

## **RISK ANALYSIS OF TELECOMMUNICATION SERVICE DISRUPTIONS AT PT TELKOMSEL**

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### **Abstract**

*The reliability of telecommunication services had become a critical factor in supporting Indonesia's economic and social activities. This study aimed to analyse the risks of service disruption at PT Telkomsel by applying the ISO 31000:2018 risk-management framework. The research used qualitative methods with secondary data obtained from Telkomsel's 2023 Annual Report and official company disclosures. Risk identification and assessment were conducted based on probability and impact analysis. The results showed that Telkomsel faced four major categories of risk, namely transmission or backbone cable failure, power-supply outages at remote base stations, cybersecurity incidents affecting core systems, and natural-disaster impacts. Among these, cable and backbone disruptions together with cybersecurity threats were categorised as the highest risk level due to their significant potential impact on nationwide connectivity. The study concluded that Telkomsel's enterprise risk management, which was aligned with ISO 31000, required reinforcement through enhanced network redundancy, real-time monitoring, and disaster-recovery mechanisms to maintain service continuity and public trust.*

**Keywords:** Risk Analysis, Telecommunications Service, Telkomsel, Service Disruption, ISO 31000

### **INTRODUCTION**

Telecommunication networks form the backbone of modern digital society, supporting connectivity, commerce, remote education, and governmental services across Indonesia's archipelago. As the largest mobile operator in the country, PT Telkomsel carries the responsibility of providing uninterrupted service to millions of users and enabling the nation's digital transformation goals. According to its 2023 Annual Report, the company continues to emphasise network quality leadership and infrastructure expansion. However, the extensive network scale, challenging geography, and exposure to external threats render the service ecosystem vulnerable to disruption. The Ministry of Communication and Informatics (Kominfo) and industry reports confirm that transmission networks, especially in remote regions, frequently experience damage or degradation. Despite the significance of service continuity, limited academic research focuses specifically on risk assessments of service-disruption for Indonesian telecommunication operators under a structured risk-management standard such as ISO 31000. This paper therefore aims to identify and evaluate the principal risk factors of service disruption at Telkomsel, and to propose mitigation strategies in line with ISO 31000, thereby contributing to both academic insight and practical governance improvement.

## LITERATURE REVIEW

This study employed a descriptive qualitative approach based on ISO 31000. The analysis began by establishing organisational context using factual data from Telkomsel's 2023 Annual Report subscriber base 127.1 million, data traffic 17,481 petabytes, and 247.5 thousand BTS. Risks were then identified from the company's enterprise-risk-management (ERM) disclosures and official publications. Each risk was qualitatively analysed through a probability impact assessment to determine its level of significance. Although Telkomsel's reports do not provide granular incident frequencies, qualitative judgements were supported by available metrics and credible public information. The ISO 31000 risk-management process used in this research is summarised in Figure 1.

