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Risks Identification in Construction of Jetty Projects: Literature Review

Kiki Patricia Dewi[1], Jatmiko Kurniawan[2], Herman Irawan[3], Humiras Hardi Purba[4]

[1,2,3]*Civil Engineering Department, Universitas Mercu Buana Jakarta, Indonesia*
[4]*Industrial Engineering Department, Universitas Mercu Buana, Jakarta,Indonesia*
email: [1]kiki.patricia.dewi@gmail.com, [2]jatmiko.kurniawan72@gmail.com, [3]herman_irw@yahoo.com

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Abstract

Project development delays are often caused by various risk factors that were not identified during project implementation, resulting in increased project delays and unforeseen costs. However, construction projects involve different risks depending on the type of project and the environmental conditions of the project, and different ways of executing the project must be addressed.

In a jetty project, risk assessment is carried out from both technical and non-technical perspectives. From a technical point of view, risks are assessed starting from soil conditions, water level, weather, installation methods, design changes, etc. Meanwhile, from a non-technical perspective, the risks arising from the environment, social and social aspects are assessed. economic, legal, and institutional aspects as well as finance and investment.

This summary of literature review shows that technical risk has the most dominant role in jetty projects, especially in the category of internal and external projects.

Keywords: *Jetty, risk management, construction, technical, non-technical, risk, dredging*

Abstrak

Keterlambatan proyek seringkali disebabkan oleh berbagai faktor risiko yang tidak teridentifikasi selama pelaksanaan proyek, meningkatkan keterlambatan proyek dan biaya tidak terduga. Namun, setiap proyek konstruksi melibatkan risiko yang berbeda tergantung pada jenis proyek dan kondisi lingkungan proyek dan oleh karena itu perlu metode pelaksanaan proyek yang berbeda untuk menanganinya.

Dalam proyek *jetty*, penilaian risiko dilakukan baik dari perspektif teknis maupun non teknis. Dari segi teknis, risiko dinilai mulai dari kondisi tanah, ketinggian air, cuaca, metode pemasangan, perubahan desain, dan lainnya.

Sedangkan dari segi non teknis dinilai risiko yang timbul dari aspek lingkungan, dan sosial, aspek ekonomi, hukum, dan kelembagaan serta keuangan dan investasi.

Ringkasan tinjauan pustaka ini menunjukkan bahwa risiko teknis memiliki peran yang paling dominan pada proyek *jetty* terutama dalam kategori proyek internal dan eksternal.

Kata kunci: *Jetty, manajemen risiko, konstruksi, teknis, non teknis, risiko, pengerukan*

INTRODUCTION

The word Risk is often assumed to imply a negative outcome and it is commonplace that risk is uncertain. Risk can have positive or negative consequences. Negative risk is defined as threat and positive risk is defined as opportunity (Cretu et al., 2011) In construction projects, hazard matrices are very sensitive as well as risk-averse. This sensitivity is due to several characteristics inherent to construction projects (Bunni, 2003) Risk is the combination of the probability or frequency of occurrence of a hazard and the magnitude of the consequences of that event. Risk assessment is an integrated analysis of the likelihood of events occurring and their effects in general as well as in significant respects. The probability, magnitude, and importance of events can be estimated from previous experience or probability calculations (Bunni, 2003) Risk management is an ongoing process and should cover all phases of the project as the project is divided into separate phases. Because construction projects are dynamic, a risk assessment is required at the end of a project phase before proceeding to the next phase (Smith et al., 2006)

RESEARCH METHODOLOGY

The journal is compiled by conducting a search looking for other journals on trusted source sites and then selecting journals based on risk identification in the construction of jetty projects.

The risk identification process when building a jetty project is extreme and critical. Risk measurement involves applying different approaches and technologies to determine the level of risk for each objective and extrapolate risk analysis. The risk management process evaluates the performance of risk management. Risk identification is the first and main step of risk management process. Explain the competitive conditions and the identification of risk and uncertainty factors (Rutkauskas, 2008) Identification of potential risk sources and accountability for uncertain events.

Project risks are divided into three groups (Zavadskas et al., 2010):

- External
- Project
- Internal

The risks reviewed are technical and non-technical risks from external, project, and internal.

