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Commission of Inquiry on Tigray Genocide

Targeted Destruction: Damage and Loss Assessment on Tigray's Public Infrastructure Sector

Volume 1

November 2025, Mekelle, Tigray, Ethiopia

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Note to the reader

This document constitutes **Volume I of the Infrastructure Sector War Damage and Loss Assessment Report**. It presents verified, self-reported data from public WASH, Transport, Municipal Services, Energy, and Media, Telecom, and ICT across the Tigray region. Due to constraints in temporal and geographic coverage, subsequent volumes will follow to incorporate additional findings.

Key considerations for interpreting this volume:

- The monetary values reported represent **intergenerational assets and accumulated wealth,** not annual budgets or gross domestic product figures. They should not be compared with fiscal or economic aggregates.
- The report covers **regional and federal institutions residing within the scope of the assessment in Tigray**, capturing the breadth of war-related effects across infrastructure sectors.
- **Losses far exceed visible damage**. The prolonged siege and blockade lasting more than two years led to widespread service disruptions and lasting setbacks in WASH, Transport, Municipal Services, Energy, and Media, Telecom, and ICT, which persisted long after the damage occurred.
- These cumulative losses, though harder to quantify, are **central to understanding the full impact** of the crisis and must inform any recovery or justice framework.

Readers are encouraged to approach this volume as a foundational reference, recognizing both its rigor and its limitations. The data herein reflects lived realities and institutional memory, and its interpretation demands sensitivity to context, scale, and the enduring consequences of the war.

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ACRONYMS

AF	Amhara Forces
AFR	Afar Forces
ATM	Automated Teller Machine
ATS	Automatic Transfer Switch
BTS	Base Transceiver Station
CITG	Commission of Inquiry on Tigray Genocide
CoHA	Cessation of Hostilities Agreement
DaLA	Damage and Loss Assessment
DaNA	Damage and Need Assessment
DWI	Dimtsi Woyane International
EDF	Eritrean Defense Forces
EEP	Ethiopian Electric Power
EEU	Ethiopian Electric Utility
EFP	Ethiopian Federal Police
ENDF	Ethiopian National Defense Forces
ERA	Ethiopian Roads Authority
EFFORT	Endowment Fund for the Rehabilitation of Tigray
GIS	Geographic Information System
GPS	Global Positioning System
GPRB	Government Public Relations Bureau
GTP	Growth and Transformation Plan
GW	Gazeta Woyen
ha	Hectare
HV	High Voltage
ICT	Information and Communication Technology
ISIC	International Standard Industrial Classification of All Economic Activities
ITU	International Telecommunication Union
LV	Low Voltage
LTE	Long-Term Evolution
MV	Medium Voltage
MVA	Megavolt-Ampere
NRET	North Region Ethio-Telecom

OPGW	Optical Ground Wire
ROW	Right of Way
SDGs	Sustainable Development Goals
THDAA	Tigray Housing Development and Administration Agency
TMMA	Tigray Mass Media Agency
TRA	Tigray Roads Authority
TRCE	Tigray Road Construction Enterprise
TUDCB	Tigray Urban Development and Construction Bureau
TWRB	Tigray Water Resources Bureau
UIIDP	Urban Institutional and Infrastructure Development Program
UN	United Nations
UNDP	United Nations Development Program
UN-ECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNHRC	United Nations Human Rights Council
URRAP	Universal Rural Roads Access Program
USD	United States Dollar
WASH	Water, Sanitation, and Hygiene
WASHCo	Water, Sanitation, and Hygiene Committee

EXECUTIVE SUMMARY

This Damage and Loss Assessment (DaLA) documents the systematic dismantling of Tigray's essential infrastructure during the two-year war (Nov202-2022). It provides a comprehensive quantification of the physical destruction and economic losses across five critical sectors, serving as foundational evidence for recovery, accountability, and justice. Infrastructure is the backbone of economic growth and social well-being. Before the war, Tigray had made significant developmental progress. Water supply coverage had reached a regional average of 58%, the road network density had expanded substantially, and the construction and energy sectors were key drivers of socio-economic growth. The war, which began in November 2020, reversed these decades of progress, inflicting unprecedented destruction and leaving millions in a state of heightened vulnerability.

The objective of this assessment is to assess, quantify, and document the war and siege-induced damages and losses sustained by Tigray’s infrastructure sectors. The assessment covered five sectors - Water, Sanitation & Hygiene (WASH), Transport, Municipal Services, Energy, and Media, Telecom & ICT - focusing on public infrastructure. The temporal scope for damages was primarily from November 2020 to August 2022, with economic losses assessed through 2023. Geographically, it covered six of Tigray’s administrative zones, excluding the Western Zone, and other peripheral areas were inaccessible due to security constraints. The assessment was conducted under a full blockade, with severe limitations on resources, transport, and communication, leading to incomplete baseline data due to the destruction of official records. In addition, security restrictions limited field verification in a few locations, and under-reporting in specific sub-sectors like irrigation and sanitation. Despite these challenges, the assessment provides a robust and representative overview of the war's devastating impact.

This assessment employed the globally recognized Damage and Loss Assessment (DaLA) framework developed by the World Bank and UN-ECLAC. The methodology involved a process of data collection, validation, and analysis. A multi-method approach was used, combining structured surveys, field inspections, key informant interviews, and reviews of administrative records. Collected data underwent systematic cleaning, coding, and validation. The analysis followed a four-stage process: validation, quantification, aggregation, and interpretation. The prevailing price method was used to value damages and losses (value of disrupted services).

The data was collected from a range of regional and federal government offices as well as media outlets. Specifically, the assessment engaged 10 regional offices and enterprises, 4 federal offices, 4 media outlets (including both streaming and publishing platforms), 84 municipal offices, and 43 town water utilities.

The staggering financial cost across the Water, Sanitation & Hygiene (WASH), Transport, Municipality Services, Energy, and Media, Telecom, and ICT sectors is quantified at USD 5.00 billion, with USD 2.03 billion in physical damage and USD 2.97 billion in economic losses. The destruction was not incidental but intentional, with the Ethiopian National Defense Forces (ENDF), Eritrean Defense Forces (EDF), and Amhara regional forces identified as the principal perpetrators of this widespread and systematic devastation.

WASH: Endured the highest physical damage at USD 1.1 billion, with losses of USD 770 million. The targeting of over 70% of water supply systems denied 3.6 million people access to clean water, and the non-operational rate of the water supply schemes has been increased from 7% to 71%. The assessment indicates that the majority of the damage, valued at approximately USD 420 million (38%)**,** falls within the medium range, signifying that most systems will require extensive repair or partial replacement to restore full functionality. In contrast, assets identified under the high and very high damage categories collectively account for an estimated USD 297 million (27%), reflecting severe destruction that will demand major reconstruction or total replacement.

Transport: Suffered the second-most severe physical damage at USD 610.73 million, with massive losses of USD 858.44 million. The near-total destruction of road networks crippled mobility, accessibility, and commerce. The assessment shows that most of the affected items fall under the high damage category, with an estimated value of USD 484.22 million, accounting for 79 % of the total damage. This is followed by the very high damage category, valued at approximately USD 111.21 million, representing 18 % of the overall losses.

Municipality Services: An assessment of municipality service revealed damages of USD 187.42 million and an economic loss of USD 597.12 million, primarily from halted urban services and lost revenues. In this sector, the assessment reveals extensive damage, with damage valued at approximately USD 112 million (59.8%) categorized as high level of damage and an additional USD 48 million (25.6%) classified as very high damage. These figures underscore the severe impact on essential urban infrastructure and the substantial resources required for restoration and recovery.

Energy: Documented USD 68 million in direct damage but massive economic losses of USD 482 million, as the destruction of the energy grid halted all electricity-dependent activities. In the Energy sector, the assessment indicates severe destruction, with damages estimated at approximately USD 58 million (85.3%) categorized as very high, and an additional USD 8 million (11.8%) classified as high damage. Together, these figures represent the vast majority of the sector's reported total damage, highlighting the extensive impact on power generation, transmission, and distribution infrastructure.

Media, Telecom, and ICT: This sector sustained a total of USD 63.63 million damage and financial loss of USD 262.60 million, reflecting the systematic dismantling of all communication lifelines. Similarly, the assessment reveals that damages valued at USD 58 million fall under the very high damage category, accounting for about 91% of the total damage recorded in this subsector. This overwhelming share signifies the extensive destruction of critical communication infrastructure, severely disrupting information flow, connectivity, and service delivery across the region.

The destruction was not limited to infrastructure but also included the complete blackout of media and a devastating human loss, with 82 documented deaths of employees.

The combined, systematic destruction of these five interdependent sectors effectively collapsed the foundational pillars of modern life in Tigray. Beyond the financial figures, this assessment documents a profound human toll. The collapse of these sectors led to loss of life, exacerbated famine, denied medical care, and stripped millions of their dignity and basic rights. This DaLA is more than a record of loss; it is the foundational evidence for a threefold imperative: Recovery, Accountability, and Justice. The data herein is essential for designing a targeted and effective path to a Relief, Rehabilitation, and Reconstruction plan. It provides the evidentiary basis for reparations claims and is critical for ensuring that the perpetrators of this destruction are held accountable. Rebuilding Tigray is not merely about restoring infrastructure; it is about restoring justice, dignity, and the right to a functioning society for its people.

PART I. GENERAL OVERVIEW

Chapter 1. INTRODUCTION

1.1. Background

Infrastructure is the backbone of economic growth, social development, and community well-being. When disrupted by war and disaster, the breakdown of infrastructure has cascading effects on health, livelihoods, and the recovery process. In Tigray, Ethiopia, the two-year war that began in November 2020 inflicted unprecedented destruction across essential sectors: water and sanitation, transport, municipal services, energy, and information and communication technology, reversing decades of progress and leaving millions of people in a state of heightened vulnerability.

Before the outbreak of the war on Tigray, significant progress had been made in developing the essential infrastructure sector of Tigray, including the water, sanitation, and hygiene (WASH), transport, municipal services, energy, and media, telecom, and ICT. However, the outbreak of war severely disrupted these achievements, leading to widespread destruction. This devastation has not only hindered the movement of people and goods but also delayed reconstruction efforts and constrained the recovery of other vital sectors such as energy, water, and communication.

1.2. Objectives

1.2.1. General Objective

The objective of this assessment is to assess, quantify, and document the war and siege-induced damages and losses sustained by Tigray's infrastructure sectors, namely WASH, transport, municipal services, energy, media, Telcom, and ICT, and to document reliable evidence for justice and accountability.

1.2.2. Specific Objective

The damage and loss assessment of the infrastructure sector aims;

- To assess and quantify the physical damage to Tigray infrastructure
- To estimate the economic losses due to service disruptions, project implementation delays, and governance collapse.
- To identify the perpetrators, the type and level of the damage.
- To properly document the damage and losses for evidence-based recovery, reconstruction, justice, and accountability
- To indicate the socio-economic impacts associated with the damage to infrastructure sectors.

1.3. Scope and Limitation of the Assessment

1.3.1. Scope of the Assessment

This assessment of Tigray's infrastructure sector is guided by temporal, geographical, and institutional boundaries. It examines the WASH, transport, municipal services, energy, and Media, Telecom and ICT sectors, focusing on areas under the Tigray Interim Administration (TIA) and excluding the Western Zone and inaccessible parts of the North-Western, Central, and Eastern Zones due to security constraints.

A. Temporal Scope

The assessment evaluates damages and losses caused by the war and siege, with sector-specific timelines:

- **WASH, Energy, and Media, Telecom, and ICT:** Damages are assessed up to August 2022, while losses are considered through 2023 to capture the prolonged effects of the war and siege.
- **Transport and Municipal Services:** Physical damages and service disruptions are analyzed from November 2020 to November 2022, with associated losses also estimated through 2023.

B. Geographical Scope

This damage and loss assessment report only includes areas under the control of the Tigray Interim Administration. Because of accessibility concerns, the assessment does not cover the whole Western Tigray and portions of the Northwestern, Central, and Eastern zones. As a result, the assessment is limited to these particular areas and might not accurately reflect the situation in other parts of Tigray.

C. Institutional Scope

The assessment primarily targets public infrastructure institutions:

- **WASH:** Tigray Bureau of Water and Energy; Tigray Water Works Construction Enterprise; Tigray Water Works Study, Design, and Supervision Enterprise and Mekelle water utility.
- **Transport:** Bureau of Transport; Tigray Road Authority; Ethiopian Road Administration, Adigrat district office; Tigray Road Construction Enterprise.
- **Municipal Services:** Bureau of Urban Development and Construction; Tigray Housing Development and Administration Agency, and 84 Municipal offices.

- **Energy:** Ethiopian Electric Power and Ethiopian Electric Utility, including the Tekeze Hydroelectric Plant and Ashegoda Wind Farm.
- **Media, Telecom and ICT:** DW International, FM Mekelle 104.4 (radio station); Tigray Mass Media Agency; Tigray Communication Bureau; Ethio-Telecom North Region; Gazeta Woyin; Tigray Digital Agency.

1.3.2. Limitation of the Assessment

The assessment was conducted under exceptionally challenging conditions, including limited resources, a full blockade, security risks, and disruptions to transport and communication. These conditions affected data collection, coverage, and completeness across all sectors. The assessment faced several specific limitations:

Institutional and data gaps

The analysis primarily focused on public sector institutions, excluding private entities such as transport companies and privately owned media outlets. In addition, the following institutions were not included in this study: Ethiopian Dry Port Mekelle branch, Ethiopian Civil Aviation, Ethiopian Postal Service, Railway project, Ethiopian Broadcasting Corporation Mekelle branch, and Ethiopian National Defense Force Construction enterprise. Municipal services data were limited to 84 towns. In the WASH sector, data focused mainly on domestic water supply, providing incomplete information on irrigation and sanitation facilities. Incomplete baseline data of all sectors. Thus, it is important to consider these limitations when interpreting and using the results of the DaLA Report.

1.4. Structure of the Report

This report is structured in two parts: Part One provides a general overview, covering the background of Tigray's infrastructure sector, the study's objective, the scope and limitations of the assessment, and the detailed methodology employed. Part Two presents the core findings, analysis and discussions organized by the five assessed sectors: Water, Sanitation and Hygiene (WASH), documenting damage and losses to public water supply, sanitation services, and irrigation; Transport assessing impacts on road infrastructure and service, construction machinery and vehicles; Municipality Services evaluating damage to municipal offices, ongoing construction projects, and Tigray housing development and administration agency; Energy, quantifying the destruction of generation, distribution, and grid infrastructure; and Media, Telecom, and ICT, detailing the dismantling of telecommunications networks and broadcasting facilities.

Chapter 2. METHODOLOGY

2.1. Introduction

The assessment of damages and losses in Tigray's infrastructure sector was conducted using the Damage and Loss Assessment (DaLA) framework developed by the World Bank Group and the United Nations Economic Commission for Latin America and the Caribbean (UN-ECLAC). This provides a structured and comparable approach for quantifying the socio-economic consequences of disasters and conflicts. Moreover, it integrates physical, economic, and institutional dimensions, ensuring methodological rigor and consistency across sectors.

2.2. Data Sources and Collection

2.2.1. Data Sources

Both primary and secondary data sources were utilized to ensure comprehensive coverage and enhance the credibility of the assessment through cross-verification. Primary data were collected by the respective sector bureaus using standardized formats developed by the Commission of Inquiry on the Tigray Genocide (CITG). These data were obtained through field surveys, on-site inspections, and expert consultations. Secondary data were drawn from administrative records, pre-war infrastructure databases, and relevant research publications. The integration of these diverse sources ensured methodological triangulation, minimized bias, and strengthened the overall reliability and validity of the findings.

2.2.2. Data Collection Methods and Tools

The assessment employed a multi-method strategy that integrated both quantitative and qualitative approaches to ensure accuracy and depth of analysis. Structured surveys were used to collect quantitative data on the types, extent, and estimated value of damages. Field inspections provided direct verification through photographic documentation and GPS-based evidence. In addition, key informant interviews with local authorities, engineers, and community members offered qualitative insights into the causes and consequences of the damage. This integrated approach enhanced the reliability and comprehensiveness of the overall assessment.

2.3. Data Valuation Methods

The **prevailing price method** was used to value the damages, and the loss was estimated considering the inflation and interest rate.

- **Damage valuation** estimated the cost to restore destroyed assets to pre-war conditions, using local market references for construction materials and labor.

- **Loss valuation** compared pre-war baseline outputs (2018–2020) to post-war outcomes (2021–2023), quantifying the economic value of lost production and service delivery.

A 33% correction factor was applied to adjust the 2023 data for inflationary effects for the production loss. All monetary estimates were converted to U.S. dollars at the National Bank of Ethiopia's official exchange rate (1 USD = 56.6 ETB).

2.4. Data Cleaning and Analysis

After data collection, all datasets underwent systematic cleaning, coding, and validation to ensure accuracy and consistency. Outliers were removed, and missing values were reconciled through triangulation with multiple data sources. The analytical process followed four key stages: validation through administrative and field cross-checks, quantification by converting verified physical damages into monetary values, aggregation of sectoral and zonal totals, and interpretation to assess socio-economic impacts and recovery priorities. Descriptive statistics and comparative analyses were applied to identify trends, proportional impacts, and variations across sectors. Finally, stakeholder consultations were conducted to verify findings, refine interpretations, and ensure the robustness of the final assessment results.

2.5. Operational Definitions and Measurements

A. Definition and Classification of Damage

Damage denotes the direct and measurable destruction of infrastructure assets, expressed in monetary value. It represents the cost of restoring, reconstructing, or replacing the damaged assets to their original or functional condition (World Bank & UN-ECLAC, 2003).

The **level of damage** was classified into four standardized levels: Low damage (<25% destruction): Minor repairable impacts. Medium damage (25–50%): Partial loss requiring moderate reconstruction. High damage (50–75%): Major loss necessitating extensive repair. Very high damage (>75%): Complete or near-total destruction requiring full replacement.

The **types of damage** observed included: Deliberate destruction, collateral damage, looting, and burning.

B. Definition and Categories of Loss

Loss represents the **indirect economic impacts** of the war arising from disruptions in infrastructure operation and service delivery. It captures both immediate and long-term effects, including loss of income, reduced productivity, and increased operating costs (UN-ECLAC, 2014).

Losses were categorized into three major types:

1. **Disruption of production and services:** reduced access to or delivery of essential infrastructure services.
2. **Governance and institutional losses:** deterioration of institutional functionality and administrative coordination.
3. **Increased vulnerability:** heightened risk exposure due to restricted access to critical infrastructure.

C. Perpetrators

Entities identified as responsible for the damage or disruption to infrastructure and resources.

- ENDF – Ethiopian National Defense Forces
- EFP – Ethiopian Federal Police
- EDF – Eritrean Defense Forces
- Amhara, Afar, and Somalia – Regional forces or affiliated groups
- Bandits – Non-state armed actors or criminal groups
- Others–Any other actors not classified above

2.6. Assumption and Ethical Consideration

2.6.1. Assumptions and Considerations

- The pre-war period (2018–2020) accurately represents baseline economic and infrastructure conditions.
- Prevailing prices reflect realistic market values and account for inflationary adjustments.
- Security constraints and inaccessibility of certain areas may have resulted in an underestimation of damages.
- Collected data are assumed to be representative and were cross-validated across multiple sources to minimize bias.

2.6.2. Ethical Considerations

This assessment was conducted in strict adherence to ethical standards appropriate for post-war research. All participants provided informed consent, and the confidentiality of sensitive information was carefully safeguarded. Throughout the study, data collection and reporting were guided by principles of neutrality, transparency, and respect for human dignity.

Beyond documenting destruction, this report serves a deeper purpose: it is a tool for justice, accountability, and recovery. Each piece of evidence contributes to a clearer understanding of the impact of war and the recovery process. The ethical approach of this study underscores the responsibility to treat the experiences of affected communities with seriousness and care, translating research into meaningful action.