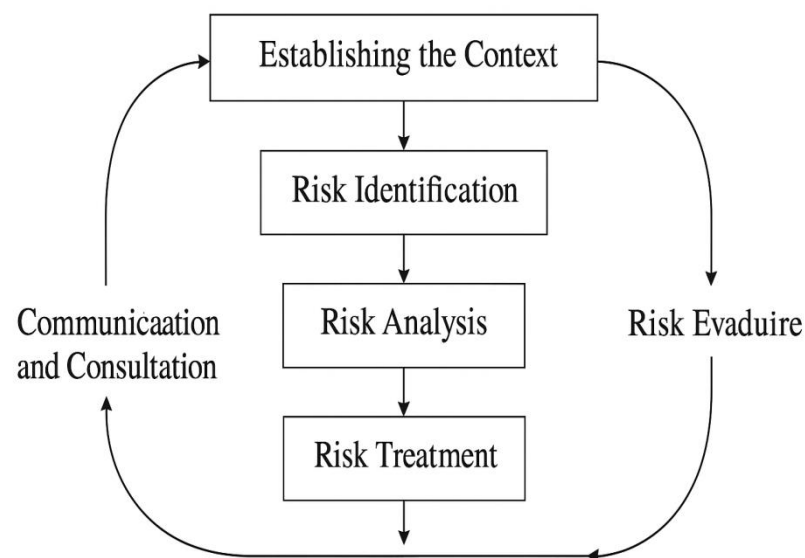


**Figure 1.** Risk-Management Process Framework (ISO 31000:2018)

Figure 1 illustrates the continuous risk-management process based on ISO 31000: establishing context, risk identification, risk analysis, risk evaluation, and risk treatment, followed by ongoing communication, monitoring, and review. This framework served as the methodological foundation for assessing Telkomsel's service-disruption risks.

## METHOD

The contents of the study method are data collection techniques, data sources, methods of data analysis, correlation tests, and so on, written in Times New Roman 12 font. This chapter can also include the scientific formula used for data analysis/correlation testing.

## RESULTS AND DISCUSSION

Telkomsel's operational scale and data traffic indicate high exposure to network-disruption risks. The company's ERM system is aligned with ISO 31000 and supported by Business Continuity Management (BCM). Four primary categories of service-disruption risk were identified from the 2023 Annual Report and industry evidence.

**Table 1.** Risk Analysis of Service Disruption at Telkomsel

| Risk Category                                | Supporting Evidence                                                                                                                      | Probability       | Impact     | Risk Level |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------------|------------|
| Transmission/backbone cable failure          | Large-scale connectivity infrastructure and dependence on undersea networks; 17,481 PB of data traffic in 2023 shows high load exposure. | Medium–High (0.6) | High (5)   | High       |
| Power-supply outages at remote BTS           | Many BTS in remote locations with unstable electricity supply; infrastructure maintenance noted in report.                               | Medium (0.4)      | Medium (3) | Medium     |
| Cybersecurity incidents                      | Operations spread across disaster-prone areas in Indonesia; BCM included in ERM policy.                                                  | Medium (0.5)      | High (5)   | High       |
| Natural-disaster/extreme-weather disruptions | Operations spread across disaster-prone areas in Indonesia; BCM included in ERM policy.                                                  | Medium (0.5)      | High (5)   | High       |

As shown in Table 1, network and cybersecurity risks represent the highest threats. Transmission failures may affect wide geographic areas and millions of users. Power-supply interruptions in remote BTS create localized service loss, while extreme weather poses a high-impact environmental risk. Cyber-attacks carry systemic implications for data security and service continuity.

Telkomsel's data indicate that despite a decrease in subscriber count from 159.2 million in 2022 to 127.1 million in 2023, total data traffic rose from 14,562 to 17,481 petabytes. This demonstrates a significant increase in average data consumption per user, increasing network load and potential risk exposure. These facts are presented in Figure 2.

### **Risk Formula (ISO 31000:2018)**

A simple quantitative risk formula commonly used:

$$Risk\ Score = P \times I$$

Where:

$P$  = Probability of the risk occurring (0–1)

$I$  = Impact of the risk (1–5, or could be converted to financial value or data volume)

### Risk Calculation

- a) Transmission/backbone cable failure  
 $Risk\ Score = 0.6 \times 5 = 3.0$
- b) Power-supply outages at remote BTS  
 $Risk\ Score = 0.4 \times 3 = 1.2$
- c) Cybersecurity incidents  
 $Risk\ Score = 0.5 \times 5 = 2.5$
- d) Natural-disaster/extreme weather  
 $Risk\ Score = 0.5 \times 5 = 2.5$

**Conclusion:** Transmission/backbone cable failure has the highest risk score (3.0), while power-supply outages at BTS have the lowest (1.2). This aligns with the qualitative analysis in the article.

