



## Analysis Of Investment Strategy For Adopting Battery Electric Vehicle Trucks in Indonesia (Case Study Of PT XYZ)

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### Abstract

**Background.** Indonesia's commitment to reducing greenhouse gas emissions through national policies and international agreements encourages the adoption of battery-electric vehicles. PT XYZ, a logistics company that operates more than a hundred diesel-powered trucks, is faced with a strategic decision regarding transitioning from internal combustion engine trucks to battery-based electric trucks amid changing technology and infrastructure readiness.

**Aims.** This study aims to analyze PT XYZ's investment strategy for adopting electric battery-based trucks by identifying and prioritizing factors that influence the decision-making process.

**Methods.** Using the *Analytic Hierarchy Process* (AHP) method as the main approach, this study evaluates technical, economic, infrastructural, environmental, social, governance, and corporate factors through a structured paired comparison.

**Result.** The study's results show that economic, infrastructure, and governance factors are the most dominant considerations, and cost efficiency, availability of charging stations, and regulatory policies are the main drivers in decision-making.

**Conclusion.** Based on the analysis's results, it was concluded that PT XYZ's adoption of electric battery-based trucks is not yet the optimal choice under current conditions, so maintaining a fleet of internal combustion engine trucks remains the most appropriate strategy.

**Implementation.** This research provides valuable insights for PT XYZ and similar companies in emerging markets. It emphasizes the importance of aligning business strategy, infrastructure readiness, and regulatory support before adopting new vehicle technologies.

**Keywords:** Decision-Making Criteria; Battery Electric Vehicle; Adoption, Multi Criteria; Investment Strategy

### INTRODUCTION

In the current era of technological advancement, environmental problems, and especially climate change, are becoming increasingly crucial. The use of fossil fuels and internal combustion engine vehicles contributes significantly to greenhouse gas emissions, thus encouraging countermeasures at both the global and national levels to reduce these impacts. Indonesia, through its commitment to *the Paris Agreement and to publishing Presidential*

*Regulation No. 55/2019, updated with Presidential Regulation No. 79/2023, has set clear targets to accelerate the adoption of battery-based electric vehicles (battery electric vehicles) as part of the strategy to reduce emissions and increase the use of renewable energy. Fiscal and non-fiscal incentives provided by the government, including tax breaks and infrastructure development support, are designed to accelerate this transition within a set timeframe.*

PT XYZ, a logistics and outsourcing company that operates over a hundred *internal combustion engine* trucks, faces a strategic dilemma in responding to regulatory developments and changing market dynamics. The company sees the potential benefits to be gained from adopting *battery-electric vehicles* to align with environmental initiatives and government policies. However, uncertainty related to technological maturity, infrastructure readiness, and high investment costs is a factors that complicate the decision-making process. This study focuses on the identification of influencing factors as well as priority criteria in decision-making to determine whether the adoption of electric battery-based trucks is a viable investment strategy for PT XYZ. The purpose of this study is to provide a structured analysis in evaluating and establishing criteria that influence the company's investment decisions in battery-based electric vehicle projects. Thus, the results of this study are expected to support PT XYZ in making appropriate and informed decisions regarding the adoption of electric battery-based trucks, taking into account the company's current conditions, regulatory framework, and market dynamics in Indonesia.

## **LITERATURE REVIEW**

The basis of this research rests on several previous studies and theories regarding the comparison between battery-based electric vehicles (*battery electric vehicle*) and vehicles with internal combustion engines (*internal combustion engine vehicle*), inhibiting factors in the adoption of battery-based electric vehicles, as well as appropriate analysis methods to be employed in this study. Previous studies form the main foundation of this study, so it is expected to produce valid and relevant solutions to the problems faced by companies. The main theory used in this study consist the comparison between battery-based electric vehicles and vehicles with internal combustion engines. The practice of using battery-based electric vehicles has been implemented in various countries. According to research conducted by Liu et al (2021), the study analyzes and compares battery-based electric

vehicles and internal combustion engine vehicles from a total-cost-of-ownership perspective.