PART II. FINDINGS AND DISCUSSIONS

Chapter 3. WASH

3.1. Summary

The content of this report focuses on the Tigray War's devastating effects on Tigray's water, sanitation, and hygiene (WASH) sector infrastructure. This assessment aims to determine the extent of the Damages and Losses to Tigray's WASH sector resulting from the Tigray war. This suggests that determining the degree of damage and loss to the sector's infrastructure helps in rehabilitation, reconstruction, and the pursuit of justice and accountability. This assessment excludes portions of the Northwestern zone, the Central and Eastern zones of Tigray, and the entire Western zone for security and accessibility reasons. In terms of time frame, this does not include any damage that occurred after August 2022.

The Damage and Loss Assessment methodology is employed in this report to thoroughly evaluate the war's impact on the Tigray WASH sector, considering both direct and indirect effects. Although it is difficult to conduct a thorough and precise analysis of the war's effects on the WASH sector, the Water and Energy Bureau of the region have been heavily involved in the assessment of the four main elements: increased risks and vulnerabilities, disruption of governance and decision-making processes, disruption of access to goods and services, and damage to infrastructure and physical assets.

The war on Tigray has left Tigray's WASH service and infrastructure severely damaged, affecting millions of lives and impeding regional development. Over 12,900, or 71%, of rural water supply systems, which included springs, shallow wells, and hand pumps, suffered damage. Likewise, 75% (nearly 300) of water schemes in urban and semi-urban areas that depended on piped systems or motorized pumps also suffered damage. About 3.6 million beneficiaries lack access to clean drinking water as a result of this extensive damage to the sector. The war also impacted irrigation systems, with an estimated 10% of the assessed irrigation schemes being damaged. This affects the food security of more than 56,000 beneficiaries by resulting in the loss of irrigation for almost 18,000 hectares of land. The physical damage to the sector has caused significant monetary value losses, amounting to approximately USD 1.1 billion. On the other hand, the Tigray war has imposed substantial financial losses on the WASH sector in Tigray, exceeding USD 770 million between 2021 and 2023. Thus, rapid recovery of access to WASH services is one of a set of actions essential to stabilizing the health of populations and ultimately assisting communities in returning to a normal existence.

3.2. Background

In general, Tigray, Ethiopia, has the lowest level of water and sanitation coverage as compared to other Sub-Saharan nations (JMP 2023). The devastating war that broke out in November 2020 has caused damage to the water, sanitation, and hygiene infrastructure of Tigray, which has made the situation worse. Accordingly, one first step that is crucial to stabilizing population health and eventually helping communities return to a normal life based on damage and loss assessment is the quick restoration of access to water and sanitation services. Infectious diseases are closely linked to mortality rates, and these diseases are strongly correlated with access to proper sanitation services and the quality of the water that is consumed. This WASH sector Damage and Loss assessment (DaLA) report quantifies the destruction to Tigray's WASH infrastructure and services, and identifies the financial losses caused by the Tigray war.

3.3. Pre-War Context

To accomplish the objectives outlined in the government's Growth and Transformation Plan (GTP) for a safe water supply as well as better sanitation and hygiene, the regional government of Tigray was building several water supply systems in the area before the war (see, for instance, Figure 3-1).

Figure 3-1: Expansion of Water Supply System at Sheraro Town

Source: *TWRB 2022.*

In an effort to meet the increasing demand for adequate, safe, and clean water as well as appropriate sanitation facilities, the Tigray Regional Water Resource Bureau and other sector stakeholders constructed water supply schemes of varying sizes (TWRB 2020). Numerous

water facilities of various sizes as a major contributor to the overall efforts being made to satisfy the people's demand for these fundamental and moral services.

As a result of the prewar efforts, based on the Ethiopian Growth Transformation Plan 2 (GTP2), the coverage of rural and urban water supplies had reached 60% and 56%, respectively, with an average (regional coverage) of 58% (TWRB, 2020). This coverage is determined using on-the-spot schemes for rural areas, with a fixed standard of 15 liters per capita per day (l/c/d) within a 1-kilometer radius. In urban areas, however, it is determined by population size and was set at 40 l/c/d for populations under or equal to 20,000, 50 l/c/d for populations between 20,000 and 50,000, 60 l/c/d for populations between 50,000 and 100,000, and 80 l/c/d for populations between 100,000 and one million. On the other hand, by building various irrigation water schemes, it was feasible to create the capacity to irrigate roughly 64,000 hectares.

In the prewar period, the WASH sector had a functional system and feasible structural setup at various levels: a regional Water Resource Bureau, a zonal maintenance crew with a crane and a team of electro-mechanics, Water Utilities Offices, Woreda Water, Mines and Energy offices, Kebele water experts, WASHCo for each water supply scheme, small-scale operation and maintenance enterprises (private service providers), a revolving fund for the supply of various electromechanical and spare parts, and private spare parts suppliers. As a result, WASH partners were taking part in capacity building, spare parts supply, water supply schemes, and other initiatives that enhanced the region's water and sanitation services. However, the WASH infrastructure and service in Tigray were severely damaged and destroyed, in turn reversing the success recorded due to the war on Tigray by the Federal government of Ethiopia and its allies.

3.4. Damage and Loss Assessment

3.4.1. Damage Value

The Federal Government of Ethiopia and its allies' war on Tigray in November 2020 has led to considerable damage and devastation of Tigray's water supply schemes. Water supply systems, including water schemes, treatment plants, pipelines, pumping stations, sanitary facilities, office infrastructure, and facilities, were destroyed or damaged. Water supply schemes were severely damaged, and equipment was looted.

According to the findings of the damage assessment, shockingly, 71% (more than 12,900) of rural water supply schemes, which include hand pumps, shallow wells, and springs, were damaged (Table 3-1), and the percentage of rural water supply schemes that are not operational rose from 7% to 71%.

Table 3-1: Damage to Rural Water Supply Schemes

S. №	Zone	Type of water scheme	Number of Assessed water schemes	Number of damaged water Schemes			
				Hand-dug well (HDW)	Shallow well (SW)	Spring (SP)	Total
1	South	HDW / SW/ SP	1731	424	364	454	1242
2	South East	HDW / SW/ SP	2090	651	579	222	1452
3	Eastern	HDW / SW/ SP	4492	1415	1508	215	3138
4	Central	HDW / SW/ SP	6283	2025	1874	163	4062
5	North west	HDW / SW/ SP	3627	757	2127	135	3019
Total			**18,223**	**5272**	**6452**	**1189**	**12913**

Source: CITG, 2022

Similarly, about 75% (nearly 300) of water schemes that relied on motorized pumps or piped systems in urban and semi-urban areas also experienced damage (Table 3-2). Consequently, about 3.6 million people were still without a reliable source of drinking water.

Table 3-2: Damage to Motorized/ Urban Water Schemes

Zone	**Type of Scheme**	**Total schemes assessed**	**Damaged Schemes (Nos)**
North Western	Deep well	51	45
Central	Deep well	76	68
Eastern	Deep well	75	62
South Eastern	Deep well	34	30
South	Deep well	120	65
Mekelle	Deep well	37	23
Total		**393**	**293**

Source: CITG, 2022

As depicted in Table 3-2, all zonal administrations are affected by the war. However, zones with the highest numbers of wells (Central zone, followed by the Eastern and North-western zones) suffered high instances of damage to the rural water supply schemes. The central zone has the greatest damage to both rural and urban water supply schemes, with 32% and 23% of the damage to the rural and urban schemes, respectively. Communities' water supply schemes were damaged during the war on Tigray.

The location of the damaged water supply system is depicted in Figure 3-2 in a map format, which shows that the damage was widespread.

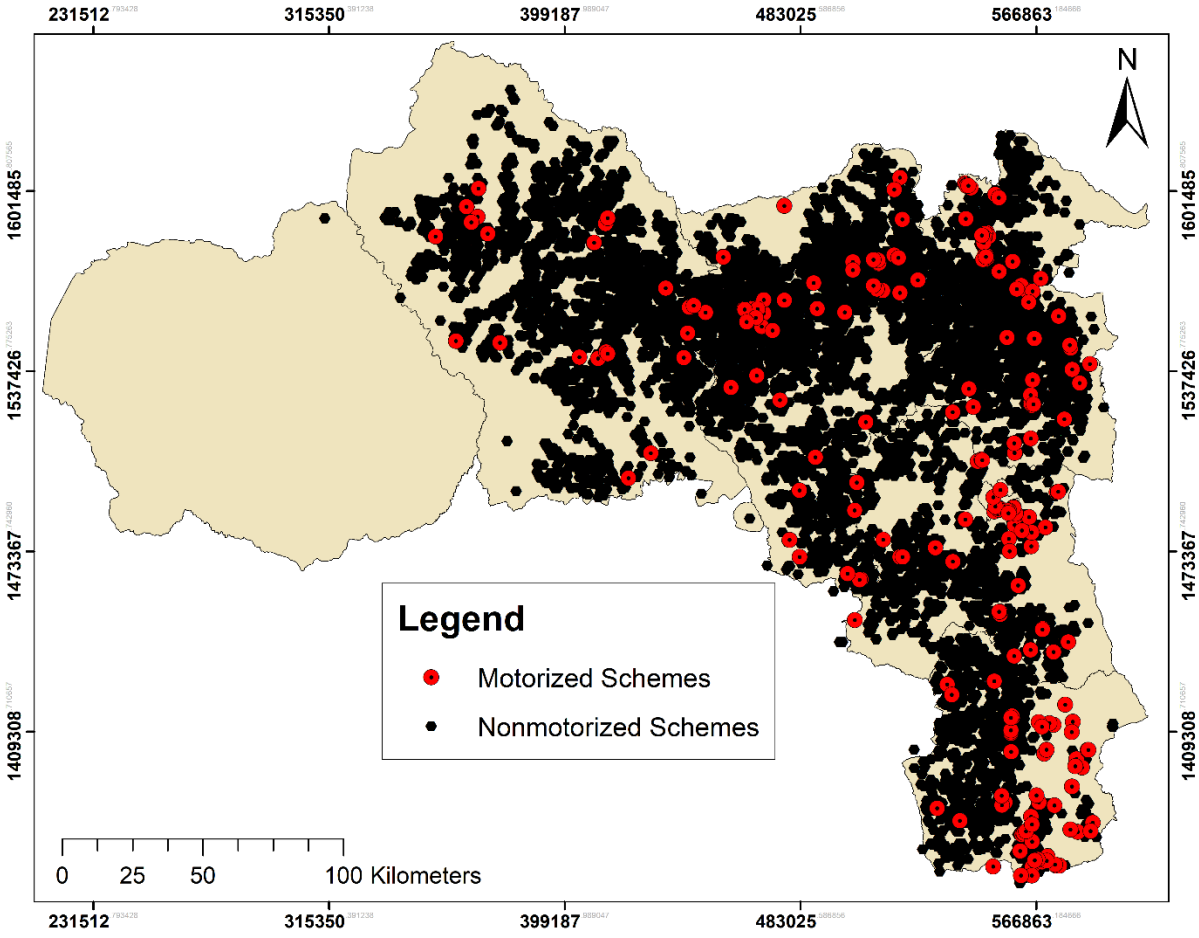

Figure 3-2: Location of Damaged Water Supply Schemes

Source: CITG, 2022

3.4.1.1. **Physical Damage to irrigation water schemes**

In a similar manner, irrigation schemes have been impacted by the war's severe damage to Tigray's irrigation infrastructure. The war has had a significant impact on Tigray's irrigation infrastructure, resulting in 3281 (approximately 10%) of the 32,333 evaluated irrigation water schemes being damaged (Table 3-3). This shows that the most severely damaged irrigation scheme is the pond, followed by the tiny pumps. The amount of irrigation then decreased to 40,972 hectares from 58,936 hectares. This results in the loss of irrigation for nearly 18,000 hectares of land, which impacts the food security of over 56,000 beneficiaries.

Table 3-3: Damage to Irrigation Water Schemes

Type of irrigation scheme	Number of damaged schemes
Dam	44
Deep well	82
Shallow well fitted with a hand pump	117
Spring	48
Hand-dug well	5
Division	188
Pond	1260
Check dam	477
Check dam diversion	71
Small pumps	732
Traditional diversion	162
Water reservoir	95
Total	**3281**

Source: CITG, 2022

3.4.1.2. Overall physical damage of the WASH sector

The findings of the damage and loss assessment show that the overall physical damage to the sector is extensive. As a result of the war, the infrastructure and assets of the WASH sector have sustained significant damage (Figure 3-3-Figure 3-5).

Figure 3-3: Damaged/Burned Water Supply Offices Building

Source: CITG, 2022

The damage to the water supply office disrupts service delivery and undermines the governing structure, which negatively impacts the sustainability and management of the infrastructure and service delivery.

Figure 3-4: Damaged/Burned Spare Parts

Source: CITG, 2022

The supply chain for spare parts in water schemes is inherently complex. Consequently, damage to these components exacerbates the issue and leads to interruptions in service delivery unless they are replaced or maintained in a timely manner.

On the other hand, damage to hand pumps in rural areas, due to the two-year war on Tigray, leads to water scarcity, increased travel distances to find clean water, and higher risks of waterborne diseases, excessively affecting women and girls who are traditionally responsible for fetching water.

Figure 3-5: Damaged Hand Pump in a Rural Area
Source: CITG, 2022

The infrastructure and assets of the WASH sector, which are estimated to be worth USD 1.1 billion, are significantly damaged by the war. According to the assessment result, the total value of destroyed physical assets damage for this sector is displayed in Table 3-4, and the damage is broken down by component in Figure 3-6.

Table 3-4: Damage Monetary Effect by Category

WASH categories	**Damage value (million USD)**
Water supply	724.14
Irrigation	278.22
Vehicle, machinery, and spare parts	37.43
Building and office equipment	51.05
Sanitation and Hygiene Services	2.19
Looted WASH materials and cash	10.39
Total	**1,103.42**

Source: CITG (2022)

When component-by-component damage is taken into account, the water supply component has the highest damage value, followed by the irrigation component at 66% and 25%, respectively (Figure 3-6).

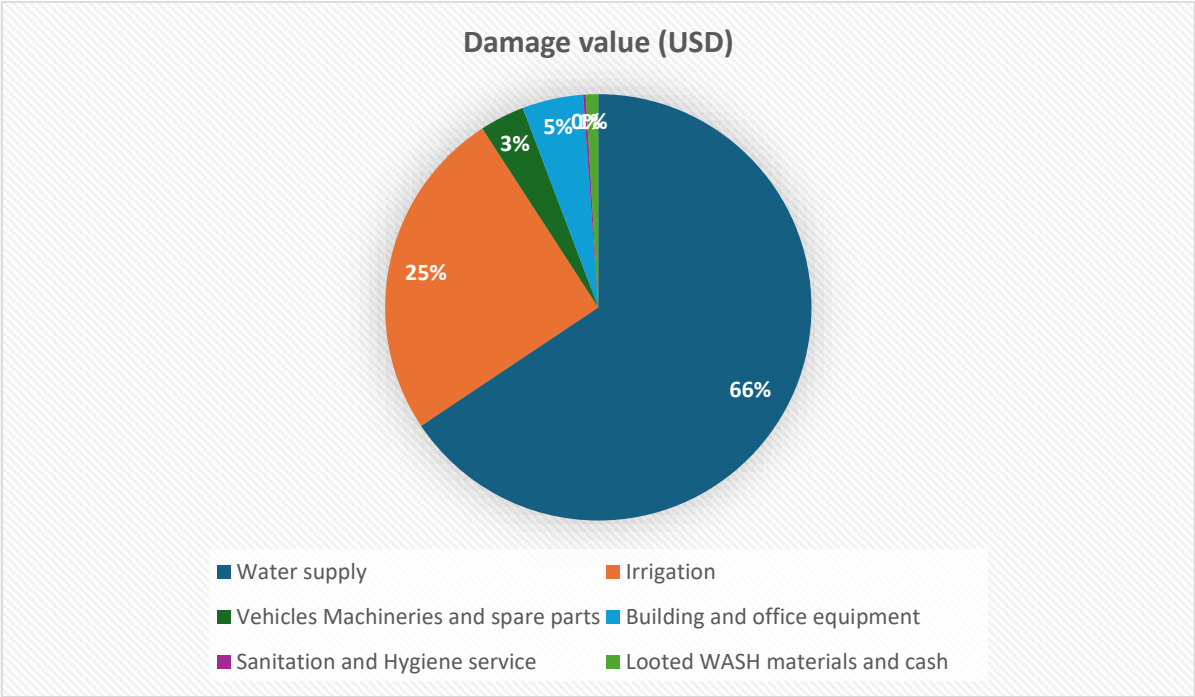

Figure 3-6: Damage Value Proportion by Component

Source: CITG, 2022

A. Type of Damage and Mechanism

As illustrated in Figure 3-7 and Figure 3-8, intentional destruction was the predominant form of damage inflicted on WASH sector assets during the war on Tigray, amounting to an estimated USD 597.74 million across 25 items. In addition, damages valued at approximately USD 335.7 million, covering 11 items, remained unspecified due to incomplete documentation and the extensive nature of the destruction. The remaining USD 170 million, representing 15 items, was attributed to looting.

Overall, the pattern of damage reveals that the destruction of WASH infrastructure was deliberate, widespread, and systematically executed with the clear intent to dismantle the sector. The attacks specifically targeted critical infrastructure components essential for service delivery, demonstrating that the destruction was not collateral but intentionally planned and purposefully carried out to incapacitate the WASH system across Tigray.

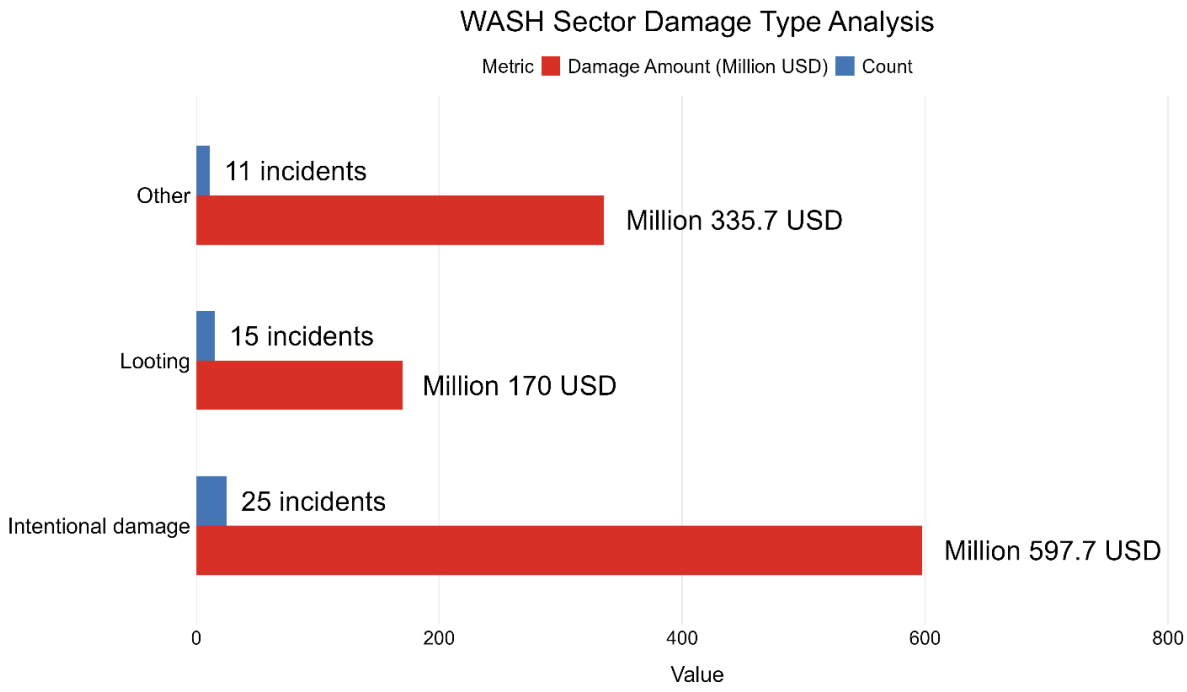

Figure 3-7: Type of Damage for the Damage Registered on the WASH Sector

Source: CITG, 2022

Figure 3-8: Damaged Water Supply Reservoir

Source: CITG, 2022

B. Level of Damage

As shown in Figure 3-9 the WASH sector components experienced varying levels of damage, ranging from medium to complete destruction. The majority of the damage, valued at

approximately USD 420 million, falls within the medium range, indicating that these systems require extensive repair or partial replacement to restore functionality.

