PPK implementation document coordinates and obtains the approval of the West Java BTP Head of The BTP Center but still has to wait for approval from the Directorate.	changes are made which results in contractor expenses becoming bloated due to the mobilization of tools and workers.	by involving a team that understands the substance planned from the beginning; 3) The contractor reschedules, temporarily, or does other work so that there is no job vacancy when this risk occurs ; 4) Complete the data needed supported by the correct field survey results; 5) Engages a team that understands the planned substance from the start	work; and 3) Discussing the planned material with competent experts and collecting more valid data by scheduling consultations with the technical directorate.	will request an extension of the implementation time because the work documents have not yet received approval.	and discuss it to the party who will approve.
Cost overruns associated with job changes	1) The lack of good planning consultants in carrying out preliminar	1) Additional costs that will be borne by the owner due to project	1) It needs opinions and opinions from design consultants which	1) Choosing work methods that can optimize in the field to carry out	KDP and Contractors share risks based on their objectivity, for KDP changes and	1) Mitigation so that financing is not swollen, an examination of the

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and additions	y planning (topography, morphology, location climate and situation) that has not been carried out comprehensively at the location of the work may need to be assessed which priorities such as flooding cause the baan body to become ablaze even though it is clear that the soil study is not well located while the protective buildings on the river are not considered and budgeting in the implementation is not included in the planning	planning that is not in accordance with the conditions in the field and determining the focus of work priorities that affect the overall work; 2) Resulting in the period of implementation of the work being increased so that it is rescheduled; 3) Financial or economic viability to work may change due to changes and additions to employment.	work is the most priority so that implementation and budgeting can be more efficient; 2) Recalculating for work that has been added is not in accordance with the plan so that the amount of overall costs that must be incurred by the KDP is obtained; 3) Reviewing the design on previous planning that is not in accordance with the current conditions of the site; and 4) Planning consultants carry out planning appropriately, and evaluate each stage of work	work that can be done based on budgeting priorities; 2) Perform steps by scheduling and studying the design on which the work is based to determine the work methods that can be carried out; and 3) Conducting a sensitivity analysis in planning proposals to minimize changes and additional costs.	additional volumes of work result in additional costs affecting the value of the work contract while the contractor will affect the timing of work implementation.	calculated cost analysis and the use of work methods are carried out which analysis can be more efficient and effective; 2) The contractor conducts a review of the work that has experienced an increase or decrease in work in accordance with field conditions; and 3) Conduct careful planning and supported by accurate and realiable data

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	calculations; 2) Lack of data on the timing of planning and preliminary design that has not accommodated activities that have not been included in the employment contract; and 3) Planning errors, due to the lack of data and experts in the analysis of work planning.		with accurate data			

CONCLUSION

1) The dominant risk factors that can affect performance are the occurrence of avalanches in the implementation of work, cost overruns related to changes and additions to work, design not in accordance with field conditions (planning constraints), constraints related to working hours with residents around the location, and delays in obtaining planning approval ;
2) The form of mitigation of the dominant risk resulting from interviews with experts obtained the following results:
   a) The occurrence of avalanches in the implementation of work is:
      1. Apart from construction work, coordinating with ppk land related to land limitations with the aim of reducing the burden of slopes due to residential areas and invetarization of areas that are included in landslide-prone areas that need to be relocated permanently by purchasing residents' property so that the burden from settlements can be removed and reduced;

2. Related to construction requires input and opinions from independent consultants for avalanche handling;
3. Carry out avalanche prevention by mapping and identifying locations that have soil conditions prone to avalanches;
4. The executor of the work must identify all the risks that will occur, and establish preventive measures, implemented and supervised and evaluated in acryodic manner.

b) The cost overruns associated with job changes and additions (X30) are:
   1. An examination of the calculated cost analysis and the use of work methods are carried out which analysis can be more efficient and effective;
   2. The contractor conducts a review of the work that has experienced an increase or decrease in work in accordance with field conditions;
   3. Carry out careful planning and supported by accurate and realiable data.

c) The design not in accordance with field conditions (planning constraints) (X6) is:
   1. Conducting a preliminary examination of the document by conducting MC 0 and focusing on primary data and secondary data as documents in the preparation of planning for the Directorate of Infrastructure to recruit the Constitutional Court to carry out special designs;
   2. Conducting testing and re-measurement by re-drilling by sampling at the work location to ensure the construction design is appropriate at the time of MC 0; and
   3. Conducting a field review, then analyzed and evaluated all the plans that have been determined, to find out the existing biases. If it is found that there are very significant differences, then make improvements or revisions to all the plans that have already been drawn up.

d) Constraints related to working hours with residents around the location (X43) are:
   1. Before the work is contracted to a third party, the owner of the work must carry out socialization and approach to the community, government officials at the job site explain the plan for the implementation of the work including the working time. Likewise, after the work is handed over to a third party, the implementing party takes the same approach and socialization;
   2. Conducting socialization and coordination at the beginning of work related to the use of *boorpile* equipment used in the implementation of work and agreements on time; and
   3. Write to the Police, Koramil, Kelurahan and residents to socialize and coordinate at the beginning of the work to get an agreement on working time.

e) Delays in obtaining planning approval are:
   1. The contractor coordinates with the KDP ensuring the completion of planning approvals to rearrange the work schedule;
   2. As soon as possible, ask the Directorate of Infrastructure for time to be able to receive the KDP for *an expose* to get suggestions and input for the acceleration of Design approval;
   3. Prepare a complete and valid planning document, explain and discuss it to the party who will approve.

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