The results of the study show that battery-based electric vehicles will reach a cost-balancing point (*cost parity*) with a vehicle with a combustion engine within a period of 6 to 8 years of ownership. The study also reveals that the heavier the type of vehicle, the greater the potential cost savings that can be obtained. This is due to lower operating and maintenance costs of battery-based electric vehicles, even though the initial purchase price is much higher than that of internal combustion engines. Meanwhile, research by (Vega et al, 2023) Provides another perspective by comparing battery-based electric vehicles and vehicles with internal combustion engines in terms of the environmental impact generated by each type of vehicle. The study results showed that battery-based electric vehicles produce significantly lower carbon monoxide (CO) and carbon dioxide (CO<sub>2</sub>) emissions, that is to say, approximately 20% less than those of internal combustion engine vehicles. Based on these two studies, it can be concluded that battery-based electric vehicles provide more benefits than internal combustion engines, both in terms of cost efficiency and environmental impact. These findings are the basis for consideration in this study to assess the feasibility of adopting electric battery-based trucks at PT XYZ.

Although battery-based electric vehicles (*battery electric vehicle/BEV*) have various advantages, according to research conducted by Shen et al (2024), several inhibiting factors limit efforts to promote and adopt electric vehicles. The research conducted in China identified five main dimensions that are obstacles in driving the adoption of electric vehicles, as shown in Table 1. The first dimension is **Technical Specifications**, where some of the technical aspects that influence the decision to adopt electric vehicles include limited battery life, long charging times, limited mileage, safety issues, and problems in the battery disposal and recycling process. The second dimension is **Infrastructure Readiness**, which includes factors such as the lack of a small number of charging stations, the uneven distribution of charging stations, and the lack of mechanism for sharing the use of charging stations (*Charging Batteries*), as well as uncertainties related to the availability of maintenance, service, and repair services. The third dimension is the **Economics**, which includes relatively high vehicle purchase prices, market uncertainty, concerns about resale value, and supply chain constraints. The fourth dimension is **Governance**, which is related to local protectionism and incomplete or inconsistent policies and regulations. The fifth dimension is **Social**, which discusses the low public awareness of and skepticism towards electric

vehicles. This study further shows that among these five dimensions, factors are most influential in inhibiting the promotion and adoption of electric vehicles in China. This finding is one of the important references in understanding similar challenges that may be faced in adopting battery-based electric vehicles in Indonesia.

**Table 1. Restricting Factors for Adopting Electric Vehicles**

<b>Restricting Factors for Adopting Electric Vehicles</b>	
<b>Technical</b>	Limited Battery Durability
	Long Charging Time
	Security Issues
	Disposal and Recycling
<b>Infrastructure</b>	Shortage of Charging Stations
	Improper Distribution of Charging Stations
	Lack of Sharing Between Charging Piles
	Uncertainty of Maintenance, Service, and Repair Infrastructure
<b>Economy</b>	High Purchase Price
	Market Uncertainty
	Anxiety About Resale
	Supply Chain Constraints
<b>Governance</b>	Local Protectionism
	Incomplete Policies and Regulations
<b>Social</b>	Lack of Awareness
	Skeptical Attitude

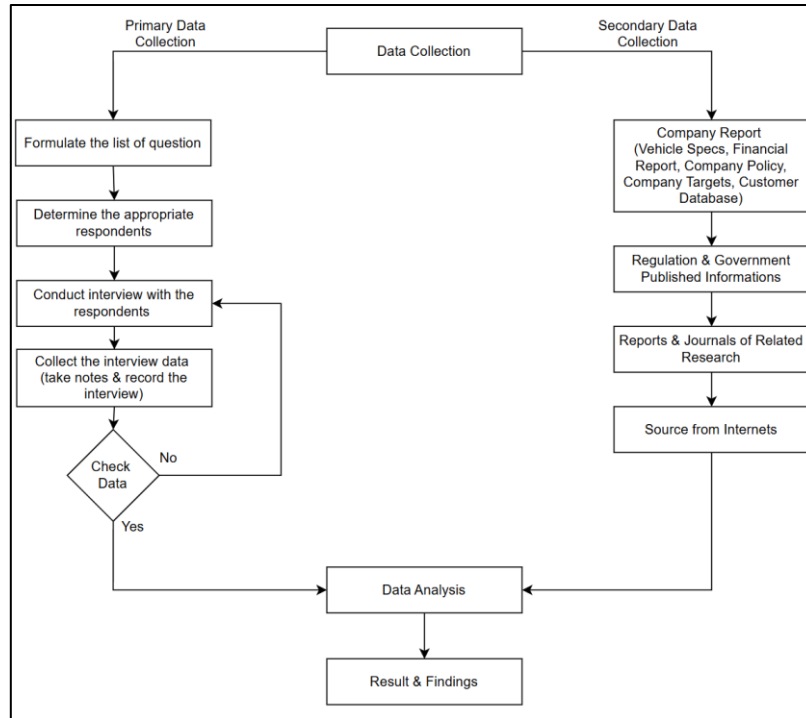
As shown in Table 1, it is clear that the adoption of battery-based electric vehicles has some inhibiting factors that influence the decision to continue the technology adoption process. According to (Elkana, 2020), problems that require finding the best solution by considering various criteria can be categorized as problems of *multi-criteria decision analysis* (MCDA) or multicriteria decision analysis. Several methods can be used to solve the problem of multi-criteria decision analysis. Based on research (Elkana, 2020) and (Shen