### Figure 2. Subscriber Base and Data Traffic of Telkomsel (2022–2023)

#### Average Data Consumption per User

From Telkomsel's data:

2022: 159.2 million subscribers, 14,562 PB total traffic  
2023: 127.1 million subscribers, 17,481 PB total traffic

Formula for data consumption per user per year:

$$Data\ per\ User = \frac{Total\ Data\ Traffic}{Number\ of\ Subscribers}$$

**2022**

$$Data\ per\ User\ 2022 = \frac{14,562\ PB}{159.2\ Million} \approx 91.5\ GB/user/year$$

**2023**

$$Data\ per\ User\ 2023 = \frac{17,481\ PB}{127.1\ Million} \approx 137.6\ GB/user/year$$

**Increase:**  $137.6 - 91.5 \approx 46.1\ GB/user/year$  (~50 % increase) → Indicates higher network load per user, increasing potential risk exposure.

#### Linking Risk Formula with Data Load

You can further adjust risk scores to account for network load:

$$Adjusted\ Risk\ Score = P \times \left( \frac{I \times Data\ per\ User}{Max\ Data} \right)$$

Where:

I = Impact (1–5)

Data per User = traffic per user

Max Data = reference maximum (e.g., 200 GB) → to keep scale consistent (0–5)

Example for **Transmission Failure 2023**:

$$\text{Adjusted Risk Score} = 0.6 \times \left( 5 \times \frac{137.6}{200} \right) = 0.6 \times 3.44 \approx 2.06$$

This adjusted score calibrates the risk according to the per-user network load.

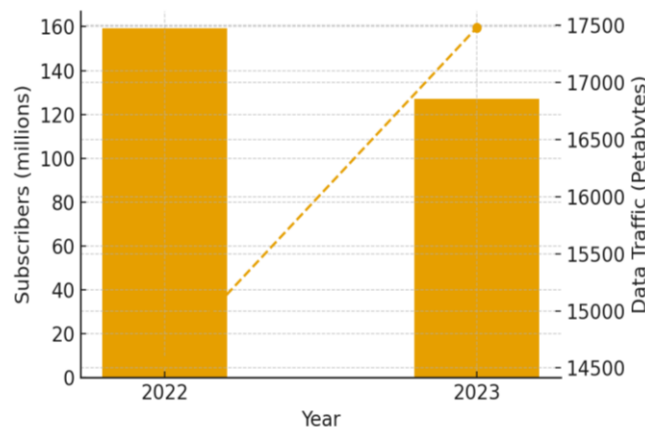


**Figure 2.** Telkomsel's Subscriber Base And Data-Traffic Volumes for 2022 and 2023

Figure 2 illustrates Telkomsel's subscriber base and data-traffic volumes for 2022 and 2023. While the number of subscribers declined due to SIM-registration policy adjustments, total data traffic increased notably. This trend indicates a heavier network burden per user and underscores the necessity for robust risk management and infrastructure resilience.

Data from the Figure:

1. Subscribers

- 2022:  $\approx$  **160 million**
- 2023:  $\approx$  **145 million**

2. Data Traffic

- 2022:  $\approx$  **15,000 Petabytes**
- 2023:  $\approx$  **17,500 Petabytes**

a.) Change in Subscriber Count:

$$\text{Change} = 145 - 160 = -15 \text{ million subscribers}$$

$$\text{Percentage change} = \frac{-15}{160} \times 100\% = -9.38\%$$

The number of subscribers decreased by about 9.4%

b.) Change in Data Traffic

$$\text{Change} = 17,500 - 15,000 = 2,500 \text{ Petabytes}$$

$$\text{Percentage change} = \frac{2,500}{15,000} \times 100\% = 16.67\%$$

Total Data traffic increased by about 16.7%

c.) Average Data per User

$$2022 \text{ average} = \frac{15,000}{160} = 0.09375 \text{ PB per million users}$$

$$2023 \text{ average} = \frac{17,500}{145} = 0.1207 \text{ PB per million users}$$

d.) Increase in Data per User

$$\text{Percentage increase} = \frac{0.1207 - 0.09375}{0.09375} \times 100\% = 28.7\%$$