Figure 1 shows the research framework of this paper.

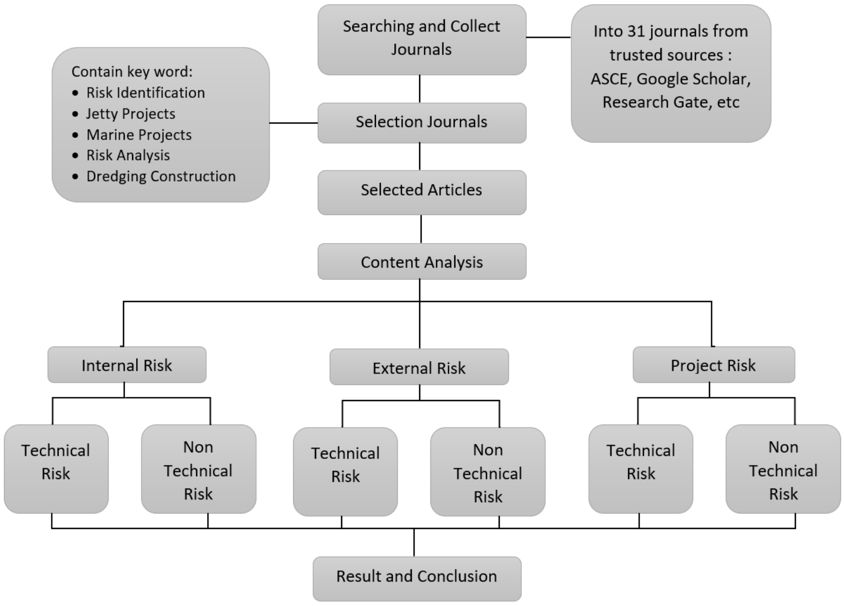

Figure 1. Research Framework

RESULTS AND DISCUSSION

Research shows that contractors are more willing to take contractual and legal risks than any other type of risk (Kartam & Kartam, 2000).

This literature review aims to identify risks during the construction of jetty projects that are the object of research and group those risks into specific categories, determine risk level based on identified risk and determine the risk response to high-risk risks.

The benefits of this review are beneficial to companies in the construction industry, especially contractors undertaking similar work related to the subject of this research, namely knowing in advance what risks have a high level of risk on the jettys, by knowing the risks. In addition, this analysis is also useful for researchers who are interested in risk analysis so that it can be used as a reference in terms of risk identification to develop further research, especially in similar fields.

In this study, a risk assessment was conducted which was divided into 3 (three) categories namely: (a) Internal risk; Internal risks may be divided by parties that may be the originator's risk events such as stakeholders, designers, contractors, and others. Internal risks in project construction, including resource risk, project staff risk, stakeholder risk, planner risk, contractor risk, subcontractor risk, supplier risk, team risk, site risk, document and information risk, (b) External risk; External risks are risks beyond the control of the project management team such as political risks, economic risks, social risks, and weather risks, (c) Project risks; construction criteria of project risk are time risk, cost risk, work quality, construction risk, and technology risk.

The above three categories are divided into 2 (two) categories including (a) Technical risk; Technical risk assessment relates to assessing the probability that the system embodied in design when built meets technical/performance requirements, and if there is an expected performance deficiency, how serious the impact is (Klein & Cork, 1998) (b) Non-technical risks; Non-technical risk (NTR) is a risk that can directly affect a particular project, the cause of which is an unplanned and unexpected event resulting in an undesirable deviation from the original project delivery site carried out by an external (non-contractor) stakeholder. a clear relationship between risk and external stakeholders distinguishes NTR from technical risks in the context of the project. In other words, NTR (also known as above-ground risk) usually comes from external stakeholders/environments (Ite, 2016). In this article, non-technical risks related to financial risk, operational institutions, land acquisition, risk from stakeholders or governments, political risks, law, partnerships, socioeconomic, weather risk, etc. (Ite, 2016).