et al., 2024), the method used to solve the problem is the *Analytic Hierarchy Process* (AHP). The AHP method allows comparison between criteria and assesses the level of importance of each criterion, so that alternative decisions can be sorted and the highest-ranked alternative will be chosen as the most optimal solution. According to (Bazayit and Karpak, 2009), the AHP method organizes perceptions, judgments, feelings, and memories into a framework that systematically shows the factors influencing the decision-making process. Thus, AHP is a practical approach in supporting the investment strategy selection process, including adopting battery-based electric vehicles at PT XYZ. The AHP method is very useful for making important decisions related to the needs of many people's livelihoods, such as the management of ecotourism through zoning in Iran taking into account the relative importance of physical, natural, environmental, and socio-economic factors to determine the suitability of ecotourism locations (Zabihia, et al., 2020); Groundwater management in Mpwapwa District, Dodoma, Tanzania by considering 7 important factors namely lithology, soil type, drainage density, straightness, magnetic intensity, slope, and elevation (Mgelwa Allya, et al., (2024); Assignment The top priorities of digital transformation strategies for energy companies, such as big data, artificial intelligence, blockchain technology, and digital twins (Chernov et al., 2025); There are 24 options for managing radiated graphite waste to protect the surrounding community and after calculating using AHP, there are 2 important factors, namely the environment and public safety (28.05%) and 'worker safety' (26.16%) according to (Guidi et al., 2024). Determination of the composition of the UK standard-compliant concrete mix and the specified concrete mix design is recommended to be divided by material weight (Joshua et al., 2024).

## **METHOD**

This study uses the AHP method. The subjects of this study include the key decision-makers at PT XYZ (President Director, Director of Operations, and Sales and Operations Manager). Respondents are selected based on their authority in strategic decision-making and a comprehensive understanding of the company's logistics operations and investment decisions. This research focuses on the electric battery-based truck investment project as the main object of the study, and it was conducted at PT XYZ (Jababeka Industrial Estate, Cikarang, Bekasi, West Java). The data collection and analysis process was carried out from January to April 2025, in line with the company's planning period regarding the potential adoption of new vehicle technology. The primary methods of collecting primary data (semi-

structured interviews with respondents) and secondary data (internal company documents, relevant government regulations such as Presidential Regulation No. 79/2023, as well as various other policy documents related to the adoption of electric vehicles in Indonesia) are shown in Figure 1.



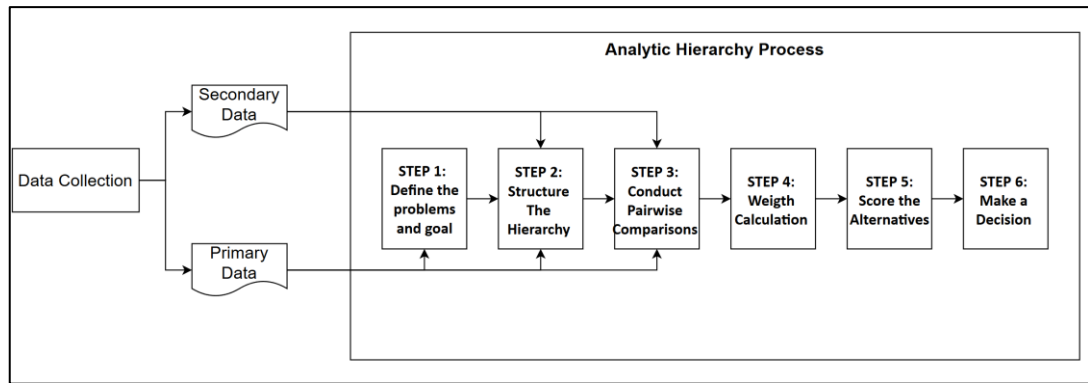
Source: Research images.