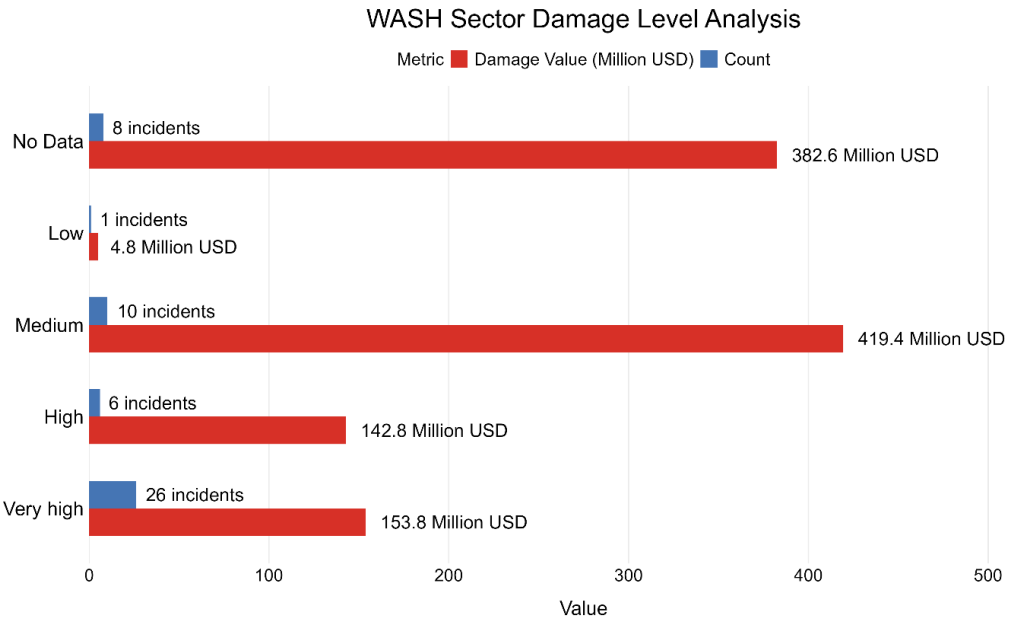

Figure 3-9: Level of Damage on the WASH Sector

Source: CITG, 2022

A substantial portion of the damage remains unspecified due to incomplete documentation and the widespread nature of the destruction, which limited the ability to conduct full assessments. Meanwhile, assets classified under high and very high levels of damage together accounted for an estimated USD 297 million, representing 32 items. This pattern underscores the severe impact of the war on the WASH sector, with extensive impairment across key infrastructure components. As shown in *Figure 3-10*, all WASH components and assets sustained damage, affecting everything from the overall scheme to the distribution and electrotechnical aspects.

Figure 3-10: Damage of Various WASH Sector Equipment

a) destruction of the water supply reservoir and its pipelines b) generator as an alternative energy source for the water supply system c) vehicle d) Electrical control system of the water supply schemes. Source: CITG, 2022

C. Perpetrators

The collected data indicate that the Ethiopian National Defense Force (ENDF), the Eritrean Defense Force (EDF), the Amhara Forces, and special police units from other Ethiopian regional states were among the allied forces that caused extensive damage to infrastructure across Tigray. These forces collectively targeted key installations, including water supply systems, sanitation facilities, and office complexes, resulting in severe disruption of essential public services.

Among them, the ENDF, EDF, and Amhara Forces were repeatedly identified as the principal actors responsible for the destruction and dismantling of WASH infrastructure. Their actions not only led to the physical damage of infrastructure but also paralyzed institutional capacity and service delivery mechanisms.

3.4.2. War-induced Losses of Tigray WASH Sector

The water and sanitation infrastructures are extremely vulnerable during armed war. War invariably devastates water and sanitation systems, creating significant damage and losses. Damage to infrastructure, disruptions in service delivery, and heightened health risks are the common consequences. Damage and losses can directly or indirectly create extensive challenges for the community in the affected area or the entire region. The war on Tigray has severely disrupted Tigray's Water, Sanitation, and Hygiene (WASH) services, leading to a range of losses that can be categorized into direct damage, indirect impacts, and long-term consequences. Examples of direct losses include losing staff members like engineers and technicians, and damaging water sources, treatment plants, pipelines, and restrooms. Indirect effects include, but are not limited to, weakened governance frameworks, disruptions in WASH material supply chains, and increased demand due to displacement. Long-term consequences include malnutrition, an increase in waterborne infections, and monetary losses due to reduced work and productivity opportunities.

The Tigray war has inflicted substantial financial losses on the WASH sector in Tigray, exceeding USD 770 million between 2021 and 2023. The biggest impact (more than USD 495 million) came from production and revenue losses brought on by damaged infrastructure and reduced service delivery. Additionally, the restoration of WASH functionality resulted in over USD 259 million in governance losses, which included hiring more staff, training employees, and system repairs. In addition, the war necessitated measures to identify and mitigate risks like waterborne infections, which resulted in losses of approximately USD 16 million.

3.4.2.1. Production and services loss

The delivery of goods and services is highly affected, and this is reflected in impacts on the production flow within the sector. Production flow changes are then estimated by comparing the non-disaster to the post-disaster performance of each subsystem, ensuring that the following issues are also valued: Decline in operational revenues of the sector enterprises, until services are brought back to normal levels, due to the temporary total suspension of operations, and the partial supply of services while assets are under repair, and due to possible temporary decrease of demand from consumers. Increase in operational costs (due to use of alternative sources or means of water supply, the temporary operation of damaged system components, or the temporary, more-intensive operation of undamaged system components). The most significant effect, over USD 495 million, stemmed from production and revenue losses due to damaged

infrastructure and reduced service delivery. The value of changes in WASH service delivery, production of goods and services is presented in Table 3-5.

Table 3-5: Loss Values of Production of Goods and WASH Service Delivery

Sub Sectors	Production Loss 2021 (USD)	Production Loss 2022 (USD)	Production Loss 2023 (USD)	Total loss (USD)
Tigray Water Works, Study, Design, and Supervision Enterprise	3,392,800	7,046,400	9,371,712	19,810,912
Tigray Water Works Construction Enterprise	14,419,400	29,947,200	39,829,776	84,196,376
Bureau of Water Resources and Energy	62,766,800	130,358,400	173,376,672	366,501,872
Water Utility of Mekelle	4,241,000	8,808,000	11,714,640	24,763,640
Total	**84,820,000**	**176,160,000**	**234,292,800**	**495,272,800**

Source: CITG, 2022

3.4.2.2. Governance and decision-making loss

Following the war, the ability of the WASH sector to respond to the emergency and plan for a long-term recovery is highly affected. Governance plays an important role within the WASH sector and involves more than just decision-making processes, but also the general health of the sector, its effectiveness, transparency and accountability. The government functions and civil servants of the WASH sector of Tigray are disrupted following the devastating war that erupted on November 2020. In other words, the management and organization of sectoral services that support life and livelihoods is affected. The effects evident on governance of WASH sector include: disruption of administrative functions such as quality control assurance and regulation, damage to documentation and baseline data, both in paper and electronic forms, social disruption of community social structures, and power relations (including gender roles). The losses related to governance of the WASH sector include: cost of system restoration (human resources, materials, vehicle/building renting); cost of training, trauma of employees, awareness, IDP and host communities, cost of recruitment – contract/permanent human resources. Governance losses of over USD 259 million were incurred for restoring WASH functionality, including system repairs, staff training, and hiring additional personnel. The effect of the war on the governance system of the WASH sector is summarized in Table 3-6.

Table 3-6: Governance Loss to Restore Functionality

WASH Sub Sectors	Governance Loss (million USD)			Total Loss (USD, Million)
	2021	2022	2023	
Tigray Water Works, Study, Design, and Supervision Enterprise	1.35	3.87	5.15	10.37
Tigray Water Works Construction Enterprise	5.76	16.45	21.87	44.07
Bureau of Water Resources and Energy	25.06	71.59	95.21	191.86
Water Utility of Mekelle	1.69	4.84	6.43	12.96
Total	**33.86**	**96.74**	**128.66**	**259.26**

Source: CITG, 2022

3.4.2.3. Risks and vulnerability losses

A key element of the assessment of effects on risks and vulnerability is to identify immediate risks to the affected population, particularly new potential threats that may deteriorate conditions if the necessary measures are not taken on time. Priority mitigation and preparedness measures are identified to avoid another disaster or the further deterioration of current water and sanitation practices, threats to WASH facilities, such as potential contamination of water sources and potential spread of disease resulting from inappropriate supplies of clean water.

The war required measures to identify and mitigate risks like waterborne diseases, resulting in losses of roughly USD 16 million. This breakdown highlights the need for resources in several areas, including infrastructure repair, staff training, and risk mitigation strategies, to ensure a successful WASH sector recovery in Tigray. The effects on risks and vulnerability of the Tigray WASH sector emanated from the war are indicated in Table 3-7.

Table 3-7: Value of Risks and Vulnerability of the WASH Sector

Sub Sectors	**Risk loss (Million USD)**			**Total loss (USD million)**
	2021	**2022**	**2023**	
Tigray Water Works, Study, Design, and Supervision enterprise	0.14	0.21	0.29	0.64
Tigray Water Works Construction Enterprise	0.59	0.91	1.21	2.71
Bureau of Water and Energy	2.58	3.97	5.28	11.82
Water Utility of Mekelle	0.17	0.27	0.36	0.80
Total	**3.48**	**5.36**	**7.13**	**15.97**

Source: CITG 2022

3.4.3. Total Damage and Loss Effect

In conclusion, the destruction and damage of water supply systems, sanitation facilities, and hygiene resources have severely impeded access to clean water and adequate sanitation across Tigray. The total impact of the war on the region's WASH sector is estimated at approximately USD 1.9 billion (Table 3-8). In addition, the Bureau of Water Resources and Energy has the biggest damage share in comparison to other sectors of WASH.

Table 3-8: Sector-based Summary of Total Effect on the WASH Sector (Million USD).

Sub Sector Name	Damage value	Loss value	Total effect	Share of damage
Water Works, Study, Design, and Supervision Enterprise	11.03	30.82	41.85	1%
Water Works Construction Enterprise	22.07	130.99	153.05	2%
Bureau of Water Resources and Energy	1,037.22	570.17	1,607.39	94%
Water Utility of Mekelle	33.1	38.53	71.63	3%
Total	**1,103.42**	**770.51**	**1,873.93**	**100%**

Source: CITG, 2022

3.5. Impact

The Tigray war has severely impacted the Water, Sanitation, and Hygiene (WASH) sector, resulting in extensive damage to essential infrastructure, reduced access to clean water and sanitation facilities, and increased health risks. In addition to the sharp decline in water sales revenue, the water supply for businesses, government agencies, and industries has also been impacted. Consequently, the public is currently facing severe water scarcity and other water-related issues. As a result, the current condition of water supply systems is defined by their inability to provide customers with reliable and reasonably priced services as well as their partial compliance with the safety and quality standards for drinking water. The devastating war has had the following primary impacts on the WASH sector:

Service delivery disruption:

The war caused significant damage to water supply systems and sanitation facilities, including pumping stations, pipelines, treatment plants, dams, and boreholes. More than 12,000 rural water supply schemes (hand pump, shallow well, and spring development) have been damaged, and the proportion of non-operational water supply schemes has increased from 7% to 71% due to the severity of the sector's damage. Furthermore, more than 290 urban and semi-urban water supply systems that are pipe-ported or motorized are not working properly. About 10%

of the 32,333 assessed irrigation water schemes have been damaged, and the amount of irrigation has decreased by roughly 18,000 hectares. Thus, the war on Tigray has severely impacted water and sanitation services, affecting both urban and rural areas. The provision of clean water and sanitation services has been disrupted as a result of the war-related damage to WASH infrastructure. A humanitarian crisis has resulted from this disruption, which has raised concerns about public health and increased the need for WASH assistance.

Increased health risks:

The lack of adequate WASH access and facilities has contributed to a rise in WASH-related illnesses, particularly among children. As the scientific report by Akeza A.A et.al (2023), indicates, a decrease in services from WASH is associated with a higher prevalence of diarrheal disease among children during the war on Tigray.

Increase Water Pollution:

The war on Tigray significantly increased water pollution by damaging and destroying water supply infrastructures like wells and pipelines, forcing communities to rely on unsafe sources like ponds and open water. This contamination led to widespread waterborne diseases such as malaria, diarrhea, and skin infections (Akeza A. A et al., 2025).

***Economic Impacts*:**

Damage to water and sanitation infrastructure not only threatens public health but also disrupts economic activities, livelihoods, overall development, and food security. The war has specifically undermined food security by destroying irrigation water schemes, thereby severely impacting food production.

Thus, due to the war's impact, the current state of water supply systems of Tigray does not provide consumers with stable and affordable services and is characterized by incomplete compliance with the quality and safety of drinking water to the requirements of suitability for human consumption. The financial impact on the sector will be extremely expensive to return the water systems, offices, and properties to their pre-war state.

3.6. Conclusion and Recommendation

3.6.1. Conclusion

The war on Tigray has caused a great deal of loss and damage to the WASH sector. The perpetrators demolished drinking water and irrigation systems, looted properties, and destroyed

sector offices, all of which had a major impact on the people. The destruction of numerous irrigation water schemes during the war had a significant impact on food security, which in turn affected irrigation-based food production. Many people in Tigray became ill from outbreaks of waterborne diseases due to the lack of access to sanitary facilities, hygiene, and clean drinking water. Water supply for businesses, government agencies, and industries has been affected, and water sales revenue has dropped dramatically. Because of the extent of the damage and looting, it will be very costly to restore the water systems, offices, and properties to their pre-loss condition. The estimated total damage and losses caused by the devastating war to the WASH sector in the assessed areas of Tigray are USD 1.9 Billion.

As a result, the current condition of water supply systems is defined by their inability to provide customers with reliable and reasonably priced services as well as their partial compliance with the safety and quality standards for drinking water that are necessary for human consumption. Much work remains before the sector returns to its pre-war condition, given the extent of the damage and the fact that Tigray remains in an unstable post-war transitional state.

The water supply systems in Tigray were severely damaged and destroyed by the Ethiopian Federal government and its allies during the war on Tigray that erupted in November 2020. The percentage of non-operational rural water supply schemes has increased from 7% to 71%, and approximately 12,912 (71%) of the 18,223 rural water supply schemes (hand pump, shallow well, and spring development) that were evaluated have been damaged. Damage also occurred in 293 (approximately 75%) of the 393 motorized or pipe-ported urban and semi-urban water supply schemes that were assessed.

Similarly, the irrigation component of the WASH sector has suffered significant damage and loss as a result of the war. About 10%, or 3281 out of the 32,333 irrigation water schemes that were assessed, have been damaged. The decrease in irrigation from almost 59, 000 hectares to 40,972 hectares affects over 56 thousand irrigation beneficiaries.

The war on Tigray has had a detrimental impact on the Water, Sanitation, and Hygiene (WASH) sector, leading to significant damage to essential WASH infrastructures, reduced access to clean water and sanitary facilities, and increased health risks. Thus, the war-related damage to WASH infrastructure has disrupted the provision of sanitation and clean water services; irrigation has reduced by approximately 18,000 hectares; the lack of proper WASH access and facilities has led to an increase in WASH-related illnesses, especially among children; and water pollution, including chemical contamination from damaged industrial sites, illegal mining, sewage

overflow, and increased dependence on unregulated water sources, has increased. Additionally, the devastation of WASH infrastructure has a detrimental effect on livelihoods, economic activity, general development, and food security.

3.6.2. **Recommendation**

For the region to recover from the destruction of WASH infrastructure and services, infrastructure must be strengthened and rebuilt, healthcare needs to be met, and hygiene practices need to be encouraged. For a recovery to be sustained, WASH facility construction and rehabilitation, as well as capacity building and hygiene promotion, are crucial. Prioritize building and repairing WASH facilities in communities, schools, and health facilities. To promote appropriate waste management, safe sanitation practices, and hand washing, launch campaigns to increase public awareness of hygiene issues. Provide systems to track the success of WASH interventions and make sure the most vulnerable are being reached. Encourage cooperation between local communities, NGOs, and government organizations to guarantee a well-coordinated and efficient response. Finally, it is recommended that all responsible bodies found at the national, regional, and international levels work together to bring the perpetrators to justice and support the rights of victims to secure justice.

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Chapter 4. TRANSPORT

4.1. Summary

Before the outbreak of the war on Tigray in November 2020, the transport sector in the Tigray region was playing a vital role in fostering economic development. The transport sector showed visible achievements in both infrastructure development and service delivery.

However, the devastating war had an unpredictable and severe impact on the region's development trajectory. The entire transport system was shut down, with widespread damage to infrastructure and significant losses in service capacity, primarily due to the siege imposed on the region.

In response, the Commission of Inquiry on Tigray Genocide (CITG), has conducted an assessment of the damages and losses in the transport sector. This effort aimed to inform recovery and reconstruction, justice and accountability, and serve as a record for documentation purposes.

Data collection and analysis adhered to international standards. Field data was gathered by experts from the CITG and relevant offices, while the analysis was centralized at the commission level.

The findings revealed a total damage of USD 610.73 million and a loss of USD 858.443 million in the transport sector from November 2020 to November 2022. Quantitatively, the Eritrean Defense Force (EDF) was responsible for 87.15% of the damaged infrastructure items. However, in terms of damage value, the combined actions of the ENDF, EDF, and Amhara forces accounted for 96.76% of the total recorded value.

As a result of these damages and losses, the transport sector in the region was rendered nonfunctional. This led to: severely reduced road accessibility, disruption of road maintenance activities, abandonment of ongoing road projects, suspension of transport services, increased travel time, and a rise in public transportation costs. The summarized damage and loss of the sub-sectors are presented below in Figure 4-1.

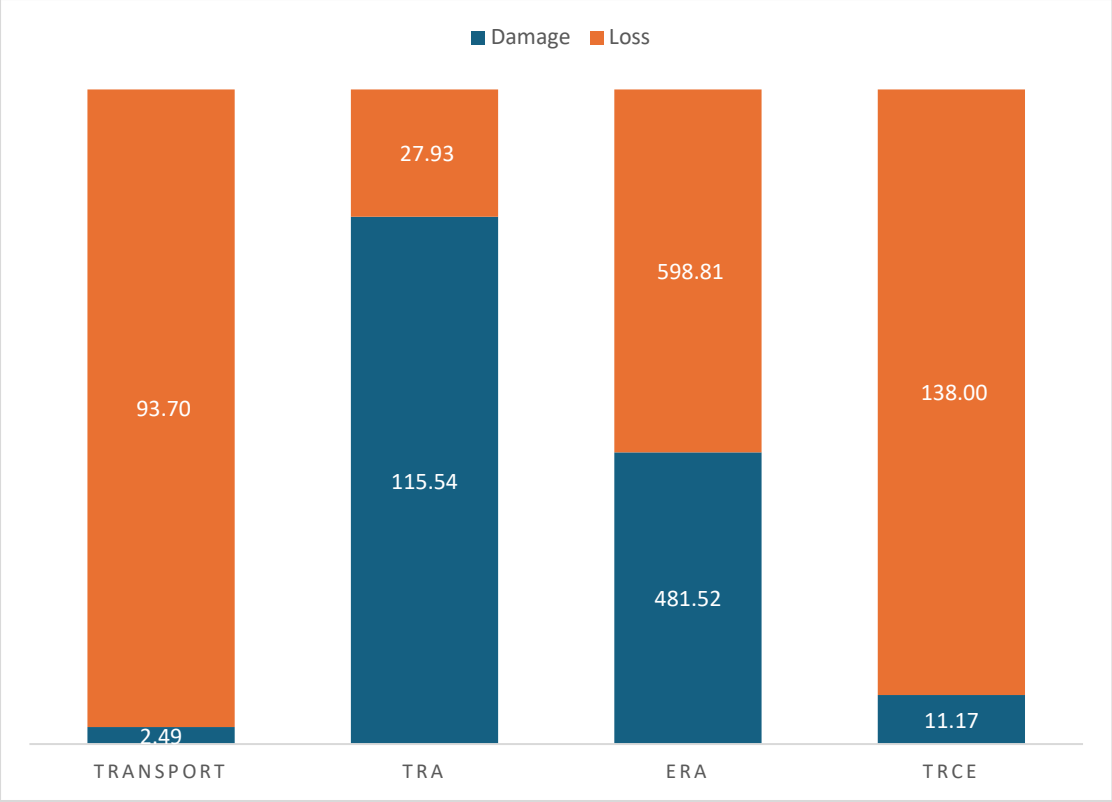

Figure 4-1: Summarized Damage and Loss per Sub-sectors of Transport (Million USD)

Source: CITG, 2022

4.2. Background

The war on Tigray has inflicted significant damage and losses on the region's transport sector. This disruption substantially impacted the provision and utilization of transport services, as well as the availability and management of essential resources within the sub-sectors, directly affecting the economy and social well-being of the region.