The results of research on safety at the pier project show the most dominant risk priority in girder bridge construction is the girder falling off during mobilization, and daydreaming is the most dominant cause. 4 (four) factors have been identified as sources that cause accident risk which are personal factors, managerial factors, technical and related tool factors and environmental factors. (Aulady et al., 2018)

3.1. Internal Non-Technical Risks

There are risk factors that are at a very high level, this includes understanding of contract documents, different location conditions, equipment productivity, material quality, cash flow, sub-contractor capacity, and weather effects (Nugroho, 2019)

The highest risks are aspects of environmental change, design incomprehension, aspects of workers' inadestruction, aspects of environmental change, aspects of employment, technical aspects of employment, aspects of price increases and mobilization of equipment, aspects of negligence and work accidents (Tangdiembong et al., 2013)

Risk management is important and useful for marine projects. Six categories of risk factors include: i) acts of god; ii) physical ; iii) financial and economic ; iv) politics and the environment ; v) design and vi) related construction (Tam & Shen, 2012)

Risk analysis on a high scale, namely: a. There was a machine failure. b. Delay in procurement of materials and equipment. c. Incompatibility of implementation results with specifications. Risk analysis above that on a medium scale, namely: a. The influence of erratic weather factors. b. Shop drawing work and design work are not detailed. (Anwar &Adi, 2015)

Designing low-cost port construction to achieve acceptable results. Work with local agencies and ship operators to combine worldwide technical knowledge with local practices and customs. Reducing risk in local communities is associated with strengthening the knowledge, skills and motivation of people in vulnerable communities and supporting their initiatives to create safe conditions and practices (Connor et al., 2011).

The list of journals of options conducted by review and analysis of the risk identification aspects in the jetty project is shown in Table 1

Table 1. Risk Identification

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
(Chou & Chiu, 2020)	V	V	V	V	V	V	A knowledge-based system is created, covering 170 risk events and solutions for various dredging projects, and a graphical user information system is built in a programming language, to enable the WRA to save engineering experience systematically for future exploitation
(Ismiyati et al., 2020)	V	X	V	X	V	X	From a construction service provider's perspective, there are five high risks: Sea tides, disruption of cargo handling operations, design changes due to site changes, discrepancies in construction methods between consultants and contractors, damage to heavy machinery

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
(Joubert & Pretorius, 2020)	V	V	V	V	V	V	The checklists are categorized according to Work Breakdown Structure (PSP) and relate to (1) Breakwaters, (2) Landfills, (3) Inlet Channels and Reservoirs, (4) Quays, and (5) Container Depots and Buildings. includes the risk of , (6) power supply, (7) project management office. Findings are produced by subject matter experts for a particular project and can therefore be used during risk identification, as a completeness check after risk identification in similar projects, or as needed. It can be used for individual activities (e.g. quay construction) depending on the scope of the project..
(Song et al., 2020)	V	V	V	V	V	V	Port works are mainly affected by coastal storm surges nonlinear flood shock interaction. In addition, his quarter-day variation in storm surge due to harbor facilities is due to the effect of harbor facilities on his quarter-day tides. Modulations of constituents and wave momentum shift into the coastal circulation.
(Keerthana & Pradeep, 2019)	V	V	V	V	V	V	Technical risk, design risk, construction risk, procurement risk and management risk are emphasized. To overcome the above hurdles, there are specific approaches to identifying risks. Formal, informal and static approaches. From the responses collected, it was found that buildability risks have a significant impact on the project, such as leading to risk.
(Roubos et al., 2019)	X	X	X	X	V	X	The target reliability index derived in this study was determined from several risk acceptance criteria. In this section, we present the confidence measures found for any teq ≥ 20. This means that the expected consequences of certain failure modes are generally smaller with some additional measures to improve system robustness.
(Nugroho, 2019)	V	V	V	X	V	V	There are seven risk factors at a very high level. This means understanding contract documents, varying site conditions, equipment productivity, material quality, cash flow, subcontractor capacity, and weather effects.
(Indraswari P, I Nyoman Norken, 2018)	V	V	V	V	V	V	The results showed 39 identified risks. 9 unacceptable risks, 25 undesirable risks, 3 acceptable risks, and 2 ignored risks. Risk mitigation of 34 dominant risks (9 unacceptable risks, namely limited waterways, licensing problems and accessibility problems and also for unwanted risks, namely design problems, natural disasters and worker coordination)
(Aulady et al., 2018)	V	X	V	X	V	X	The results of this study indicate that the most dominant risk priority in beam bridge construction is beam fall during mobilization. Daydream are the most dominant cause. Four factors were identified as sources of accident risk: personal factors , administrative factors ,