**Figure 1. Data Collection Diagram**

The analysis process begins with preparing a decision hierarchy, which consists of main objectives, criteria, sub-criteria, and investment alternatives. The criteria and sub-criteria were identified based on a literature review and validated through interviews with key stakeholders at PT XYZ.

Paired comparisons were carried out using a scale developed by (Saaty, 1990) to assess the relative importance of each factor. The calculation of priority weights and consistency ratios is carried out using the software "SuperDecision" to ensure accuracy and logical consistency in the analysis results. A consistency ratio below 0.10 is considered to meet the eligibility criteria.

Each alternative (electric battery-based trucks and fuel-fueled trucks) was assessed against sub-criteria based on input from stakeholders. The resulting weights were subsequently accumulated to determine the most appropriate investment options and identify key factors in decision-making, as shown in Figure 2. Through this process, the research provides a clear basis for PT XYZ to make strategic decisions related to vehicle investment.

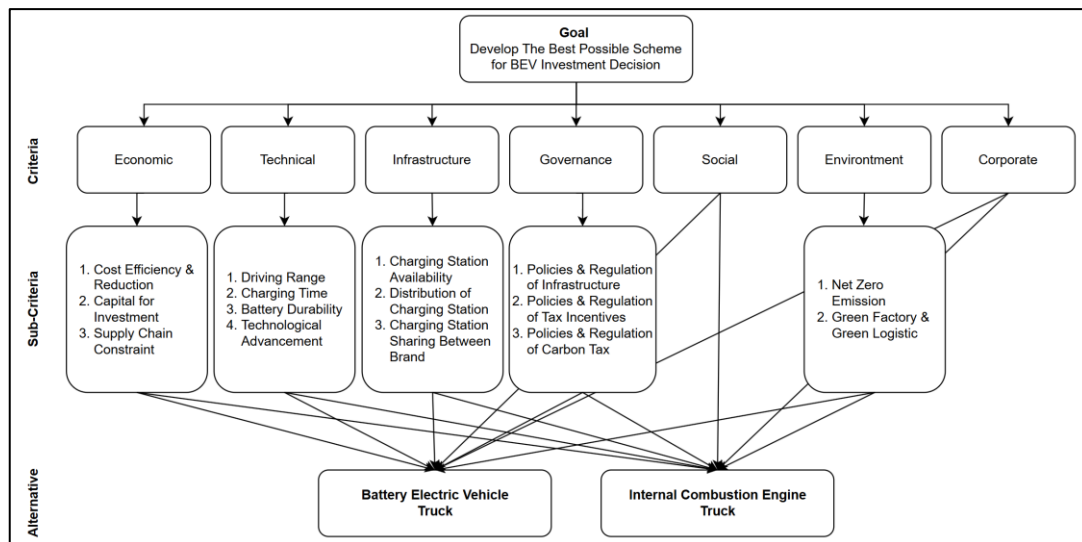


Source: Research images.

**Figure 2. Data Analysis Diagram**

## DISCUSSION

This study aims to analyze the investment strategy in adopting *battery electric vehicles* in PT XYZ by identifying the influencing criteria, determining the priorities of each, and formulating the best possible investment scheme. These criteria and sub-criteria are then compiled into a decision hierarchy to formulate the best investment scheme for adopting electric battery-based trucks, as shown in Figure 3.



Source: Research images.

**Figure 3. AHP Hierarchy**



The analysis results using the AHP method show that economic, infrastructure, and governance factors are the three main priorities that influence investment decisions the most. According to research by (Gupta et al, 2015), to support sustainability, manufacturing companies must pay attention to three aspects, namely economic, social, and environmental. Economic factors ranked highest with a weight of 34.85%, which shows that the financial aspect remains the most crucial consideration for PT XYZ. Infrastructure readiness is ranked second with a weight of 21.15%, reflecting the limitations of the charging infrastructure for electric trucks in Indonesia. Meanwhile, the *governance* factor ranked third with a weight of 17.19%, emphasizing the importance of government incentives and regulatory clarity in supporting the investment decision-making process, as shown in Figure 4.