A damage and Loss Assessment (DaLA) was conducted to assess the extent of the war and its impact on the region's transport infrastructures and services. This report focuses on public offices directly related to the transport sector, mainly the Tigray Road Authority (TRA), Bureau of Transport, the Ethiopian Road Administration Adigrat district (ERA), and Tigray Road Construction Enterprise (TRCE). Other offices, which are considered under transport, like the Ethiopian Aviation Tigray branch, the Railway (Weldiya Mekelle route), the Dry port, and the Ethiopian postal office Mekelle branch, are not included in this report. This was due to the absence of data, and some of them were not accessible during the data collection period. This may ultimately undermine the total damage and loss result of the sector.

This damage and loss assessment report for the transport sector begins by outlining the sector's pre-war condition, followed by a quantitative and qualitative analysis of the destruction caused

by the war. It further describes the impacts resulting from the identified damages and losses. Based on these findings, the report presents key conclusions and recommendations.

4.3. Pre-War Context

Transport infrastructure and services underpin the economic growth and social development of any country. When the transport network is disrupted, from a natural disaster, war, or other incident, the consequences can be widespread, including halting the productive sector and thus increasing the cost of goods; preventing people from accessing critical services, such as health care; delaying the restoration of key sectors, such as water and energy supply; and stalling reconstruction. Damages may be sustained to physical infrastructure, such as roads and vehicles, leading to economic losses for owners and operators of transport assets and services, as well as losses to other sectors when breakdowns in transport links lead to higher costs and reduced economic activities. Such damages and losses are highly experienced in the region following the devastating war on Tigray.

In the Tigray region, it is known that road transport serves as the primary mode of transportation. According to the data collected from the Tigray Road Authority (TRA, 2022), the total length of roads in Tigray has increased from 906.1 km in 1991 to 6367 km in 2019. Of this, 2220.75 km are asphalt roads administered by the federal government, and 4225.25 km are gravel roads (including 2403.07 km connecting Woreda to Tabiya road, under the Universal Roads Access Programs. Consequently, the density of the road network has increased from 16.6 to over 118.12 km/1000 sq. km. In addition, before the war, 510.73 km of asphalt, 139.14 km of gravel, and 561.5 km of URRAP roads were under construction in the 2019 budget year.

The Ethiopian Roads Authority (ERA), through its Adigrat district subdivision, oversees the construction and administration of asphalt highways. The district's maintenance and asset management directorates are responsible for road conservation. By 2019, 14 asphalt road projects totaling 796.4 km were underway, with an additional five projects (295.37 km) scheduled for 2020.

In the year 2019, TRCE, a governmental contractor, was operating in 16 gravel road construction projects with an average progress of 17%. The enterprise demonstrated consistent

progress in 2011 to 2019, supported by 220 construction machineries and a work force of 713 manpower (skilled professionals and unskilled laborers).

The transport service sector of the region is the economic backbone that fosters and facilitates the transactions of goods and the smooth movement of people. While the three respective bureaus reinforce the infrastructure demands of the transport sector, the service provision is exclusively the responsibility of the Transport Bureau. In the past 20 years, there has been good progress with an estimated 54 thousand vehicles, 54 bus stations, 140 driving license training centers, and 133 garages. As a result, in 2020, there were a total of 50.7 million modern round-trip made by transport users, covering 231 million Km, with 4026 public transport vehicles which were registered under the bureau's 'Simrit'. The overall Tigray Road network is depicted in Figure 4-2.

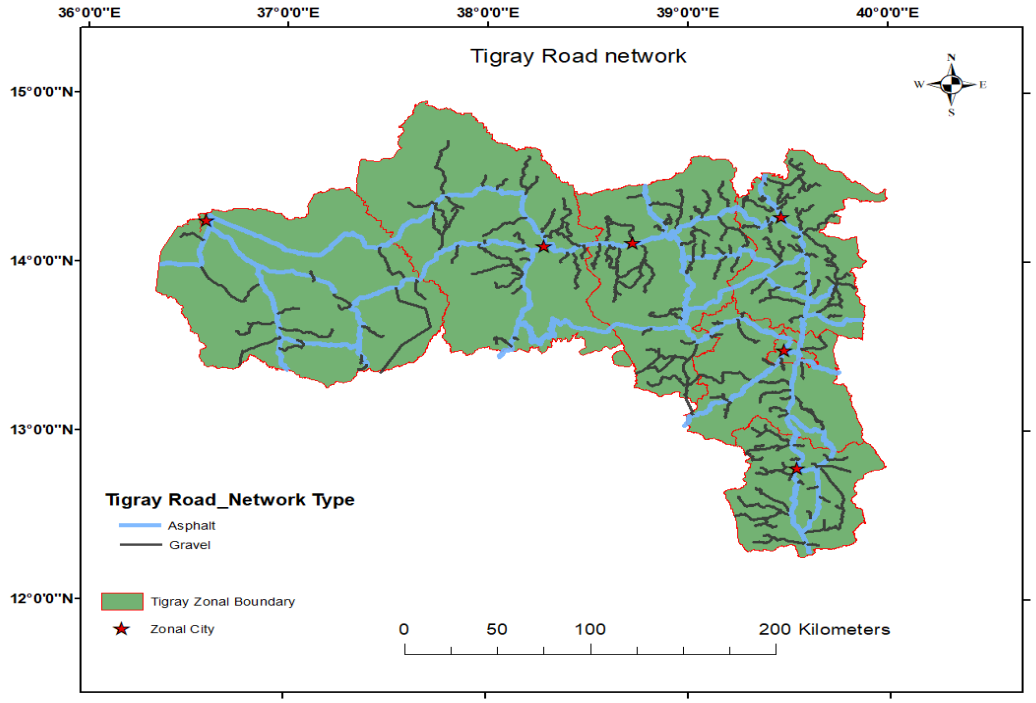

Figure 4-2: Tigray Road Network

Source: CITG, 2022

Generally, pre-war, the road density (measured as road length by 1000 sq. km) was planned to increase from 116.68 km to 200km. The accessibility measured as an average walking distance (time) to all seasoned roads was 3.65 km (1.2 hours), though the plan was to attain 0.8 hrs. In addition, it was planned to increase the good road conditions by 80%.

4.4. Damage and Loss Assessment of Transport Sector

4.4.1. War-induced Damage Value

The war on Tigray caused significant damage to the region's transportation sector, which is critical for economic and social well-being. This damage impacted both infrastructure and services.

Roads (asphalt, gravel, and earthen), a vital component of the transportation network, suffered from the weight of tanks and heavy military vehicles exceeding their design loads. Additionally, shelling during the war directly damaged roads and buildings. These factors, along with the siege that prevented fuel supplies (the economic sector report details this impact), contributed to the collapse of the transport sector. Public and construction equipment vehicles were looted, and the vital ICT infrastructure supporting transportation services was either damaged or looted. Some representative damage to the transportation sector is depicted in Figure 4-3.

Figure 4-3: Damage Registered on Transport Sector
(a) asphalt work machinery on the road project of Mekelle-Samre, b) Broken bridge on the main road of Tigray from Alamata to Mekelle, specifically Garjale c) Bombarded Asphalt Road, and d) Abi-Adi to Semema asphalt road project). Source: CITG 2022.

To assess the damage, the condition of each asset was documented (damaged or looted), and a corresponding unit price was applied to calculate the total cost. The level of damage determined the extent of damage that occurred. Detailed information, including damage types, damage level, quantity, and amounts for each asset category for the transport sector, is presented in Table 4-1

Table 4-1: Damage Amount in Transport Sector with Damage Level (Million USD)

Item Name	**Low**	**Medium**	**High**	**Very high**	**Total Amount**
Building items			0.04	0.0002	0.04
Road infrastructure (Asphalt, Gravel, Access roads, km)	2.87	12.23	484.18	92.76	592.04
Vehicles and Construction Machinery		0.1984		12.09	12.29
Electronics and ICT				0.97	0.97
Office Furniture				2.01	2.01
Consumables				3.38	3.38
Total	**2.87**	**12.43**	**484.22**	**111.21**	**610.73**

Source: CITG, 2022

The total damage is predominantly categorized as high damage, accounting for 79.29% (equivalent to 484.22 million USD), followed by very high damage, 18.21% (111.21 million USD), while the remaining 2.51% is within the medium and low damage level. These figures are further classified into corresponding institutions. The ERA Adigrat district experienced the highest damage, with damages amounting to 481.52 million USD, followed by the Tigray Road Authority (TRA), which incurred 115.54 million USD in damages.

The recorded damages in all types of road surfaces cover both operational roads and roads under construction at the time of the war. In addition to roadway surfaces, the destruction also extended to critical water-crossing structures, including bridges and culverts. A detailed breakdown of the damages across the offices is presented in Figure 4-4.

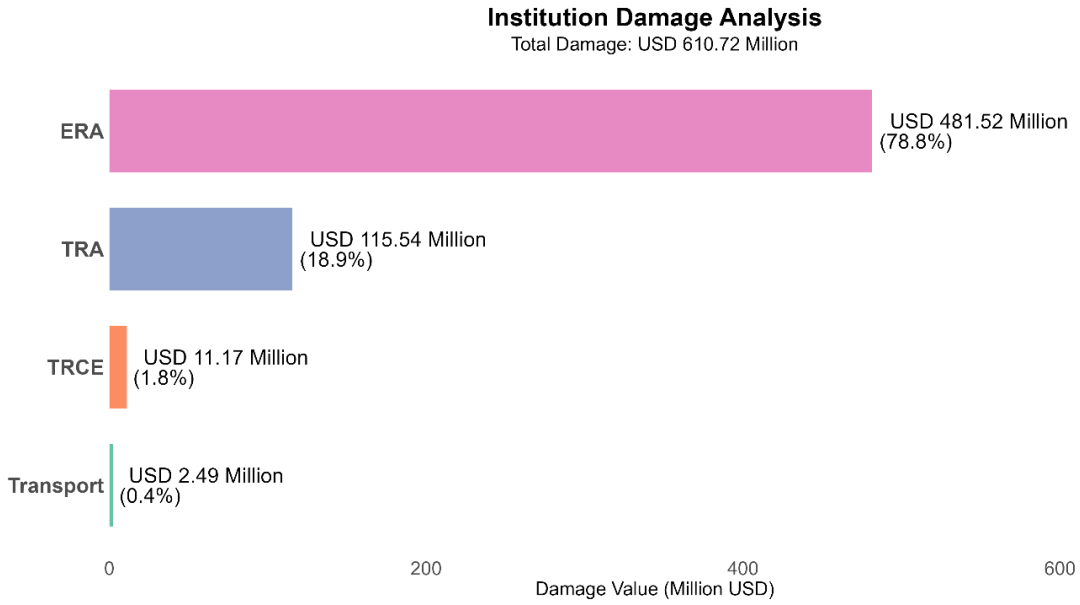

Figure 4-4: Damage Amount in Each Institution in the Transport Sector

Source: CITG, 2022

A. Type of Damage and Mechanism

During the war on Tigray, the damage type and damage level induced on each asset of the transport sector is predominantly reported as deliberate destruction. The road infrastructure was traversed by various large, weapon-carrying vehicles and tanks, for which the road was not designed to accommodate.

According to the Ethiopian maximum axle load standard (FDRE Council of Ministries, 2022), public roads are designed to accommodate a maximum load of 56 tons with pneumatic tyres. However, during the war on Tigray, the actual conditions were significantly different. The roads were traversed not only by vehicles with axle loads that exceeded the prescribed limit but also by tanks and armored tracked military vehicles, which are prohibited from using public roads. These heavy military vehicles moved across all types of road surfaces, whether asphalt or gravel, causing extensive damage regardless of the construction material or design.

Furthermore, shelling damage was recorded on the surface of the road infrastructure, which is also categorized under deliberate destruction, as it was mostly done in the absence of active war. The other type of damage, which is mostly recorded on office equipment, vehicles, and electronic equipment, is looting-type damage. The overall damage type on the transport sector is expressed in a figure format below in Figure 4-5. The amount of damage counts USD 592.39million (112 in number) in deliberate destruction, while the looting damage type

amounts USD 18.35million (207 in number). From the perpetrator's perspective, both types of damage, deliberate destruction and looting, are categorized as intentional acts of damage.

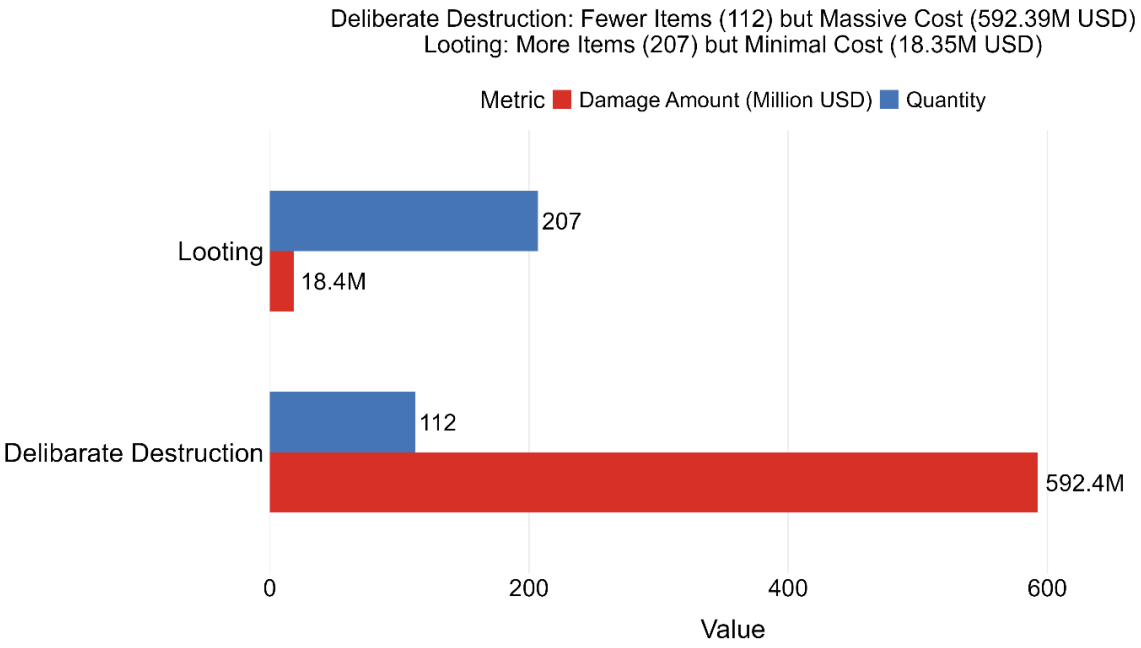

Figure 4-5: Damage Type and Damage Amount

Source: CITG, 2022

B. Level of Damage

The extent of damage to the transport sector is categorized into four levels: low, medium, high, and very high, with a range described in the methodology. A summary of the damage levels in the transport sector with the damage value is presented below in Figure 4-6.

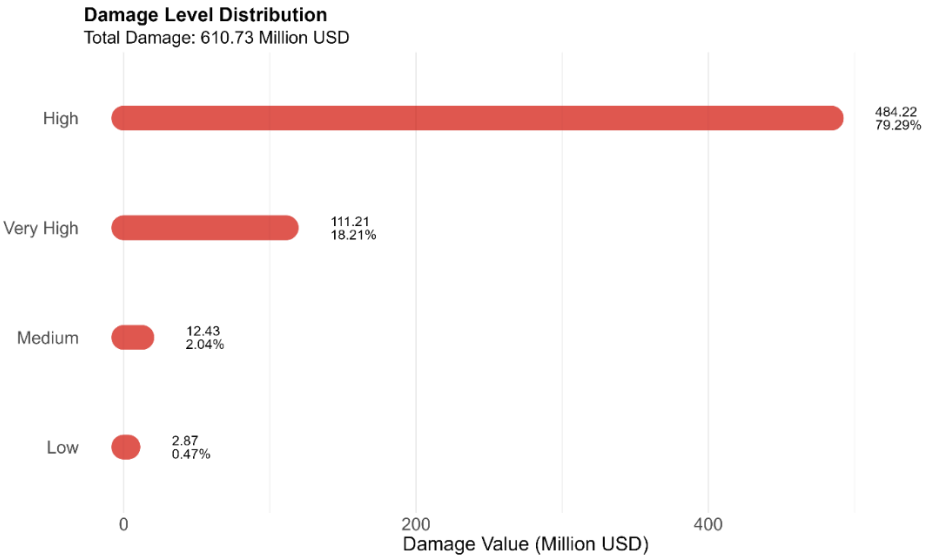

Figure 4-6: Damage Level Distribution on the Transport Sector

Source: CITG, 2022

As per the data in Figure 4-6 most of the items damaged are under high damage level, amounting to USD 484.22 million, with 79%, followed by very high damage amounting to USD 111.21 million and representing 18% of the total. A sample gravel road with very high damage is depicted below in Figure 4-7. Such roads serve as vital links between Woreda towns and zonal capitals, where more advanced social services and facilities are concentrated. The disruption or collapse of such roads has a direct adverse impact on the social welfare of populations residing in both Woreda towns and surrounding rural areas. In particular, limited access to referral hospitals forces communities to revert to home deliveries, a practice that has significantly declined, thereby contributing to heightened risks of maternal mortality.

Figure 4-7: Highly damaged Aksum Semema Gravel Road

Source: CITG, 2022

The damage to road infrastructure in the transport sector varied by road type. Asphalt roads experienced the highest damage, with 98% of the total asphalt network affected experiencing high and very high damage, including both roads in service and those under construction, amounting to USD 477.57 million[1]. Gravel roads were also heavily impacted, with 85%

[1] *Damage estimates for asphalt roads are based on the replacement cost approach (prevailing cost), considering the damage levels as described in the methodology section.*

sustaining high to very high damage, totaling USD 42.89 million. URRAP[2] roads, which serve as critical links between rural communities and Woreda centers, faced extensive destruction, with 100% of the network affected with high and very high damage estimated at USD 70.89 million. The cumulative effect of these damages severely disrupted mobility, limited access to essential services, and increased transportation costs throughout the region. Figure 4-8 illustrates representative examples of damaged roads by type.

Figure 4-8: Sample Damaged Roads on Gravel and Asphalt Road Surface

Source: CITG, 2022

C. Perpetrators Registered in Transport Sector

During the war on Tigray, various actors had significant negative impacts on the people of Tigray. Foremost among them were the Ethiopian National Defense Force, the Eritrean Defense Force (a foreign military force), and the Amhara Forces, who were prominent on the front lines.

In addition, reports indicate that other regional forces were involved in acts of destruction. These include the Ethiopian Federal Police, as well as regional forces from Afar, Somalia, and Oromia.

The proportional involvement, the quantity and amount damaged by these perpetrators in the war who participated in transport damage are illustrated below in Figure 4-9.