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
							technical and tool-related factors, and environmental factors .
(Kresna, 2018)	V	X	V	V	V	X	The dredging that will be carried out at the APBS has internal risks and external risks whose risks are divided based on the stages of dredging activity, namely the risk when dredging is carried out, the risks when sending sediment material to the discharge location, and the risk of removing sediment material. Another risk in dredging activities in the APBS that is not found in other dredging activities is the presence of submarine pipes and cables and mines scattered around the dredging area.
(Yuan et al., 2017)	X	X	V	X	V	X	Possible types of seismic failure of such structures, taking into account the effects of certain corrosion phenomena in long-term operation
(Iswanto et al., 2017)	V	V	V	V	V	V	The 12 main risk factors are effect on time performance are: Unstable socio-political environment, Big waves, Accidents that occurred to workers, Denial of implementation projects from the surrounding community caused by environmental pollution the surrounding community who does not support the construction project, Difficulty use of new technology, error in estimating the time of work in the field or wrong regulation, Uncertainty of the surrounding government policies on project activities, The process of land acquisition for problematic projects, Material damage, Lack of local government support for projects, outbreak of conflicts with local communities
(Mondoro et al., 2017)	V	V	V	V	V	V	Minimizing life cycle costs and minimizing maximum life cycle risk are conflicting goals, with repairs and retrofits increasing life cycle costs but decreasing maximum life cycle risk. The risk likely : hurricane, traffic hazards, and deterioration mechanisms, post-disaster regional economic conditions such as rising building materials and labor costs, real interest rates, etc
(Anwar & Adi, 2015)	V	X	V	V	V	X	Risk analysis is on a high scale, namely: a. There is a heavy equipment failure b. Delays in procuring materials and equipment c. Incompatibility of implementation results with specifications The risk analysis above which is on a moderate scale, namely: a. The influence of erratic weather factors. b. Shop drawing and design work is not detailed.

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
(Jaber, 2015)	V	V	V	V	V	V	According to this study, the top 10 factors are: security measures, losses due to corruption and bribery, losses due to delays in the permitting bureaucracy, unofficial holidays, losses due to political change, rising material prices, unfair bidding, improper project planning and budgeting, design changes and personnel. increase in expenses
(Khan, 2013)	V	V	V	V	V	V	This paper describes impact of identified risks on project schedule, scope and budget through quantitative and qualitative analysis using a database of two real construction projects. These risks have resulted in scope being out of control, costs over budget, time overruns, or quality issues.
(Tangdiembong et al., 2013)	V	X	V	X	V	X	The results of the analysis show that the highest risk is the aspect of environmental change, incomprehension design, aspects of Worker Inability, aspects of Environmental Change, aspects Manpower, technical aspects of work, aspects of price increases and equipment mobilization, aspects of negligence and work accidents
(Tam & Shen, 2012)	V	V	V	V	V	V	Risk management is important and useful for Six categories of offshore project risk factors were investigated. i) acts of god/force majure; ii) physically; iii) finance and Economics. iv) political and environmental; v) design; vi) construction related.
(Skibniewski & Vecino, 2012)	V	V	V	V	V	V	Using PMFD (Management Framework for Dredging Projects) is key to assisting those involved in dredging projects with proper management tasks. In addition, PMFD creates a basis for planning, forecasting, and evaluating future projects. These capabilities are essential because they free administrators from the burden of manually processing information, allowing them to spend more time analyzing, planning, inspecting, and monitoring. These key features of PMFD are summarized in the following sections.
(Wayan et al., 2012)	V	V	V	V	V	X	There are 6 risk variables that exist at level High is risk due to nature/ weather, settlement is not on time, penalties for late arrival, there is an increase in the price of iron, occurs an increase in the price of concrete sand, occurred increase in cement prices
(Siswanto, 2012)	V	V	V	V	V	V	There are 10 risks that have a high level of risk that need attention are extreme weather (heavy rain, strong currents, strong winds, lightning), work completion (sub-contractors) is not timely, extreme climate disturbs productivity, incomplete / unsuitable data investigations in the field, unforseen problems (rocks in the ground, mines, utility networks), another party's