Inconsistency: 0.09876		
1. Econom~	<div style="width: 34.85%;"></div>	0.34851
2. Enviro~	<div style="width: 6.13%;"></div>	0.06132
3. Infrasm~	<div style="width: 21.15%;"></div>	0.21152
4. Govern~	<div style="width: 17.19%;"></div>	0.17187
5. Techni~	<div style="width: 9.39%;"></div>	0.09399
6. Social	<div style="width: 5.87%;"></div>	0.05870
7. Corpor~	<div style="width: 5.40%;"></div>	0.05409

Source: Research images.

**Figure 4. Ranking of Criteria**

The alternative assessment analysis compares *battery-electric vehicles* and *internal combustion engine* trucks based on predetermined sub-criteria. The analysis results indicate that internal combustion engine trucks are still the superior option under current conditions, with a total score of 61.58% compared to 38.42% for electric battery-based trucks, as shown in Figure 5. Although battery-electric trucks have shown good environmental benefits, corporate responsibility, and technological advancements, these advantages have not offset high investment costs, limited infrastructure, and *supply chain constraints*. Therefore, based on this analysis, a truck with internal combustion engines remains the most suitable choice for PT XYZ in the short term.

Name	Graphic	Ideals	Normals	Raw
1. Battery Electric Vehicle Truck		0.624047	0.384254	0.133089
2. Internal Combustion Engine Truck		1.000000	0.615746	0.213267

Source: Research images.

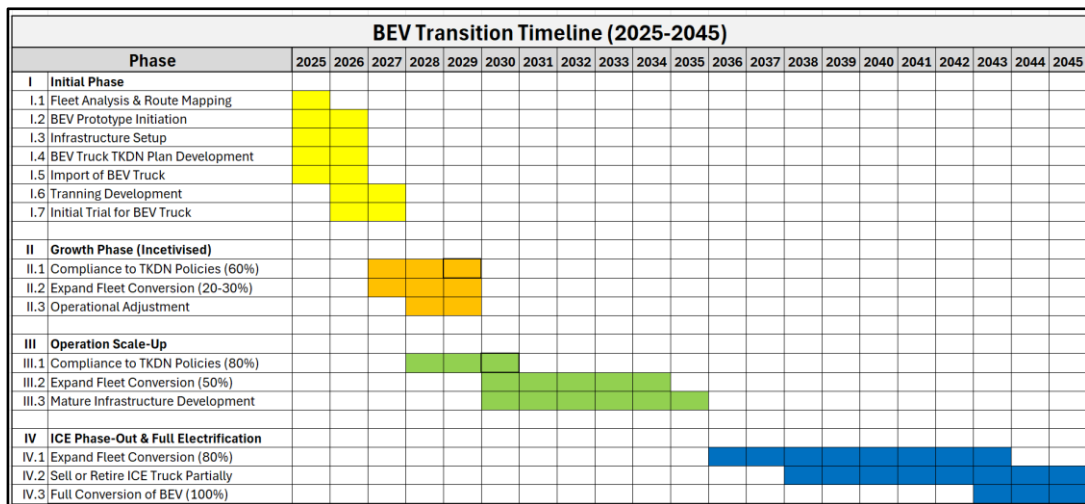
**Figure 5. Result of Alternative Scoring**

The calculations show that adopting *battery-electric vehicles* requires alignment between economic benefits, infrastructure readiness, and regulatory support. Without significant improvements in these three aspects, the full implementation of the adoption soon can pose operational and financial risks for PT XYZ. The results of this study are expected to be a strategic reference for PT XYZ and other logistics companies in emerging markets that face similar decisions.

The process of transitioning and adopting electric battery-based trucks requires a well-implemented plan. This implementation plan's preparation considers the most influential criteria, namely economic criteria (cost efficiency and cost reduction), infrastructure (availability of charging stations), and governance (policies and regulations related to infrastructure).