[2] *URRAP roads are under the Universal Rural Road Access Program, designed to connect rural communities to essential services; their high damage levels significantly impacted social and economic access. These roads were constructed for accessibility purposes, although they were highly damaged when traversed by tanks and armored military heavy vehicles. The delay for on-time maintenance was also another contributing factor for the damage.*

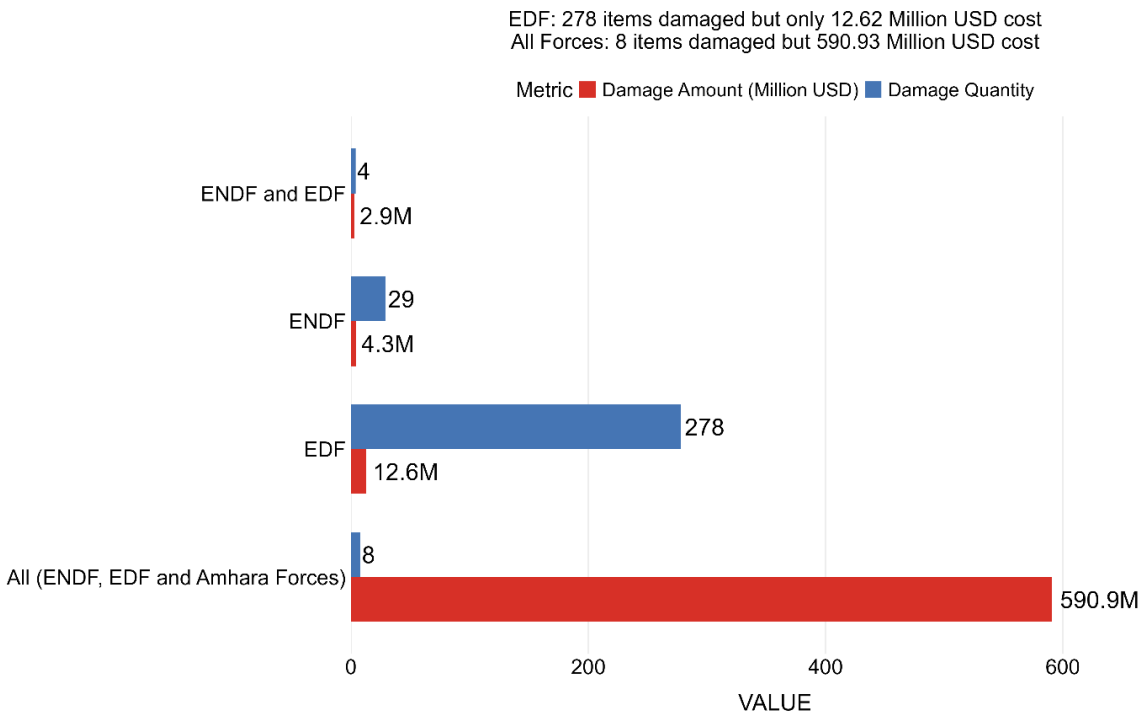

Figure 4-9: Damage Ratio and Perpetrators

Source: CITG, 2022

As illustrated in Figure 4-9, above, the EDF is responsible for the majority of the damage in terms of count, accounting for 278 item types, which represent 87.15% of the total damaged items. However, in terms of monetary value, the combined damage caused by the three forces, the ENDF, EDF, and Amhara forces, amounts to the highest share, totaling USD 590.93 million, despite representing only 8 item types. This indicates that the EDF primarily engaged in the looting of equipment that was easily transportable, whereas the most financially significant damage to the transport sector resulted from the combined actions of all three forces.

One specific example can illustrate this regard. A strategically important bridge[3] (refer to Figure 4-10), which connects the region with the central part of the country and serves as a vital corridor for freight transport, was deliberately damaged due to the continuous passage of ENDF tanks[4]. This incident reinforces the concept highlighted in Section 4.4.1, namely that such bridges were not designed to withstand the weight and impact of tanks and other military weapon-carrying vehicles. The resulting damage severely disrupted the movement of fuel and other essential food supplies into the region, creating unexpected hardships for the population.

[3] *The bridge is part of a key transport corridor linking Tigray with central Ethiopia, facilitating the movement of goods and services prior to the war*

[4] *Eye witness from the surrounding community who is not willing to have his name revealed in this report.*

Figure 4-10: Garjale Bridge Damage (Alamata to Mekoni), Main Road from Amhara to Tigray

(A bridge that was repeatedly loaded by many tanks and collapsed, Photo taken by TRA, November 2022), Source: CITG,2022

As described above in Section 3.3.1, the damage was also documented on roads that were under construction at the time of the war. The impact on these projects was twofold: not only were the road structures themselves damaged, but there was also collateral damage to adjacent farmland and properties. Field assessments conducted along the Mekelle–Samre–Finarwa, Abiadi–Semema–Endabaguna, and Adwa–Rama Road projects revealed additional adverse effects. These included damage to farmlands caused by unmanaged water flow, suspension of economic activities in buildings located within the right-of-way (ROW), and disruption of access to essential services, particularly healthcare facilities[5].

A case study from the Mekelle–Samre–Finarwa road construction project illustrates the extent of the problem. This project, spanning approximately 100 km, was one of the major road works heavily damaged during the war on Tigray[6]. Before the war, the project was under construction by the Defense Construction enterprise to connect Mekelle, the regional capital, with the Woreda towns of Dengolat, Samre, and Finarwa in the southeastern zone. The alignment begins

[5] *Disruptions in access to healthcare were reported at nearby clinics and referral hospitals, reflecting the broader social impact of damaged transport infrastructure.*

[6] *The project experienced both direct structural damage to the road and collateral impacts on adjacent lands due to military activities.*

at the northern end of Mekelle, near the Lachi Bridge, and extends about 18 km through the city, affecting residential properties located on both sides of the ROW.

According to national road construction directives, affected households were expected to receive compensation. However, data collected from residents indicate significant grievances. Many have reported that compensation has either not been provided or was inadequate. An elder from Kebele 05 of Mekelle, whose property was affected, stated:

> *"I was living with my children in a moderate standard of living before the war erupted. The road was expected to be completed within nine months. However, once the war started, construction activities ceased, and the ROW issue remained unresolved. We are now restricted from making any changes to our house. My children, who used to live with me, have been forced into rented houses. Due to inflation, they are facing severe economic hardship and emotional trauma."*

Similar experiences were reported by a project engineer in Samre Woreda. Many households within the ROW were not compensated on time, while others who did receive compensation at the time of valuation are now unable to reconstruct due to increased costs and inflation. Those who received no compensation remain uncertain about their fate, as they are prohibited from making improvements or adjustments to their properties. The prolonged suspension of the project, lasting more than two years, has left these individuals exposed to economic distress, health challenges, and long-term social instability. A representative photograph is presented below in Figure 4-11.

Figure 4-11: Sample Unsettled ROW cases on Mekelle Resident Houses (Kebelle 05)

Source: CITG 2022

When road construction was interrupted due to the war on Tigray, excavated drainage structures were left exposed without any preventive or protective mechanisms for surrounding residents. This posed serious safety hazards, particularly for vulnerable groups such as children, disable persons and the elderly people. Reported cases from Mekelle Kebelle 05 around Elala school indicate that two elderly residents collapsed while attempting to traverse one of the unfinished sections and sustained fractures to their knees. Despite the severity of these incidents, no responsible party was held accountable.

Figure 4-12: Sample Unarranged drainage structures near Elala Scholl, Mekelle

Source: CITG,2022

As can be noticed in Figure 4-13, there were many damaged and burnt vehicles and construction materials, which in turn affected the surface of the roads.

Figure 4-13: Damaged Construction Machinery and Materials on the Mekelle-Samre and Abi Adi- Semema Road Projects.

Source: CITG,2022

The impact of the road damage extended beyond the road infrastructure itself, severely affecting farmlands located along several under-construction corridors. Since the outbreak of the war, drainage structures have remained unmanaged, leading to uncontrolled water flow, flooding, and erosion of nearby arable lands.

A notable case was documented along the Abiadi–Semema road construction project, where Mr. Hagos[7], a farmer residing adjacent to the alignment lost his farmland due to uncontrolled runoff from the unfinished drainage works. Having cultivated the land for many years, he had relied on its cereal production to sustain his family. However, when the farmland was buried under boulders and aggregates washed down from the road, the family lost its primary source of food. As a result, they were left unable to meet even their daily consumption needs, highlighting the profound social and economic consequences of the infrastructure damage. A sample image is depicted below in Figure 4-14.

Figure 4-14: Sample Damaged Arable Land Due to Uncontrolled Drainage

Source: CITG, 2022

[7] *His name was changed for this reporting purpose.*

4.5. War-induced Losses of the Transport Sector

The war and siege in Tigray caused immense damage beyond just physical infrastructure. Economic activity ground to a halt as all services and production ceased, with public offices shutting down entirely. This resulted in multiple losses within the transportation sub-sector. Disasters and wars often disrupt infrastructure sectors in several ways, including the interruption of production and access to goods and services, the disruption of governance and decision-making processes, and the creation of increased risks and vulnerabilities.

This report focuses on the loss of production and access to goods and services experienced by all transport sector offices. The report's second version will incorporate losses stemming from disrupted governance and increased risks.

The war on Tigray inflicted heavy losses on the transportation sector, accounting for USD 858.44 million. When the loss in disruption of production of goods and services and access to goods and services is considered, the Ethiopian Roads Authority (ERA) bore the leading harm of the loss, accounting for USD 598.81 million or 70% of the total losses. This highlights the significant impact on the region's major road network managed by ERA. The Tigray Road construction Enterprise also suffered substantial losses of USD 139 million (16% of the total), indicating that damage to the regional governmental contractor hindered its development trajectory. In contrast, losses to Tigray Transport Bureau (USD 93.7 million) and the Tigray Road Authority (27.93 million USD) were comparatively lower, representing 11% and 3% of the total, respectively. Table 4-2 provides details on loss types in the transport sector, while Figure 4-15 depicts the loss share among institutions.

Table 4-2: Estimated Loss of the Transport Sector (Million USD)

Loss category	Loss			Total
	2021	2022	2023	
Loss due to a decline in output	6.599	39.018	16.215	61.832
Revenue Loss due to declined service	3.036	4.377	4.377	11.79
Loss due to operating cost (due to altered conditions of access to goods and services)	0.819			0.819
Loss due to the disruption of programs, contracts, and the budget	38.66	319.68	425.18	783.525
Induction Training			0.05	**0.05**
Identifying possible risks	0.071	0.084	0.084	0.333
Distributing basic goods to minimize risks		0.066		0.066
Coordinating to prevent further pandemics		0.002		0.002
Organizing forums against further risk			0.011	0.021
Total	**49.186**	**363.232**	**445.92**	**858.44**

Source: CITG,2022

The losses are further classified into corresponding institutions. ERA Adigrat district contributes the greatest share with 69.76% (equal to USD 598.81million), followed by TRCE with 16.08% (USD138.00 million). Detailed loss share is depicted in Figure 4-15 below.

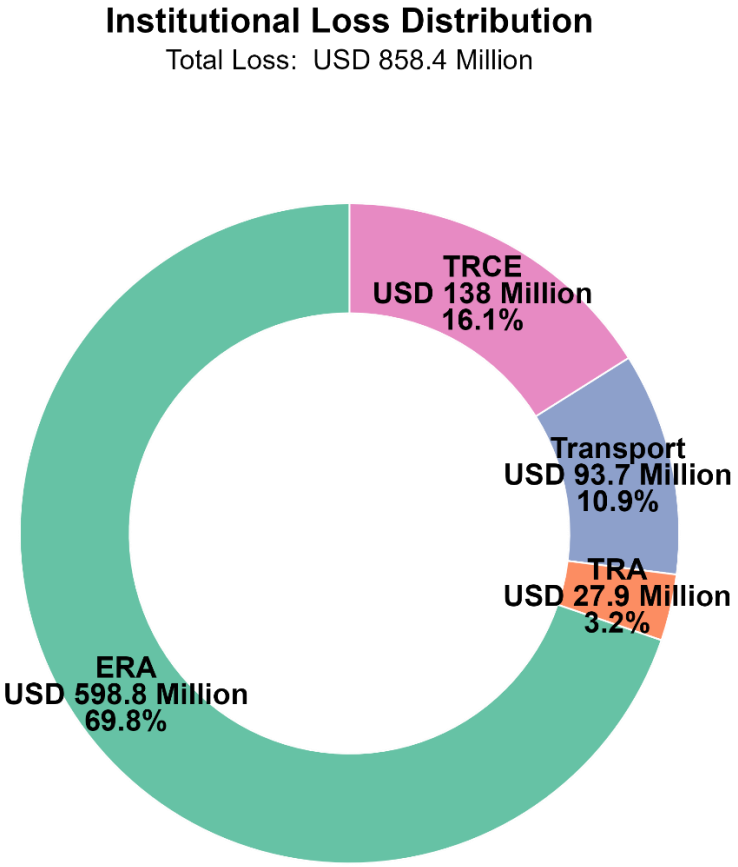

Figure 4-15: Loss Share Across Subsectors of the Transport Sector

Source: CITG 2022

4.6. Impact

Damage to the transport sector has multi-dimensional impacts extending beyond physical infrastructure.8 Some of these impacts are demonstrated by case studies, particularly for projects that were under construction during the war[9].

In wartime, all road types in Tigray were traversed by tanks and artillery-carrying vehicles, which damaged roads and even led to full collapse in some cases. URRAP roads become out of use. This led to the full transport service shutdown in the region. The damages experienced on these roads hindered the mobility of people from origin to destination, in turn exposing the

[8] *Beyond structural damage, impacts include disruption of services, reduced mobility, economic losses, and social consequences for communities dependent on transport networks.*

[9] *Case studies, such as the Mekelle–Samre–Finarwa and Adwa–Rama Road projects, illustrate the compounded effects of halted construction and unprotected right-of-way areas.*

community to economic disruption. The damage was not only on the road infrastructure but also on the office facilities; electronic equipment, construction machinery, transport vehicles, and stationary facilities that were mobilized in each sector of different offices.

The impact of the war on the road and transport sector can be expressed in various ways. The proportion of gravel roads suffering heavy damage rose dramatically from 18% in 2019 to 88% after the war, while fully destroyed roads increased from 12% to 22%. Asphalt road infrastructures, both active and under construction, were also severely affected, with 81% experiencing major damage, 8% minor to severe damage, and 1% full damage due to the war. Furthermore, about 295.37 km of planned asphalt roads remain suspended. The destruction extended beyond roads, as 47 out of the 55 transport-related offices and bus stations in the region, representing 85% suffered war-related damage, and all driving license training centers were forced to close. In addition, the Tigray Road Construction Enterprise (TRCE), a government contractor that had been operating with good progress, was left idle with 713 employees and 127 construction machines, while also losing 8 personnel during the wartime.

Following the war on Tigray, the service returned to the primitive animal-supported mode of transport. All bus stations were shut down, no fuel was available for public transport service, and movement from origin to destination was restricted due to security problems. The overall consequences observed in the transport sector, covering both infrastructure and service delivery, are summarized below, while acknowledging that additional impacts exist.

4.6.1. Infrastructure-related impact

Damage to transportation infrastructure has a cascading impact on a community's economic and social development. In Tigray, the physical damage and economic losses sustained by the transportation sector across four war-affected offices have resulted in several consequences. Some of the visible impacts that can be mentioned are reduced accessibility of the road network, difficulty in delivering road maintenance services, hindered completion of ongoing roadwork projects, closure of transport services, and increased travel times and transportation costs for public transport users.

The closure of transport services can also lead to environmental issues, particularly through waste material generation and contaminant disposal. Damaged infrastructure, such as rubble from destroyed bridges and shelled pavements, contributes to debris accumulation.

These physical damages and losses within the transport sector have cascading negative impacts. For instance, damage to gravel roads has significantly downgraded their condition, as

illustrated in Figure 4-16, the initial assessment of gravel roads indicated good road conditions, which have now deteriorated to poor due to the war.

The war inflicted high damage on Tigray's transportation infrastructure, particularly gravel roads. As per the collected data, mainly on gravel roads, 85% of the damage recorded is classified as severe or above. This significantly hinders maintenance efforts. Road surfaces that were previously maintained easily through routine measures now require rehabilitation or even reconstruction.

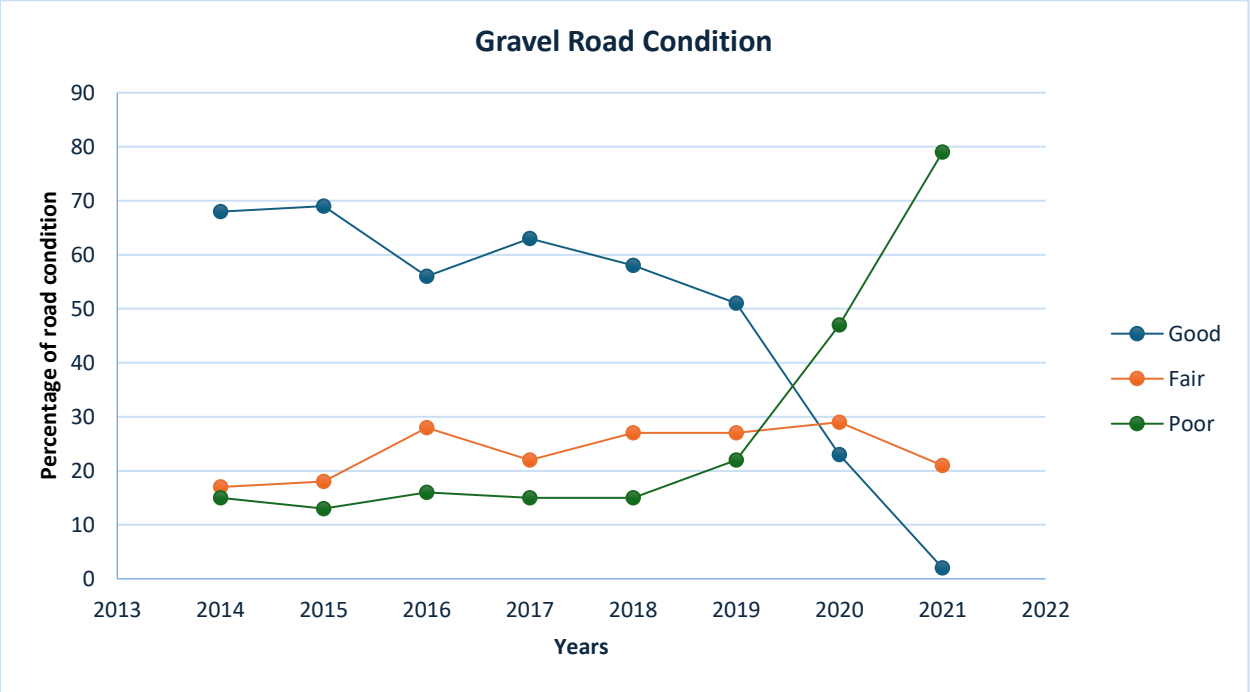

Figure 4-16: Impact on Gravel Road Conditions

Source: TRA, 2022

4.6.2. Service Disruption and Social Impact

The war also crippled the transportation service sector. Bus stations shut down, and the region experienced a regression in transportation options. Horse-drawn carts reappeared in Tigray's towns, posing safety and health concerns. Fuel shortages and spare parts scarcity led to the disruption of most public transport, with remaining services experiencing inflated fares. The collapse of the transport bureau further aggravated the situation, leaving people vulnerable to robberies while forced to travel long distances on foot.

The war's impact on Tigray's transportation sector extends far beyond damaged infrastructure. Disrupted market linkages are a major consequence, caused by limited access to markets and

towns, infrequent trips due to a lack of functioning transport, safety concerns, and significantly increased travel times. This situation also affects job opportunities and income, as the temporary closure of road projects has led to job losses. Healthcare access suffers as well, with reduced frequency of hospital visits and hampered delivery of essential drugs and medical equipment due to poor road conditions. Livelihoods, particularly those relying on non-agricultural opportunities, decline due to limited mobility caused by transportation disruptions. The education and healthcare sectors may also face challenges in retaining qualified personnel if increased transport costs make these jobs less attractive. Furthermore, vulnerable groups like women, children, elderly people, and those with disabilities face even greater obstacles due to mobility limitations caused by the damaged transportation network. Finally, rising operational costs threaten the financial sustainability of transport businesses. These broader impacts paint a grim picture of how severely the war has crippled not just Tigray's transportation infrastructure but also its social and economic well-being.

Most of the access roads were linked through community roads constructed under the URRAP program. However, these roads were left destroyed after the war, leaving rural communities disconnected from essential social services such as health centers and educational institutions.