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
							ship crashing into construction, pontoon barges and tug boat collision with another ship during operation, due to errors working conditions different from the contract, changes in the scope of the contract
(Liew & Lee, 2012)	X	X	V	X	V	X	The continuous supply chain system applied in this industry consists of many loopholes that make the supply chain system inefficient and vulnerable to various types of risks. Examine the risk of commodity price fluctuations and develop mathematical models to quantify risk.
(Connor et al., 2011)	V	V	V	V	V	V	Designing cost-effective port developments that achieve acceptable results. Work with local agents and boat operators to combine global technical knowledge with local practices and customs.Reduces risks in local and relevant communities by enhancing the knowledge, skills and motivation of people in vulnerable communities and supporting initiatives to create safer conditions and practices. Rather than looking at ports in isolation, propose an integrated approach that combines port operations with flood and typhoon planning, community-based disaster risk management, and overall economic development goals.
(Suedel et al., 2008)	V	V	V	V	V	V	A combination of risk assessment and multi-criteria decision analysis enables the development of a framework of objective processes consistent with the National Academy of Sciences recommendations for setting environmental windows
(Balas & Ergin, 2002)	X	X	X	X	V	X	The risk of structural damage during construction has been found to be an important factor to consider in reliability-based project management. This is because coastal projects carry a significant risk of damage during construction.
(Gudmestad, 2002)	V	X	V	X	V	X	For deepwater facility vulnerability to weather during the installation phase is emphasized, especially as recent project management principles increasingly focus on cost-effective project execution.
(Ergin & Balas, 2002)	X	X	V	X	X	X	The reliability-based structural risk assessment model provides a valuable tool in the design of coastal structures, which are characterised by large failure consequences and substantial capital expenditures
(Simm & Camilleri, 2001)	V	V	V	V	V	V	Modern general risk methodologies can be applied to the construction of river and coastal engineering projects to better define risks and attribute them to the best parties to manage them. Particular attention should be paid to the weather (wind, wave level, river flow) and ground conditions.

Paper Identity	Risk Identification						Results
	Internal		External		Project		
	T	NT	T	NT	T	NT	
(Kartam & Kartam, 2000)	V	V	V	V	V	V	This study found that contractors are more willing to take contractual and legal risks than other types of risk
(Thompson et al., 1996)	V	V	V	V	V	V	The following conclusions are drawn for the risk-based analysis of coastal projects. • A risk-based approach provides a powerful tool for analyzing coastal projects. • Risk-based analysis can lead to better project optimization decisions. • The life cycle approach is particularly suitable for coastal construction.
(Al-Bahar & Crandall, 1990)	V	V	V	V	V	V	Risk category: • Acts of God • Physical • Financial and economic • Political and environmental • Design Construction-related

Note: Technical (T), Non-Technical (NT)

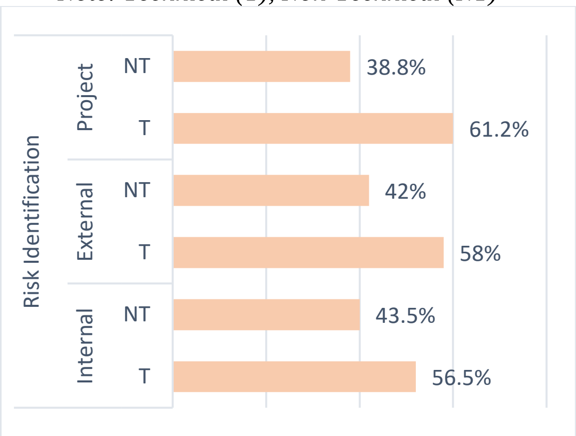

Figure 2. Barchart Analysis of Research Articles by Risk Category in Jetty Project**1**

In the Figure 2, it appears that the percentage of risk caused by technical risk has a greater amount compared to non-technical, and the highest risk is project risk.