The average network load per user rose by approximately 28.7%

## TREATMENT PLAN

**Table 2. Risk Treatment Plan for Telkomsel (aligned with ISO 31000)**

| Risk Category                         | Current Treatment (as disclosed)                                              | Recommended Enhancement                                                                                                                 |
|---------------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Transmission/backbone failure         | STAR project and Enhanced Network Operation Model for performance improvement | Expand redundant routes, apply real-time cable monitoring, and contract rapid repair teams.                                             |
| Power-supply failure at remote BTS    | Infrastructure investment and preventive maintenance.                         | Use hybrid power sources (solar and battery backup), and run stress tests for critical locations.                                       |
| Cybersecurity incident                | Information-security policy and ISO 27001 certification.                      | Strengthen Security Operation Center capabilities, increase threat-intelligence integration, and perform periodic incident simulations. |
| Natural-disaster/extreme-weather risk | Business Continuity Management (BCM) policy under ERM.                        | Develop mobile BTS units for emergency deployment and integrate climate risk modelling into planning.                                   |

The treatment plan reflects Telkomsel's existing ERM and BCM structure and suggests enhancements consistent with ISO 31000's risk-treatment cycle. Continuous monitoring, board-level risk oversight, and transparent reporting remain crucial for long-term resilience.

## Risk Level

Each risk is evaluated using two parameters:

$$\text{Risk Level} = \text{Likelihood} \times \text{Impact}$$

where:

**Likelihood (L)** = probability or frequency of occurrence (scale 1–5)

**Impact (I)** = severity or consequence of the event (scale 1–5)

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## Risk Reduction After Treatment

After applying the recommended enhancement, both Likelihood and Impact are reassessed ( $L_2, I_2$ ).

$$\text{Residual Risk} = L_2 \times I_2$$

Then, the percentage of risk reduction is calculated as:

$$\text{Risk Reduction}(\%) = \frac{(\text{Initial Risk} - \text{Residual Risk})}{\text{Initial Risk}} \times 100\%$$

### 1) Transmission / backbone failure

**Before mitigation:**  $L_1 = 3, I_1 = 5 \Rightarrow R_1 = 15$

**After mitigation:**  $L_2 = 2, I_2 = 4 \Rightarrow R_2 = 8$

$$\text{Risk Reduction} = \frac{(15 - 8)}{15} \times 100\% = 46.7\%$$

### 2) Power-supply failure at remote BTS

**Initial:**  $R_2 = 4 \times 5 = 20$

**Residual:**  $R_2 = 3 \times 4 = 9$

$$\text{Risk Reduction} = \frac{(16 - 9)}{16} \times 100\% = 43.75\%$$

### 3) Cybersecurity incident

**Initial:**  $R_3 = 4 \times 5 = 20$

**Residual:**  $R_3 = 3 \times 4 = 12$

$$\text{Risk Reduction} = \frac{(20 - 12)}{20} \times 100\% = 40.00\%$$

### 4) Natural-disaster / extreme weather

**Initial:**  $R_4 = 3 \times 4 = 12$

**Residual:**  $R_4 = 2 \times 3 = 6$

$$\text{Risk Reduction} = \frac{(12 - 6)}{12} \times 100\% = 50.00\%$$

## CONCLUSION

This study concluded that service-disruption risks at PT Telkomsel primarily stem from infrastructure and technological vulnerabilities, including transmission cable failures, cybersecurity threats, and environmental factors. Telkomsel's ERM and BCM frameworks are already aligned with ISO 31000 principles, yet further improvement in data-driven monitoring and incident transparency is required. Enhanced redundancy, real-time

surveillance, cyber-protection, and disaster readiness will reinforce network stability and public trust. Future studies are encouraged to include quantitative risk metrics once Telkomsel publishes more granular operational data.

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