4.6.3. Experts' loss of the Transport sector

The transport sector not only suffered from infrastructure damage and loss, but also the loss of experienced professionals. These were killed while executing their civil works without participating in any war-related activities. The total impact and detailed atrocities on these professionals are documented on the commission for further detail research out put on human atrocity. The data revealed here is only to show how the transport sector was impacted due to losing these experienced professionals. Naturally, the experience the professionals had attained after intensive and continuous training by the organizations and individual commitment. The organization was investing in such training to fill professional gaps. Thus, the loss of these professionals over a short period brought a significant and visible impact on the human resource development of the institutions. All of this expertise loss happened on the governmental contractor TRCE. As the main objective of TRCE is to produce profit by harmonizing machines and skilled laborers, the loss of experienced experts has a profound impact and will greatly delay the developmental progress of the enterprise. A total of nine experts in the transport sector lost their lives; five were killed by the ENDF, and four were

killed due to joint actions by the EDF and ENDF. This highlights the severe human resource loss experienced by the sector.

4.7. Conclusion and Recommendation

4.7.1. Conclusion

The war on Tigray has severely and adversely affected the region's transport sector. The impact extends beyond the destruction of physical infrastructure to encompass significant losses in transport-related services and institutional capacity.

This damage and loss assessment focused on key institutions: The Tigray Transport Bureau, Tigray Road Authority, Tigray Road Construction Enterprise, and the ERA Adigrat District, which is responsible for the administration of asphalt roads in the region.

According to the data collected and analyzed, between November 2020 and November 2022, the transport sector sustained a total documented damage of USD 610.73 million and a total recorded loss of USD 858.339 million.

Among the institutions assessed, the ERA Adigrat District suffered the most significant damage, accounting for 78.84% of the total recorded damage value. This reflects the extensive destruction inflicted on the region's asphalt road infrastructure.

The war saw the involvement of multiple armed actors in causing damage to transport infrastructure: Quantitatively, the EDF was responsible for 87.15% of the damaged items, while in terms of damage value, the combined forces of the ENDF, EDF, and Amhara regional forces were responsible for 96.67% of the total damage amount.

The fallout from this devastation resulted in the near-total shutdown of the transport sector, with widespread consequences: Severely reduced road accessibility across the region, complete disruption of road maintenance and construction services, increased travel time, higher public transport costs, and impeded access to essential social services, particularly healthcare.

Tragically, these effects led to the loss of lives, as individuals were unable to reach referral hospitals in time. In rural areas, halted road construction, especially the absence of proper drainage infrastructure, caused runoff, soil erosion, and deposition of boulders on farmlands. These environmental impacts disrupted agricultural activities and have contributed to acute food insecurity, a situation unprecedented in the region in recent years.

4.7.2. Recommendation

The transport sector plays a critical role in boosting the economy and improving the welfare of the community. Unfortunately, the sector suffered severe setbacks in both infrastructure and services during the war on Tigray. To restore the sector to its pre-war trajectory, the following recommendations are proposed:

1. **Infrastructure Rehabilitation**
    - Damaged critical infrastructure, such as bridges and major roads, should be repaired and maintained as a priority, ensuring that post-war recovery supports the safe and efficient operation of transport services.
2. **Reconstruction Planning**
    - A comprehensive reconstruction plan should be developed and implemented under the "building back better" principle, with reconstruction activities commencing as soon as possible to restore functionality and resilience.
3. **Community Support and Restoration**
    - A systematic and rational approach should be adopted to address the needs and concerns of the affected communities, providing support to mitigate the social and economic impacts of the war.
4. **Accountability**
    - All actors responsible for damages and disruptions during the war should be held accountable for their actions to ensure justice and prevent future violations.

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Chapter 5. MUNICIPAL SERVICES

5.1. Summary

Before the outbreak of the war on November 2020, municipalities in the Tigray National Regional State had developed strong institutional capacity, driving rapid urban growth, infrastructure expansion, and socio-economic progress. However, the war caused catastrophic destruction across the municipal, housing development, and construction sectors, dismantling decades of development gains. The war led to the deliberate targeting of urban infrastructure, public institutions, and administrative systems, resulting in severe physical, economic, and human losses.

The Damage and Loss Assessment (DaLA) on municipal services amounted to USD 187.42 million in total damage, with the municipal offices sector accounting for 85% (USD 159.15 million). Road and greenery infrastructure were the most affected, followed by vehicles, ICT equipment, furniture, and public buildings. The construction sector incurred USD 27.54 million in damages, while the Tigray Housing Development and Administration Agency (THDAA) sustained losses amounting to USD 0.72 million, primarily due to looting.

In addition, damages to municipal offices were categorized as follows: deliberate destruction accounted for USD 117.11 million (73.6%), looting for USD 37.47 million (23.5%), combined destruction and looting for USD 3.46 million (2.2%), and collateral damage for USD 1.11 million (0.7%).

The main perpetrators responsible for the destruction of municipal services were the ENDF, which caused USD 92.80 million (58.31%) in damage; joint actions of all perpetrators, USD 35.35 million (22.21%); the EDF, USD 17.55 million (11.03%); and combined ENDF and EDF actions, USD 11.40 million (7.16%).

Moreover, the assessment reveals that destruction in Tigray's publicly owned construction sector amounted to USD 22.10 million (80.24%) of total damages, primarily caused by the ENDF and EDF through systematic and deliberate targeting of ongoing construction projects.

Similarly, the Tigray Housing Development and Administration Agency (THDAA) sustained significant socio-economic damage that severely disrupted housing services. Joint actions by the ENDF, EDF, and Amhara forces accounted for the largest share of the damage, USD 0.462 million (64%), while unspecified perpetrators were responsible for USD 0.262 million (36%).

Similarly, war-induced economic losses totaled USD 597.12 million, with municipal offices suffering the largest share (USD 426.80 million) due to revenue disruptions, halted projects, and unpaid salaries. The construction sector loses USD 169.42 million primarily through canceled contracts and delayed projects, while THDAA incurred USD 0.90 million in operational losses.

The war inflicted severe expertise human capital losses within municipal institutions, with over 427 cases documented among staff, encompassing death, injuries, torture, and psychological trauma. Joint actions accounted for 50% of these incidents, highlighting the coordinated nature of the attacks. These actions represent serious violations of international humanitarian law, demonstrating a deliberate effort to undermine local governance and administrative capacity.

Overall, the war resulted in the near-total collapse of municipal governance. Administrative records were destroyed, service delivery halted, and revenue generation ceased. The destruction of roads, utilities, and green infrastructure crippled urban mobility and public health systems. The combined effects of physical devastation, economic paralysis, and human suffering have left Tigray's municipalities incapacitated and communities impoverished.

5.2. Background

Before the outbreak of the November 2020 war on Tigray, municipalities in the Tigray National Regional State demonstrated strong institutional capacity and played a key role in promoting urbanization and local development.

Over the past two decades, the construction industry across Ethiopia has been a critical driver of socio-economic development. Its contribution to the national economy increased from 4.03% of GDP in 2009 to 19.29% in 2018, with an estimated annual average growth rate of 4.58%. This growth was largely fueled by large-scale investments in infrastructure sectors such as transport, electricity, tourism, manufacturing, and industrial parks (Tigray Urban Development and Construction Bureau, 2020).[10]

In Tigray, however, this growth trajectory was severely disrupted by the outbreak of the war hindered investment, delayed development projects, and created a significant backlog of reconstruction needs. It involved both internal and external forces and caused widespread

[10] *(Tigray Urban Development and Construction Bureau, 2020). (Unpublished Document)*

destruction, severely disrupting municipal services and development programs throughout the region.

Municipal offices experienced substantial human, economic, and organizational losses, as numerous employees were killed, detained, displaced, or suffered psychological trauma. Simultaneously, key infrastructure and public assets, including administrative buildings, vehicles, machinery, office equipment, utilities, and official documents, were extensively destroyed, damaged, burned, or looted. These combined effects led to a breakdown of institutional capacity, halting essential municipal services and suspending vital development projects.

To quantify these impacts, the Commission of Inquiry on the Tigray Genocide conducted a Damage and Loss Assessment (DaLA). The assessment aimed to generate evidence-based data to support justice, accountability, and reparations efforts. Its main objective was to estimate the extent of wartime damage and losses by analyzing pre-war asset values and service conditions.

The assessment categorized damages into three main sectors: municipal offices, ongoing construction, and housing development. It examined a broad range of losses, including destruction of physical infrastructure, cancelled projects, additional costs, and interrupted services. The DaLA report presents a comprehensive finding of the extent, nature, and perpetrators of the damage and losses imposed by the war on Tigray's municipal services.

5.3. Pre-War Context

In 2013, the Tigray National Regional State had 101 officially recognized urban centers, comprising 89 emerging towns and 12 larger cities. By the end of 2020, this number had increased to 127, consisting of one regional-policy city (Mekelle City Administration), 30 municipal offices, and 97 emerging towns, indicating substantial urban growth at an average annual rate of 4.5% (Tigray Urban Development and Construction Bureau, 2020).

Under the current administrative structure, the Tigray National Regional State is divided into seven zonal administrations, collectively encompassing 134 towns and cities, including Mekelle's sub-cities. The Central Zone contains the largest number of towns (29), followed by the Northwestern Zone (24) and the Eastern Zone (23). The Southern Zone has 20 towns, the Western Zone 17, and the South-Eastern Zone 13. The regional capital, Mekelle, functions as a regional policy City and is divided into seven sub-cities (Tigray Urban Development and Construction Bureau, 2024).

Before 2020, the Tigray Bureau of Construction, Roads, and Transport oversaw more than 100 major construction projects across the region. In addition, proposals were made to implement approximately 1,450 construction projects at the Woreda level each year, with a combined estimated cost of over USD 20 million annually. These figures highlight the rapid growth and critical role of the construction sector in advancing regional development.[11]

5.4. Damage and Loss Assessment of Municipal Services

5.4.1. Damage Value

Municipal infrastructure and fixed assets across the Tigray National Regional State sustained severe damage during the war, including administrative buildings, vehicles, information and communication technology (ICT) equipment, furniture, surveying tools, utility systems, and official records. Many of these assets were either destroyed or rendered partially unusable. This damage significantly impaired the operational capacity of municipal offices, limiting their ability to deliver essential administrative and public services.

The regional construction sector was also heavily affected. Public projects, including roads, bridges, drainage systems, and government buildings, suffered major setbacks, with many sites looted, burned, or abandoned due to war. Construction equipment and materials were often destroyed or stolen, causing the suspension of most ongoing projects

[11] *Tigray Bureau of Construction, Roads, and Transport (2020); (unpublished document)*

Figure 5-1: Damaged Office Equipment, Furniture, Vehicles, and Buildings
Source: CITG,2022

Figure 5-2: Damaged Administrative Buildings, Records, Documents, and Office Facilities
Source: CITG 2022

In general, the war caused both direct and indirect losses to municipal offices across Tigray. Beyond the destruction of physical assets, these offices incurred increased costs associated with emergency repairs and the replacement of looted or damaged equipment.

Table 5-1: Estimated Damage of Municipal Offices, Housing, and Construction Assets

Item / Item Category	Total Effect Value (USD, Million)	Share (%)
Municipal offices		
Building Infrastructures [12]	8.039	5.1%
Consumable goods	3.712	2.3%
ICT / Electronics Equipment and Spare Parts	5.579	3.5%
Official Record File	1.179	0.7%
Office furniture and Facility Equipment's	5.233	3.3%
Planning and Surveying Instruments	0.768	0.5%
Roads and Greenery Infrastructure	119.459	75.1%
Sport items	0.060	0.04%
Vehicles and machinery	15.125	9.5%
Subtotal	**159.154**	**100.0%**
Construction Sector		
Ongoing Building Construction Projects	27.052	98.2%
ICT Equipment (Computers, etc.)	0.261	0.9%
Office Furniture (Desks, Chairs)	0.182	0.7%
Vehicles	0.047	0.2%
Subtotal	**27.542**	**100.0%**
Tigray Housing Development and Administration Agency		
Building	0.158	21.9%
ICT Equipment (Computers, etc.)	0.010	1.4%
Office Furniture (Desks, Chairs, etc.)	0.002	0.3%
Spare Part	0.291	40.2%
Vehicles	0.262	36.2%
Subtotal	**0.723**	**100.0%**
Grand Total	**187.419**	

Source: CITG, 2022

As shown in Table 5-1, the total estimated damage across the municipal, housing, and construction sectors amounts to USD 187.42 million, with municipal offices accounting for

[12] *The physical damage to administrative buildings primarily involved the destruction of structural components such as walls, roofs, doors, windows, and internal fixtures.*

USD 159.15 million, representing approximately 85% of the overall damage. Within this sector, roads and greenery infrastructure were the most heavily affected, constituting 75% of the municipal damage cost. Other significant damages include vehicles and machinery, ICT equipment, office furniture, and building infrastructure, reflecting widespread destruction across various public asset types.

The construction sector experienced substantial losses, estimated at USD 27.54 million, predominantly due to destroyed buildings, which accounted for over 98% of the sector's total damage. Minor losses occurred in ICT equipment, office furniture, and vehicles, representing a small proportion of the sectoral total.

The Tigray Housing Development and Administration Agency sustained total damages of USD 0.72 million, primarily from vehicles and spare parts, followed by office buildings and smaller losses in office furniture and ICT equipment. Compared to other sectors, the agency's assets were relatively less affected by the war.

Beyond quantitative damage, the destruction of office equipment, furniture, and ICT tools severely constrained the operational capacity of municipal offices, disrupting administrative workflows, record-keeping, and the provision of essential public services. Damage to roads, bridges, drainage systems, and other infrastructure impeded mobility and access to municipal services, while damage to planning and surveying instruments slowed urban development projects. Additionally, the destruction of official records and documents undermined governance, accountability, and continuity of historical data, exacerbating institutional challenges.

The war also generated significant economic consequences. Municipal offices incurred increased costs for emergency repairs, replacement of damaged assets, and delays in ongoing projects, which strained budgets and limited revenue collection. The disproportionate damages to roads and public infrastructure highlight the need to prioritize transport and utility reconstruction to restore operational capacity and regional economic connectivity. Concurrently, the recovery of office equipment, ICT systems, and official records is critical to reestablish administrative efficiency and strengthen governance functions across Tigray.

A. Type of Damage and Execution Mechanism

The war inflicted significant damage on municipal services and infrastructure across Tigray. Municipal offices experienced both deliberate and collateral destruction, including arson, looting, and other deliberate attacks. Office equipment, furniture, records, and ICT systems were heavily affected, severely limiting administrative functions and service delivery.

The construction sector suffered substantial damage, with ongoing projects disrupted due to the destruction and looting of materials, damage to equipment, and structural deterioration. Many construction sites were abandoned, burned, or looted.

The Tigray Housing Development and Administration Agency sustained considerable damage. Its properties, vehicles, and office equipment were either destroyed, burned, or looted.

Table 5-2: Distribution of Municipal Service Damages by Type and Estimated Value (Million USD)

Damage Type	Total Effect Value	Share (%)
Deliberately destroyed	117.11	73.6%
Looting	37.47	23.5%
Deliberately destroyed and looted	3.46	2.2%
Collateral damaged	1.11	0.7%
Grand Total	**159.15**	**100%**

Source: CITG, 2022

The analysis of municipal service damages in Tigray, as summarized in Table 5-2, highlights that the majority of the destruction resulted from deliberate actions rather than incidental or collateral effects. The total estimated value of damages amounted to USD 159.15 million. Among these, deliberate destruction accounted for USD 117.11 million, representing 73.6% of the total damage value. Looting followed as the second most significant contributor, with an estimated loss of USD 37.47 million, equivalent to 23.5% of the total. A smaller but notable portion of the damage, USD 3.46 million (2.2%), stemmed from combined incidents involving both deliberate destruction and looting. Meanwhile, collateral damage, which occurred as an indirect consequence of war-related activities, was estimated at USD 1.11 million, or 0.7% of the total loss.

Overall, the data clearly indicate that intentional and targeted acts, particularly deliberate destruction and looting, were the predominant drivers of municipal infrastructure and service damage in Tigray. The overwhelming share of damage caused by deliberate actions underscores the severity of intentional assaults on public assets, reflecting not only the physical

devastation but also the deliberate undermining of essential municipal functions and community well-being during the war.

A concrete case illustrating these damage types is the destruction of Edaga-Arbi town municipal office, primarily carried out by the Eritrean army, with Ethiopian forces participating at various stages of the war. The attacks were systematic, targeting homes, businesses, and public institutions. Residential and commercial properties were looted, municipal records destroyed, and public infrastructure rendered nonfunctional. The most severe phase occurred during the third round of the war in 2022, leaving Edaga-Arbi virtually paralyzed and its residents highly vulnerable. This case underscores the deliberate and extensive nature of destruction inflicted on urban areas in Tigray, reflecting broader patterns of targeted and high-value asset damage across the region.[13] The municipal head officer of Edaga-Arbi described the situation as follows:

"During the war, our municipal office was completely disrupted. The Eritrean army primarily carried out attacks, and Ethiopian forces participated at different times. Homes, businesses, and public institutions were systematically targeted. Municipal records were destroyed, office infrastructure was rendered unusable, and public services were completely halted. The most severe phase of destruction occurred during the third round of the war in 2022, leaving the town paralyzed and our residents extremely vulnerable. Recovering from this level of damage has been overwhelming, as almost all administrative and service functions were interrupted."[14]

Following the assessment of municipal office damages, the construction sector in Tigray also suffered substantial damage and losses. Ongoing projects were disrupted, materials and equipment were destroyed or looted, and many sites were abandoned or burned.

Table 5-3: Distribution of Construction Sector Damages by Type and Estimated Value (Million USD)

Damage Type	Total Effect Value	Share (%)
Deliberately destroyed	22.24	80.8%
Looting	0.54	2.0%
Deliberately destroyed and looted	4.2	15.3%
Collateral damaged	0.56	2.0%
Grand Total	**27.54**	**100.0%**

Source: CITG, 2022

[13] *Edaga Arbi (Tigrinya: ዕዳጋ ዓርቢ) is a town in Ethiopia's Tigray Region, located 42 km southeast of Adwa. It serves as the administrative and economic center of Werie Lehe Woreda and is known for its historic monastery.*
[14] *Key Informant Interviews, Edaga Arbi Municipal Officials, 2022.*

The assessment of damages to the construction sector, as detailed in Table 5-3, indicates that the total estimated loss amounted to USD 27.54 million. The largest portion of this damage stemmed from deliberate destruction, which accounted for USD 22.24 million, representing 80.8% of the total damage. Combined forms of intentional damage, such as deliberate destruction accompanied by looting, contributed an additional USD 4.20 million (15.3%). Meanwhile, looting and collateral damage each accounted for a relatively small share, at USD 0.54 million (2.0%) and USD 0.56 million (2.0%), respectively.

Overall, these figures demonstrate that the overwhelming majority of the destruction within the construction sector was intentional in nature. The dominance of deliberate and combined damage types collectively exceeding 95% of total damage reflects a systematic and targeted effort to dismantle physical infrastructure and disrupt municipal development capacities in the region.

In addition to municipal offices and construction projects, the Tigray Housing Development and Administration Agency (THDAA) sustained significant damage during the war. The agency's properties, vehicles, office equipment, and ongoing housing projects were looted, destroyed, or rendered nonfunctional, severely impairing its capacity to provide essential housing services.

Table 5-4: Damage by Type in Tigray THDAA (Million USD)

Damage Type	Total Effect Value	Share (%)
Looting	0.57	78%
Deliberately destroyed	0.16	22%
Total	**0.72**	**100%**

Source: CITG, 2022

The data in Table 5-4 indicate that the total damage cost to the Tigray Housing Development and Administration Agency amounted to USD 0.72 million. The majority of this damage, 78.16% (USD 0.57 million), resulted from looting, the predominant form of damage. Deliberate destruction accounted for 21.84% (USD 0.16 million) of the total damage. These findings demonstrate that while targeted damage occurred, the primary impact on the agency was due to looting rather than physical destruction.