While the risk recapitulation in the jetty project based on the review of the article is shown in the Table 2.

Table 2. Journal Recapitulation

Risk Category		Research Jurnal
Project	NT	2,5,8,12,13,14,15,17,18,19,20,22, 23,24,27,28,29,30,31
	T	1,2,3,4,5,7,8,9,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,26,27, 28,29,30,31
External	NT	2,4,8,12,13,14,15,16,17,18,19,20, 22,23,24,25,27,28,29,30,31
	T	1,2,3,5,6,7,8,9,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,27,28, 29,30,31
Internal	NT	2,4,5,8,12,13,14,15,17,18,19,20,2 2,23,24,27,28,29,30,31
	T	1,2,3,4,5,7,8,9,12,13,14,15,16,17, 18,19,20,22,23,24,25,27,28,29,30, 31

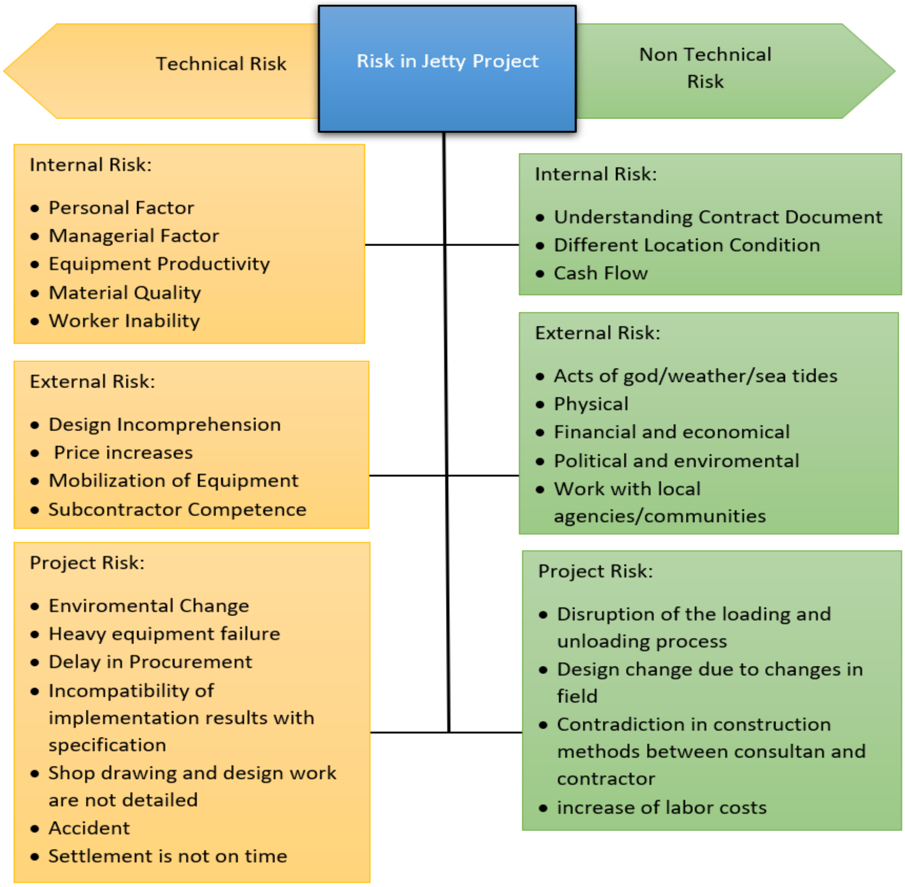

Figure 3. Risk in Jetty Project Based on Articles Review

Based on Figure 3, it can be seen that the risk groups that often occur in jetty projects, both technical and non-technical categories and occur due to internal, external and the project itself. From the technical category, project risk has the highest number compared to internal risk and external risk.

CONCLUSION

The following conclusions are obtained regarding the risk-based analysis of the jetty project:

The project risks can be divided into three groups consist of project risk, external risk, and internal risk. The risks reviewed are technical and non-technical risks.

The percentage of risk caused by technical risks has a greater amount compared to non-technical risks.

From the technical category, project risk has the highest number compared to internal risk and external risk.

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