There are three documents needed for the implementation plan to be realized effectively. The first document is *the Energy Sector Roadmap to Net Zero Emissions in Indonesia, published by the IEA (2022)*, which provides an overview of the decarbonization process of trucks with internal combustion engines. The second document, Presidential Regulation No. 79/2023, provides an understanding of government support related to infrastructure

development and the incentives provided. The third document is **Minister of Finance Decree No.8/2024**, which describes the fiscal incentive scheme for companies switching to electric battery-based trucks. These documents will serve as guidelines in preparing BEV adoption implementation plans in companies. The implementation plan is formulated as a Gantt Chart, which presents the stages of the plan as a *timeline* for the transition process to 100% electric battery-based truck fleets, as shown in Figure 6.



Source: Research images.

**Figure 6. BEV Transition Timeline**

The *initial phase* focuses on comprehensive planning and initial investment in infrastructure, such as the construction of charging stations and the procurement of prototype BEV trucks. In this period, PT XYZ is expected to take advantage of government incentives, including sales tax exemption on luxury goods (PPnBM) and import duties for battery-based electric vehicles in the *Completely Built-Up (CBU)* and *Completely Knocked-Down (CKD)* schemes. During this stage, the company also needs to develop a Domestic Component Level (TKDN) fulfillment plan, which includes the identification of local suppliers, component localization strategies, and cost analysis for the localization process. In parallel, pilot project trials were carried out on selected routes to test operational feasibility while allowing operational teams to adapt to new technologies.

The *growth phase* begins after 2027, assuming the charging infrastructure and supporting facilities have developed better. In this phase, PT XYZ plans to increase the proportion of BEV trucks to 20-30% of the total fleet. Operational adjustments, such as new route mapping and fleet scheduling, are implemented to optimize the utilization of BEV vehicles. The TKDN plan prepared in the previous stage is also implemented to meet regulatory provisions

and maximize the benefits of fiscal incentives, including Value Added Tax (VAT) discounts as stipulated in Minister of Finance Regulation No.8/2024.

The next phase, known as the *operational scale-up phase*, targets a significant increase in fleet conversion in line with the maturity of the BEV ecosystem. At this stage, PT XYZ plans to convert up to 50% of its fleet to BEV vehicles by 2030. The main requirement in this phase is to comply with the TKDN regulations of 80%. Further expansion is adjusted to infrastructure developments, operational needs, and applicable regulatory provisions. According to (Alaouia, 2025), in order to support a sustainable expansion process, it is necessary to pay attention to supply chain management (SCM), emphasizing human-centered, sustainable, and resilient practices by applying digital technologies, including collaborative robots, the Internet of Things (IoT), and Artificial Intelligence (AI).

The final stage is the gradual *phase-out of ICE* vehicles and the transition to *full electrification*, which is in line with Indonesia's national commitment to achieve *net-zero emissions by 2060*, as well as the *planned discontinuation of ICE vehicle sales by 2045*, as reported by the International Energy Agency (IEA). At the beginning of this stage, PT XYZ targets to achieve 80% adoption of the BEV fleet, with a gradual sale process or retrofitting of the remaining ICE fleet until it reaches the target of 100% electrification by 2045.

This phased approach is designed to provide flexibility and risk mitigation while placing PT XYZ in a strategic position to make optimal use of government incentives and contribute to achieving national sustainability targets. The success of implementing this plan is highly dependent on the consistency of regulatory implementation, timely infrastructure development, and technological advances as projected. It should also be added that industrial competitiveness is important for countries implementing export-oriented industrialization policies (Sirikrai et al., 2006).

## CONCLUSION

This study shows that the decision to adopt BEV trucks today is most influenced by three main factors, namely economic feasibility, infrastructure readiness, and *governance support*. Among these three factors, economic aspects—particularly cost efficiency and cost reduction—have the highest priority, reflecting the company's focus on operational sustainability and profitability. The availability of infrastructure, especially the readiness of charging stations, as well as government policies related to tax incentives and Domestic

Component Level (TKDN) requirements, also play an important role in shaping investment decisions.

The process of adopting BEV trucks on a full and large scale is not optimal for PT XYZ to carry out immediately, considering the high initial investment needs, limited charging infrastructure, and constraints in the supply chain. However, the transition approach is carried out gradually, starting with pilot projects (*initial phase*) and gradual fleet expansion adjusted to infrastructure developments and government policies, becoming a more appropriate strategy to balance opportunities and mitigate risks.

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