The destruction inflicted on municipal offices during the war was not only extensive in scale but also varied in its execution mechanisms, reflecting a combination of deliberate military

targeting and opportunistic looting. Municipal assets such as roads, green spaces, vehicles, machinery, ICT equipment, furniture, official records, and administrative buildings were damaged through multiple means, including intentional destruction, arson, and theft. These mechanisms of damage demonstrate both organized efforts to dismantle public institutions and uncontrolled acts of plundering that further undermined service delivery and governance.

Table 5-5: Type of Damage Mechanism and Share of Total Damage Value (Million USD)

Item / Item Category	Mechanism				
	Airstrike[15]	**Shelling[16]**	**Burning**	**Heavy vehicles**	**Looting**
Building infrastructures	0.007	4.08	1.05	1.10	1.80
Consumable goods	-	0.01	0.02	-	3.67
ICT/ electronics equipment and spare parts	0.014	0.06	0.04	-	5.46
Official record file	-	0.03	0.67	-	0.48
Office furniture and facility equipment's	0.014	1.13	0.03	0.03	4.02
Planning and surveying instruments	-	0.06	0.03	-	0.68
Roads and greenery infrastructure	0.088	92.88	0.03	14.23	12.24
Sport items	-	-	-	-	0.06
Vehicles and machinery	0.001	-	-	0.01	15.11
Total	**0.124**	**98.26**	**1.87**	**15.37**	**43.52**
Share (%)	**0.08%**	**61.74%**	**1.2%**	**10%**	**27%**

Source: CITG, 2022

As shown in Table 5-5, shelling was the main source of damage, totaling USD 98.26 million (62%), primarily affecting roads, greenery, and building infrastructures. Looting type of destruction caused USD 43.52million (27%), targeting vehicles and machinery. Damage from heavy vehicles such as tanks accounted for USD 15.37 million (10%), largely impacting roads, green infrastructure, and machinery. Airstrikes (USD 0.124 million, 0.08%) and burning-related damages (USD 1.87 million, 1.2%) contributed less in value but caused significant losses to official records, administrative facilities, and ICT systems.

[15] *Destruction caused by aerial bombardment.*
[16] *Damage resulting from artillery fire.*

Figure 5-3: Damage to Municipal Record Office Due to Targeted Attack

Source: CITG,2022

B. Level of Damage

The systematic assessment of damages to municipal offices provides critical insight into the extent to which the war has debilitated local governance and service delivery. By examining both the physical infrastructure and operational assets, this study offers a comprehensive evaluation of the magnitude and nature of disruptions within municipal systems.

Assets were categorized by type, including administrative buildings, office equipment, vehicles, and official records, and assessed by severity, ranging from destruction to partial impairment. This dual approach captures two interrelated dimensions of loss: the tangible devastation of municipal facilities and the disruption of essential operational resources necessary for daily administrative functions.

Table 5-6: Municipal Offices Damages by Item Category and Severity Level (Million USD)

Damage Level Category	Medium	High	Very high
Building infrastructures	0.05	6.04	1.95
Consumable goods	-	0.09	3.62
ICT / electronics equipment and spare parts	-	0.02	5.56
Official record file	-	-	1.18
Office furniture and facility equipment's	-	0.00	5.23
Planning and surveying instruments	-	-	0.77
Roads and greenery infrastructure	0.09	106.65	12.72
Sport items	-	-	0.06
Vehicles and machinery	-	0.01	15.12
Total	**0.14**	**112.80**	**46.21**

Source: CITG, 2022

Figure 5-4: *Destruction of Building by Heavy Artillery*
Source: CITG, 2022

Table 5-6 indicates that the total estimated monetary value of damages sustained by municipal offices reached USD 159.15 million, reflecting substantial economic destruction concentrated in the high and very high severity categories. The roads and greenery infrastructure category suffered the most significant losses, totaling USD 119.46 million (USD 106.65 million under high and USD 12.72 million under very high severity levels), underscoring the extensive disruption of transport networks and urban amenities.

Vehicles and machinery followed with damaged, valued at USD 15.13 million, primarily due to the destruction and looting of service and operational fleets. ICT and electronic equipment, including spare parts, accounted for USD 5.58 million, representing critical losses to digital and communication infrastructure essential for municipal operations.

Office furniture and facility equipment sustained damages worth USD 5.23 million, while consumable goods recorded USD 3.71 million, showing that even administrative resources were heavily affected. Building infrastructures experienced USD 8.04 million in combined losses, indicating considerable structural damage to administrative and public service buildings.

Overall, the data demonstrate that financial impacts were widespread across both physical and operational assets, reflecting the severe degradation of municipal capacity and service delivery functions.

The assessment of damages to the Tigray Housing Development and Administrative Agency (THDAA) provides a critical extent of damage and losses during the war. By categorizing affected assets by item type and severity level, the analysis highlights both the physical and operational impacts on the agency.

Table 5-7: *Distribution of HDAA Damages by Item Category and Severity Level (Million USD)*

Damage Level Category	Medium		Very high	
	Quantity (№ Units) and Value			
	Quantity	Value	Quantity	Value
Building	8.00	0.16	-	-
ICT equipment (computers, etc.)	-	-	68.00	0.010
Office furniture (desks, chairs)	-	-	480.00	0.002
Spare parts	-	-	816.00	0.291
Vehicles	-	-	7.00	0.262
Total	**8.00**	**0.16**	**1,371.00**	**0.565**

Source: CITG, 2022

Table 5-7 indicates that the bulk of damages to the Tigray Housing Development and Administrative Agency (THDAA) were concentrated in the "very high" severity category, affecting 1,371 units with a total estimated value of USD 0.565 million. The most heavily impacted items include spare parts (816 units, USD 0.291 million), office furniture (480 units, USD 0.002 million), ICT equipment (68 units, USD 0.010 million), and vehicles (7 units, USD 0.262 million). Medium-level damages were limited, with only 8 building units affected, valued at USD 0.16 million.

These findings suggest that the war affected operational and movable assets, which are essential for day-to-day functioning, while structural damages to buildings were relatively limited. The concentration of losses in the very high category highlights the severity and intensity of the destruction, indicating that THDAA's capacity to deliver housing services was significantly disrupted.

In addition to the damage to the construction sector provides an understanding of the scale and severity of damage and losses caused by the war. By categorizing affected items according to damage level and monetary value, the assessment shows both the physical destruction of construction projects and the disruption of critical operational assets, including ICT equipment,

Overall, the damages reflect both the economic and functional toll of the war on municipal offices, emphasizing the need for strategic planning and resource allocation to restore full operational capacity.

Table 5-8: Construction Sector Damages by Item Category and Severity Level (Million USD)

Damage Level Category	Medium		High		Very high	
	Quantity	Value	Quantity	Value	Quantity	Value
Ongoing building construction projects	69.0	26.29	-	-	2.0	0.76
ICT equipment (computers, etc.)	-	-	-	-	477.0	0.26
Office furniture (desks, chairs)	-	-	-	-	1,037.0	0.18
Vehicles		-	-	-	52.0	0.05
Total	**69.0**	**26.29**	**-**	**-**	**1,568.00**	**1.25**

Source: CITG, 2022

Table 5-8 shows that damages in the construction sector were primarily concentrated in the medium and very high severity categories, totaling 1,568 affected units valued at approximately USD 1.25 million. Medium-level damages were largely associated with ongoing building construction projects (69 units, USD 26.29 million), reflecting partial losses to works in progress. Very high damages affected ICT equipment (477 units, USD 0.26 million), office furniture (1,037 units, USD 0.18 million), and vehicles (52 units, USD 0.05 million), indicating severe losses to operational assets required for project management and administration.

The data suggest that while physical damage to construction projects was significant at the medium level, the greatest impact was felt in operational assets, which are essential for sustaining ongoing construction activities. The combined effect of these losses likely disrupted project timelines and administrative efficiency. These findings underscore the need for targeted interventions to replace high-value operational assets and resume construction activities, alongside strategies to restore partially damaged buildings and construction projects. The overall pattern of damages highlights both the economic and functional toll of the war on the construction sector.

C. Perpetrators

The pattern and extent of destruction observed in the municipal service sector of Tigray indicate that the damage was not random but the result of coordinated actions by multiple armed actors. Evidence gathered from field assessments, municipal records, and key informant interviews suggests that the Ethiopian National Defense Forces (ENDF), Eritrean Defense Forces (EDF), and Amhara Forces played central roles in inflicting extensive and systematic damage. Their

involvement varied by location and intensity but collectively contributed to the widespread collapse of urban infrastructure, administrative systems, and public service delivery.

Table 5-9: Perpetrator attribution to the value of damage to the municipal service sub-sector (Million USD)

Perpetrators	Value of damaged	Share
ENDF	92.80	58.31%
Joint[17]	35.35	22.21%
EDF	17.55	11.03%
ENDF and EDF	11.40	7.16%
EFP	1.08	0.68%
ENDF and Amhara Forces	0.34	0.22%
Amhara Forces	0.04	0.02%
Others	0.58	0.37%
Total	**159.153**	**1.000**

Source: CITG, 2022

The data in Table 5-9 reveal that ENDF was the leading contributor to municipal damage, accounting for USD 92.80 million, or 58.31% of the total. Joint operations involving all perpetrators were responsible for USD 35.35 million (22.21%), reflecting the extensive coordination among armed groups in targeting urban assets. The EDF followed, with USD 17.55 million (11.03%) of total damage, while combined ENDF and EDF actions contributed USD 11.40 million (7.16%). Other perpetrators, including the Ethiopian Federal Police (EFP), Amhara forces (AF), and unidentified groups, collectively accounted for less than 2% of total damages.

These figures demonstrate that state and allied forces were the primary agents of destruction in Tigray's municipal sector, underscoring a pattern of deliberate and coordinated damage aimed at dismantling local governance and service delivery systems.

[17] *All forces except the category's others*

Table 5-10: Perpetrator Contribution on Construction Sector (USD Million)

Perpetrators	Value of damaged	Share
Joint [18]	22.1	80.2%
ENDF and EDF	3.187	11.6%
ENDF	1.414	5.1%
ENDF and Amhara Forces	0.598	2.2%
EDF and Amhara Forces	0.123	0.4%
EDF	0.071	0.3%
Amhara Forces	0.048	0.2%
Total	27.542	**1.00**

Source: CITG, 2022

The damages to the publicly owned construction sector in Tigray highlight the predominant role of joint operations by multiple perpetrators. According to Table 5-10, coordinated attacks accounted for USD 22.10 million, or 80.24% of the total damage, indicating that destruction was largely driven by systematic and organized actions rather than isolated incidents. Joint operations by the ENDF and EDF contributed an additional USD 3.19 million (11.57%), further demonstrating the deliberate targeting of construction infrastructure. This distribution shows that while all actors contributed to infrastructure damage, coordinated military operations caused the majority of destruction.

Overall, the construction sector in Tigray sustained severe damage predominantly from joint operations (over 80%), with ENDF and EDF combinations responsible for most of the remaining losses. Individual forces had a minor but noticeable impact. These patterns emphasize the strategic and coordinated nature of attacks on critical infrastructure during the war.

The destruction of Adi-Daero's municipal office and broader town infrastructure was carried out primarily by the EDF in coordination with the ENDF. Evidence from interviews with local officials and eyewitnesses indicates that the attacks were deliberate, targeted, and systematic, rather than incidental damage from the war. The perpetrators intentionally burned official municipal documents, including decades of land ownership records and lease agreements, effectively erasing administrative work and undermining legal property rights. One municipal officer stated, "Our entire record room was burned. We lost decades of land ownership

documents. Now people come claiming land, but we have nothing to prove or disprove their cases."[19]

The EDF deliberately set fire to the municipal office building, along with its furniture, equipment, and other assets. This destruction paralyzed administrative functions and halted essential public services. As a municipal officer described, *"The office itself was destroyed, including all equipment. We had no chairs, no desks, no computers, nothing. We could not provide any service to our people."*[20] The economic impact was equally severe. Before the war, the municipality generated nearly USD 9 million annually; after the destruction, income dropped to zero due to the collapse of local markets and taxation systems, leaving residents without access to basic services

Furthermore, the destruction and ensuing disruption forced many merchants and residents to flee, while those who remained faced extreme vulnerability. As highlighted by another officer, "Many merchants and residents fled. Those who stayed had nothing to rely on because both the economy and governance collapsed completely." Collectively, these underscore the deliberate and systematic nature of destruction inflicted on Adi-Daero, reflecting broader patterns of targeted attacks and high-value asset damage across urban centers in Tigray.

Figure 5-5: *Damage to Municipal Vehicles due to Targeted Attack*

Source: CITG, 2022)

[19] *Key Informant Interviews, Adi-Daero Municipal Officials, 2022.*

The assessment of damages to the Tigray Housing Development and Administration Agency (THDAA) shows the severe socio-economic impact on local communities. In particular, it has reported substantial losses, reflecting the disruption of housing services.

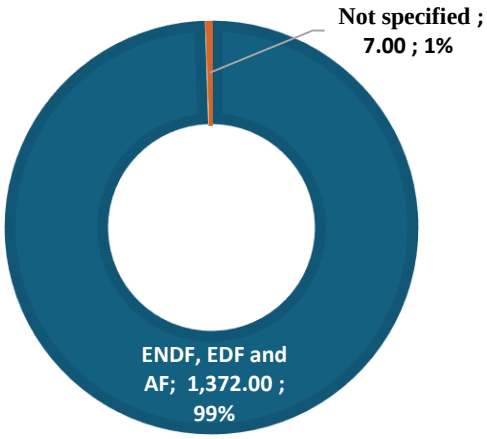

Figure 5-6: Perpetrator Quantity Share on THDAA.

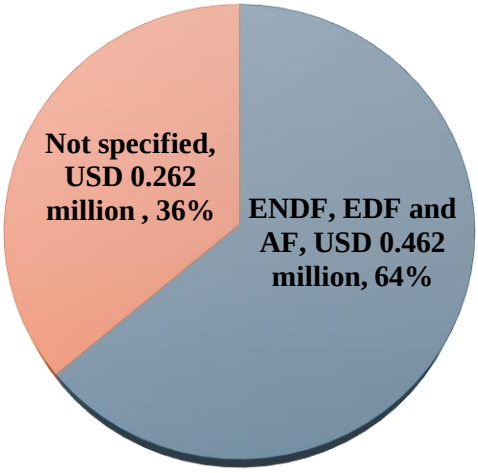

Figure 5-7: Perpetrator Cost Share on THDAA.

Source: CITG Survey 2022

Among the identified perpetrators, the joint operations of the Ethiopian National Defense Forces (ENDF), Eritrean Defense Forces (EDF), and Amhara forces account for the largest known share, totaling USD 0.462 million (64%) and unspecified forces of USD 0.262 million (36%) damage incurred. The data underscores the heavy toll inflicted by federal and allied forces.

5.4.2. War-Induced Loss Value

The war on Tigray caused severe economic and operational losses to municipal services, as revenues sharply declined due to the disruption of income from service charges, local taxes, and license fees. The closure and incapacitation of municipal offices further exacerbated the fiscal crisis, leaving local governments unable to perform essential administrative and public service functions.

This situation was compounded by the suspension of critical external funding, particularly from programs such as the Urban Institutional and Infrastructure Development Program (UIIDP), which had previously supported infrastructure development and operational capacity.

Table 5-11: Estimated Loss Value of Municipal (Million USD)

Loss category	Loss			Total Loss	Share (%)
	2021	2022	2023	Public	
Municipal offices					
Revenue loss value due to Tax income from lease, rental, service, penalty, and sale of prosperity and service	71.2037	85.8267	111.1207	268.15	62.8%
Forgone loss due to the disruption of projects at the contract bidding for new projects	117.5113	9.6495	9.6325	136.79	32.1%
Loss due to unpaid employees' salaries	3.3858	17.2979	-	20.68	4.8%
Additional Cost	0.0021	1.0696	0.1015	1.17	0.3%
Sub-Total	192.10	113.84	120.85	426.80	100.0%
Construction Sector					
Loss of revenue due to the cancellation of the contractor's bid sale	0.0054	0.0071	0.0095	0.02	0.01%
Loss of revenue due to the registration of a new license	0.0209	0.0278	0.0369	0.09	0.05%
Loss of revenue due to license renewals	14.0876	0.0151	0.0201	14.12	8.34%
Loss of revenue due to the upgrading of license renewals	0.0037	0.0050	0.0066	0.02	0.01%
Loss due to unpaid salaries	0.4696	-	-	0.47	0.28%
Forgone loss due to budget cuts	34.2835	-	-	34.28	20.24%
Forgone loss due to the disruption of development projects and programs	22.7408	30.2453	9.9809	62.97	37.17%
Forgone loss due to the disruption of contract bidding	39.9286	13.1764	4.3482	57.45	33.91%
Sub-Total	111.5400	43.48	14.40	169.42	100
Tigray Housing Development and Administration Agency					
Foregone Loss due to unpaid salaries	0.63	0.26	-	0.88	98%
Additional cost	0.01	-	-	0.01	2%
Sub-Total	0.64	0.26	-	0.9	100%
Total	**304.28**	**157.58**	**135.26**	**597.12**	

Source: CITG Survey 2022

The economic impact of the war on municipal services, the Tigray Housing Development and Administration Agency (THDAA), and the construction sector was substantial, reflecting both direct and indirect losses over three years (2021–2023).

As shown in Table 5-11, municipal offices experienced the most significant financial impact, with total losses of USD 426.80 million. The majority of this loss resulted from revenue disruptions, including service charges, local taxes, rental income, penalties, and property sales. Disruptions to contract bidding and ongoing projects caused an additional USD 136.79 million in forgone revenue, while unpaid employee salaries accounted for USD 20.68 million. Additional operating costs were comparatively minor at USD 1.17 million. Collectively, these figures highlight that the war caused a near-complete collapse of municipal revenue streams and severely constrained the capacity of local governments to provide essential services.

The construction sector suffered total losses of USD 169.42 million, largely due to the disruption of development projects and programs (USD 62.97 million) and delays or cancellations of contract bids (USD 57.45 million). Budget cuts and lost revenue from license renewals contributed an additional USD 34.28 million and USD 14.12 million, respectively, while minor losses occurred from unpaid salaries, license registrations, and contractor document fees. These data demonstrate that the construction sector's revenue streams were heavily disrupted by administrative and operational challenges caused by the war, slowing development and investment.

The Tigray Housing Development and Administration Agency incurred total losses of USD 0.90 million, with unpaid employee salaries representing 98% of the total. This indicates that operational disruptions and staff incapacitation, rather than direct asset destruction, were the main sources of economic loss.

Overall, municipal offices bore the greatest financial burden due to their diverse revenue-generating functions, whereas operational paralysis accounted for most losses at THDAA. In the construction sector, project disruptions and budget shortfalls were the primary contributors to losses. These patterns suggest that post-war recovery strategies must address not only physical reconstruction but also the restoration of administrative systems, revenue mechanisms, and operational capacity across all sectors to ensure sustainable urban service delivery.

5.4.3. Experts' Human Capital Loss

The war on Tigray caused not only extensive physical destruction and economic losses but also substantial damage to human capital within municipal institutions and related sectors. Skilled personnel, including administrative staff, engineers, and technical officers, were killed, displaced, injured, or rendered unable to perform their duties due to insecurity and the destruction of workplace infrastructure.

Municipal staff, who are essential for the functioning of local governance and the delivery of public services, were among the most directly affected. Many suffered death, injury, torture, or psychological traumatize.

Table 5-12: Overview of Human Casualties and Perpetrators of Municipal Office Staff

	Perpetrators								
Type of Damages	**ENDF**	**EDF**	**AF**	**ENDF and EFP**	**ENDF and EDF**	**Joint[21]**	**Other**	**Total**	**Share**
Death	19	25	1	-	16	6	9	76	17.8%
Physical injury	10	6	1	1	12	3	-	33	7.7%
Torture	-	-	2	-	-	-	-	2	0.5%
Physical injury and torture	1	-	-	-	-	-	-	1	0.2%
Torture and psychological trauma	1	88	-	-	16	204	6	315	73.8%
Total	**31**	**119**	**4**	**1**	**44**	**213**	**15**	**427**	**100.0%**
Share	**7%**	**28%**	**1%**	**0.2%**	**10%**	**50%**	**4%**	**100%**	

Source: CITG Survey 2022

The data presented in Table 5-12 indicate that the war caused severe human capital losses among municipal office staff in Tigray, with a total of 427 documented cases of death, injury, torture, and psychological trauma. The most prevalent form of harm was torture combined with psychological trauma, accounting for 315 cases (73.8%), which highlights the significant mental and emotional impact of the war.

Deaths accounted for 76 cases (17.8%), primarily resulting from actions by the Eritrean Defense Forces (EDF) and joint acts by allied perpetrators. Physical injuries were recorded in 33 cases (7.7%), largely caused by the joint of the ENDF and EDF.

Analysis of perpetrators shows that joint operations were responsible for 50% of all incidents, followed by EDF alone at 28% and ENDF alone at 7%. These findings suggest that human capital losses resulted mainly from systematic and coordinated campaigns targeting municipal

[21] *Joint actions by ENDF, EDF, and Amhara forces*

personnel. The widespread psychological trauma and combined forms of harm may lead to long-term consequences for survivors, including reduced productivity, social isolation, and intergenerational effects.

From a legal perspective, these acts constitute violations of international humanitarian law (IHL) and human rights standards. Targeted attacks against civilian personnel, torture, and psychological harm are prohibited under the Geneva Conventions of 1949 and their Additional Protocols, as well as the Convention against Torture (CAT, 1984). The deliberate targeting of municipal staff, who are considered protected persons under IHL, also violates customary international law rules concerning the protection of civilians and civilian objects during war.

Furthermore, the destruction of records and administrative infrastructure undermines governance rights protected under international human rights law, including the right to public administration and access to essential services. Beyond individual suffering, the loss of skilled personnel weakens municipal service delivery, delays post-war reconstruction, and disrupts local governance structures. Overall, the evidence demonstrates that the war not only destroyed physical infrastructure but also systematically dismantled the human and institutional foundations of urban governance in Tigray, in breach of applicable legal frameworks. [22]

5.5. Impact

The war has severely undermined the institutional capacity of Tigray's municipalities, particularly in the areas of urban development, construction, and housing development. The loss of skilled human capital due to displacement, injury, and trauma has created a significant expertise gap and disrupted administrative continuity. Extensive destruction of municipal offices, critical records, ICT systems, and essential equipment has drastically reduced operational efficiency. Consequently, municipalities have struggled to manage urban planning, allocate resources, and deliver essential public services. These limitations have led to fragmented governance, poor coordination, and delayed responses to pressing urban needs.

According to one municipal officer in Adi-Daero, "*Our entire record room was burned. We lost decades of land ownership documents. Now people come claiming land, but we have nothing to prove or disprove their cases.*"[23] This loss of documentary evidence has paralyzed land administration and urban management functions, undermined public trust, and exposed residents to property disputes. Another municipal employee added, "*Before the war, our*

[22] *HL: International Humanitarian Law; CAT: Convention*
[23] *Key informant interview, Adi-Daero Municipal Officer, 2022*

municipality generated over 500 million birr each year. After the town was burned, our income dropped to zero. There was no market, no electricity, and no way to collect taxes." [24] Such testimonies highlight the magnitude of administrative and financial collapse experienced across Tigray's municipalities.

The economic base of the municipalities has been equally devastated. The destruction of public assets, including administrative buildings, machinery, and construction materials, brought development activities and municipal service delivery to a standstill. Many traders, contractors, and local service providers lost their livelihoods due to the suspension of construction work and public contracts. The collapse of local markets, compounded by inflation and the interruption of municipal projects, further constrained economic recovery. As one local merchant explained, "*We lost our shops, goods, and vehicles. Even when peace returned, we had nothing left to restart our business*."[25] Similarly, revenue losses from property taxes, business licenses, and service fees placed heavy pressure on municipal budgets, preventing the funding of essential maintenance and employment programs.

The social consequences of the war have affected all dimensions of urban life. The collapse of water, sanitation, and waste management systems has worsened public health conditions, exposing urban residents to water-borne diseases and hygiene-related hazards. Municipal staff and community members alike reported widespread psychological distress, anxiety, and fatigue resulting from the destruction and insecurity. One municipal worker stated, *"The office itself was destroyed, including all equipment. We had no chairs, no desks, no computers, nothing. We could not provide any service to our people."*[26] This pervasive loss of morale and institutional function has weakened governance and community resilience.

A striking example of these combined effects is observed in Edaga Arbi, where approximately 70% of the town's infrastructure, including water supply, electricity, and telecommunications networks, was destroyed. Municipal buildings were burned, vital records were lost, and more than 70 households were displaced without compensation. Farmers were denied access to their land, leading to hunger and severe food insecurity. Local businesses, shops, and vehicles were looted, resulting in massive unemployment and economic stagnation. Cultural and religious

[25] *Key informant interview, Municipal Service Department Staff, Adi-Daero, 2022.*

institutions, including monasteries, were desecrated, compounding social trauma and eroding community identity[27].

The overall findings reveal that the war inflicted multidimensional damage on administrative, economic, and social leaving municipalities incapacitated and communities impoverished.

5.6. Conclusion and Recommendation

5.6.1. Conclusion

The assessment indicates that the municipal service sector in Tigray sustained USD 187.42 million, with the municipal offices bearing USD 159.15 million, accounting for about 85% of the overall damage. USD 159.15 million in physical damage during the war. Of this total, deliberate destruction was the predominant cause, accounting for 72.39% or approximately USD 115.20 million, while looting contributed 23.55% or approximately USD 37.47 million. The Ethiopian National Defense Forces (ENDF) and the Eritrean Defense Forces (EDF) were primarily responsible for these damages, underscoring the targeted nature of attacks on municipal infrastructure and administrative functions.

Direct physical damage to the construction sector amounted to USD 27.54 million, with deliberate targeting and destruction responsible for over 95% of this damage, specifically, 78% (around USD 21.49 million) from deliberate destruction alone and an additional 17.7% (approximately USD 4.89 million) from combined acts of destruction with looting or burning. These figures highlight the systematic and intentional nature of the destruction within the construction sector. The economic losses in this sector further reflect the disruption of ongoing and planned infrastructure works between 2021 and 2023.

Damage to the Tigray Housing Development and Administration Agency totaled USD 0.72 million, with the majority 78% (about USD 0.57 million) attributed to looting, while deliberate destruction accounted for the remaining 22% (around USD 0.16 million). The ENDF and EDF were the main perpetrators of these damages, with a significant portion of housing-related damage attributed to their joint operations. Other groups, including the Amhara Forces and Ethiopian Federal Police, contributed to a lesser extent.

Across all sectors (municipal offices, construction, and housing development), the total estimated economic loss and foregone value reached around USD 597.12 million. The

municipal office sector bore the largest burden with losses totaling USD 426.8 million, mainly due to disrupted revenue streams such as taxes, property rentals, service charges, penalties, and program interruptions. The housing development sector experienced relatively minor economic setbacks of USD 0.90 million, largely driven by unpaid salaries. The construction sector faced economic losses amounting to USD 169.42 million, largely reflecting canceled or delayed projects, budget cuts, and reduced income from contractor bids and licensing.

Beyond physical destruction, the Tigray war inflicted profound human capital losses. Municipal staff suffered recorded cases of death, injury, torture, and psychological trauma, with nearly half involving torture combined with psychological trauma. ENDF and EDF were responsible for most of these violations, often operating jointly, indicating that municipal personnel were systematically targeted.

5.6.2. **Recommendation**

Based on the findings of this assessment, a set of targeted recommendations has been developed to guide post-war recovery and institutional rebuilding across the urban development sector in Tigray.

- Prioritize the rehabilitation of municipal infrastructure, allocate emergency budgets, and enhance institutional safeguards to prevent future looting.
- Accept responsibility for damage caused by federal forces and allied forces, provide proportional reparations, support regional reconstruction funds, and promote reconciliation.
- Develop and implement a post-war housing recovery strategy focusing on displaced and vulnerable groups.
- Restore basic municipal services, digitize critical records, and strengthen revenue collection to sustain recovery.
- Reactivate halted construction projects, support affected contractors, and reassess damaged infrastructure for redevelopment.
- Provide financial and technical assistance, enhance institutional capacity, and advocate for accountability through global and legal engagement.

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Chapter 6. ENERGY

6.1. Summary

The Tigray war, which erupted in November 2020 and lasted for two years, caused extensive and systematic destruction to Tigray's energy infrastructure, paralyzing power generation, transmission, and distribution systems. A comprehensive assessment of this damage and loss, conducted by the Commission of Inquiry on Tigray Genocide, has documented close to 1,864 incidents of war-induced damage, systematically geo-referenced and verified through technical audits and field verification.

Key findings of this assessment reveal significant destruction of Tigray's energy infrastructure. Of the infrastructure facilities documented in this study, over 97% - including substations, transmission corridors, and distribution lines- were either severely damaged or destroyed in terms of the count of incidents and the cost of damage. The destruction was consistent across administrative zones, with the Central, Eastern, and North-Western zones experiencing over 96% destruction of the reported incidents. The Tekeze Hydropower Plant and Ashegoda Wind Farm, two of the country's most strategic power generation assets, were rendered non-operational due to direct aerial strikes, grid disconnections, and war-induced maintenance paralysis. High-voltage corridors such as the Tekeze-Mekelle 230kV line and substations in key urban centers faced targeted aerial bombardments, while widespread looting and deliberate destruction further exacerbated losses.

The total verifiable physical damage is quantified at USD 68 million, with transmission and distribution systems accounting for over 92% of the total damage costs. The total financial impact, dominated by long-term economic losses, amounts to USD 482 million. Damage attribution analysis indicates that Ethiopian National Defense Forces and Eritrean Defense Forces were responsible for the majority of the destruction, with financial impacts varying based on the value of targeted assets.

This assessment not only quantifies economic and physical losses but also exposes the deliberate dismantling of critical infrastructure, raising serious questions about compliance with international humanitarian law and underscoring the urgent need for justice. The findings are essential for future reconstruction planning, reparations claim, and the establishment of evidence-based accountability mechanisms to ensure perpetrators are held responsible. Recovery will require a phased, inflation-adjusted rebuilding framework, alongside

institutional and technical capacity rehabilitation, all grounded in principles of transitional justice and long-term accountability.

6.2. Introduction

The war on Tigray, which erupted in November 2020 and lasted until the Pretoria Agreement of Cessation of Hostilities (CoHA) in November 2022, inflicted profound damage on critical civilian infrastructure, reversing decades of development progress in the region. Among the most severely affected sectors was energy, an essential foundation for public services, industrial activity, social stability, and post-war recovery. Energy systems are recognized as the backbone of modern society, and their destruction has been shown to have catastrophic, cascading effects on public health, economic stability, and social order (Ali and Kamraju 2023). The widespread destruction of power generation, transmission, and distribution systems has had cascading effects on every aspect of life in Tigray which contributed to prolonged humanitarian crises, economic collapse, and breakdown of essential services such as water supply, healthcare, and telecommunications. This collapse exemplifies the concept of 'critical infrastructure interdependence,' where the failure of one system (energy) directly causes the failure of others, thereby multiplying humanitarian impacts (Berezutskyi and Tokhtamysh 2024; Al-Saidi et al. 2020).

This report provides a comprehensive and evidence-based assessment of the war-induced damage and economic losses sustained by Tigray's energy sector. It aims to not only quantify the physical and financial toll of the war on energy infrastructure but also to contribute to national and international efforts for reconstruction, justice, and post-war accountability. The assessment focuses on publicly owned assets under the Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU) which operate high-voltage transmission lines, substations, distribution systems, and generation plants across the region.

The assessment aims to provide a comprehensive account of the war's impact on Tigray's energy sector by documenting the destruction of power generation facilities, transmission lines, and substations. It further estimates the direct and indirect economic losses arising from infrastructure damage, service disruption, and halted development projects, establishing a foundation for reparations claims and transitional justice. The methodology for estimating economic loss aligns with established post-disaster assessment frameworks, such as the Damage and Loss Assessment (DaLA) methodology developed by the United Nations and the World Bank (World Bank and United Nations Development Programme 2010; United Nations Statistics Division 2008). In addition, the study analyzes spatial and perpetrator-specific

patterns of infrastructure targeting to shed light on possible violations of international humanitarian law (IHL), while consolidating evidence that can inform future legal and policy frameworks for both restorative and retributive justice.

The scope of the assessment covers the core period of the war, from November 2020 to July 2022, and focuses on accessible areas in all parts of Tigray. Security restrictions and ongoing occupation prevented coverage of Western Tigray and other inaccessible zonal areas. Moreover, the study is confined to public infrastructure and does not include private assets, those owned by regional governments, or non-state actors, ensuring clarity of focus while acknowledging the limitations of the data.

Despite these constraints on timeframe, geographical coverage, and asset scope, the findings presented in this report represent the most comprehensive account to date of the destruction inflicted on Tigray's energy sector. The data and analysis are intended to inform urgent recovery efforts, support reparations claims and transitional justice initiatives, and contribute to long-term energy planning and resilience-building in Tigray and other war-affected regions of Ethiopia. Critically, this evidence base advances accountability by documenting potential violations of international law, ensuring that the scale and patterns of destruction are formally recognized in both reconstruction and justice processes.

6.3. Pre-War Context

The energy sector forms the backbone of Tigray's socio-economic development, powering homes, industries, and essential services. Before the November 2020war on Tigray, the region's power infrastructure was a critical component of Ethiopia's national power grid system, comprising major generation assets like the Tekeze Hydropower plant and the Ashegoda Wind Farm. This infrastructure, which included an extensive high-voltage transmission network, and a growing distribution system serving hundreds of thousands of customers. This section details the capacity, operational performance, and financial standing of this critical infrastructure immediately before the war, establishing a baseline against which the subsequent destruction can be measured.

Tekeze Hydropower, a critical energy infrastructure project in Ethiopia, located on the Tekeze River in the Tigray region, features a 188-meter double-curvature arch dam—one of the tallest in Africa— with a reservoir capacity of 9.3 billion cubic meters and a total installed capacity of 300 MW, generated through four 75 MW turbines. Before the war on Tigray disrupted operations, only one unit was functional, producing 60 MW of electricity, far below its potential

annual output of 981 GWh. The power generated is integrated into Ethiopia's national grid through the Lachi substation in Mekelle, with additional high-voltage lines supplying Axum and Shire Endasillasie. As Tigray's largest hydropower plant, Tekeze plays a vital role in regional and national energy supply, supporting economic growth and infrastructure development.

However, the war on Tigray severely impacted Tekeze's operations, damaging infrastructure and limiting power generation. Despite its design capacity, the plant has long faced operational challenges, including mechanical issues and underutilization.

As Ethiopia's first and largest wind farm, Ashegoda was a flagship renewable energy project designed to support the national grid. Strategically located approximately 24 km southeast of Mekelle, the facility combined thirty 1 MW Vergnet turbines and fifty-four 1.67 MW Alstom turbines. Its operational history was marked by distinct phases:

Initial Success (2012/2013 - 2016/2017): The plant demonstrated strong performance, consistently meeting or exceeding production targets after its commissioning. Peak output of 233.96 GWh in 2014 validated its technical capability.

Operational Decline (2017/2018 - 2018/2019): Performance plummeted due to the abrupt departure of the contractor, Vergnet SA. This resulted in deemed energy losses of 153.42 GWh and 122.43 GWh in consecutive years, exposing critical vulnerabilities in maintenance arrangements. Thus, by the onset of the war, the wind farm was already in a fragile state due to these pre-existing contractual and maintenance failures.

Tigray's electricity transmission network consisted of high-voltage lines at 230 kV, 132 kV, and 66 kV, connecting key substations across the region. The system comprised:

- ✓ 230-kV system (grid backbone): 852 km supported by 1,864 towers
- ✓ 132-kV lines: 263 km (606 towers)
- ✓ 66-kV lines: 48 km (165 towers)

Major transmission routes included:

- ✓ 230-kV: Tekeze Hydropower to Lachi substation (105 km), Tekeze-Axum (115 km), Axum-Shire (50 km), Shire-Welqayit (164 km), and Welqayit-Humera (135 km)
- ✓ 132-kV: Mekelle to Adigrat (100 km), Adwa (140 km), and Axum (16 km)
- ✓ 66-kV: Alamata to Maychew (48 km)

Despite expansion plans targeting 2,050 km of high-voltage lines, only 1,348 km were operational before the war. The network also included 6,785 km of medium-voltage (MV) and 5,802 km of low-voltage (LV) distribution lines.

Before the war, Tigray's electricity demand significantly outstripped its supply capacity. In 2019/2020, total demand reached 2,300 MW—comprising 1,400 MW from general consumers and 900 MW for rural electrification. This demand highlighted a critical need for infrastructure expansion that the existing grid could not meet.

The region's 11 active substations were critically overloaded, operating at or beyond their safe capacity and creating a high risk of systemic failure. Key facilities included:

- ✓ Mekelle Substation: 97% load
- ✓ Shire Substation: 100% load
- ✓ Wukro Substation: 76.55% load
- ✓ Adigrat Substation: Highest peak load (41.44 MW)

Five substations were formally flagged for urgent upgrades or replacement. Overloaded feeders and aging infrastructure further strained the system, compromising grid reliability and limiting energy access, particularly in rural areas.

This pre-war state of chronic overload made Tigray's energy system uniquely vulnerable to the systematic destruction that followed. The infrastructure was already operating on the brink of failure before the war began.

Tigray's distribution network delivered power from substations to end-users through medium-voltage (15 kV, 33 kV) and low-voltage (400V) lines, providing 220V for single-phase and 380V for three-phase customers.

By 2019/2020, the network comprised substantial infrastructure:

- ✓ Medium-voltage lines: 6,416 km
- ✓ Low-voltage lines: 3,751 km
- ✓ Distribution transformers: 4,161 units
- ✓ Sub-transmission (66 kV): 45 km

This extensive network represented significant pre-war investment in electrification. However, the limited 66-kV sub-transmission capacity created a structural vulnerability, potentially constraining power flow from the high-voltage grid to local distribution networks and limiting expansion to underserved areas.

The pre-war electric utility service network in Tigray was extensive yet reflected significant urban-rural disparities. Organized into two main districts (Mekelle and Shire), the network comprised 47 service centers and 414 satellite stations serving over 313,000 customers.

This structure revealed a system heavily oriented toward urban centers. A small number of high-grade service centers (e.g., Mekelle 1-3, Adigrat, Aksum) served the vast majority of customers, while over 20 Grade D centers in rural areas each served fewer than 3,000 customers. This imbalance, coupled with the uneven geographic distribution of infrastructure, highlights the ongoing challenge of achieving equitable and efficient rural service delivery, even as the network achieved broad regional coverage.

The electric utility maintained an extensive customer service infrastructure across Tigray, organized into 2 main districts (Mekelle and Shire), 47 service centers, and 414 satellite stations serving more than 313,000 customers.

Network distribution:

- ✓ Mekelle District: 26 service centers, 226 satellites
- ✓ Shire District: 21 service centers, 188 satellites

Service center classification:

- ✓ The utility graded centers A-D, revealing significant disparities:
- ✓ Grade A centers (Mekelle 1-3, Adigrat, Adwa, Aksum): Served the largest customer bases
- ✓ Grade D centers (over 20 locations): Each served fewer than 3,000 customers
- ✓ Underutilized centers: Mekelle 4 and Baeker reported zero customers despite available infrastructure

Geographic coverage:

Service distribution was uneven, concentrated in Eastern and Central zones. Satellite station allocation ranged from 25 (Enticho) to as few as 2-7 at rural Grade D centers.

This pre-war service structure demonstrates a system achieving broad geographic coverage while struggling with rural access quality and significant urban-rural disparities. The concentration of resources in urban centers, while serving immediate demand, created vulnerabilities in service resilience across the region.

This extensive customer network was the result of a sustained period of rapid electrification. As shown in Figure 6-1, the utility experienced consistent and strong customer growth in the

years leading up to the war, primarily driven by residential and commercial connections. This trend underscores the region's growing dependence on the grid for daily life and economic activity. However, the graph also reveals a critical structural weakness in the pre-war economy: the negligible rate of industrial electrification, which accounted for less than 1% of total customers. This lack of industrial demand limited the sector's revenue potential and made it disproportionately vulnerable to disruptions in residential and commercial centers.

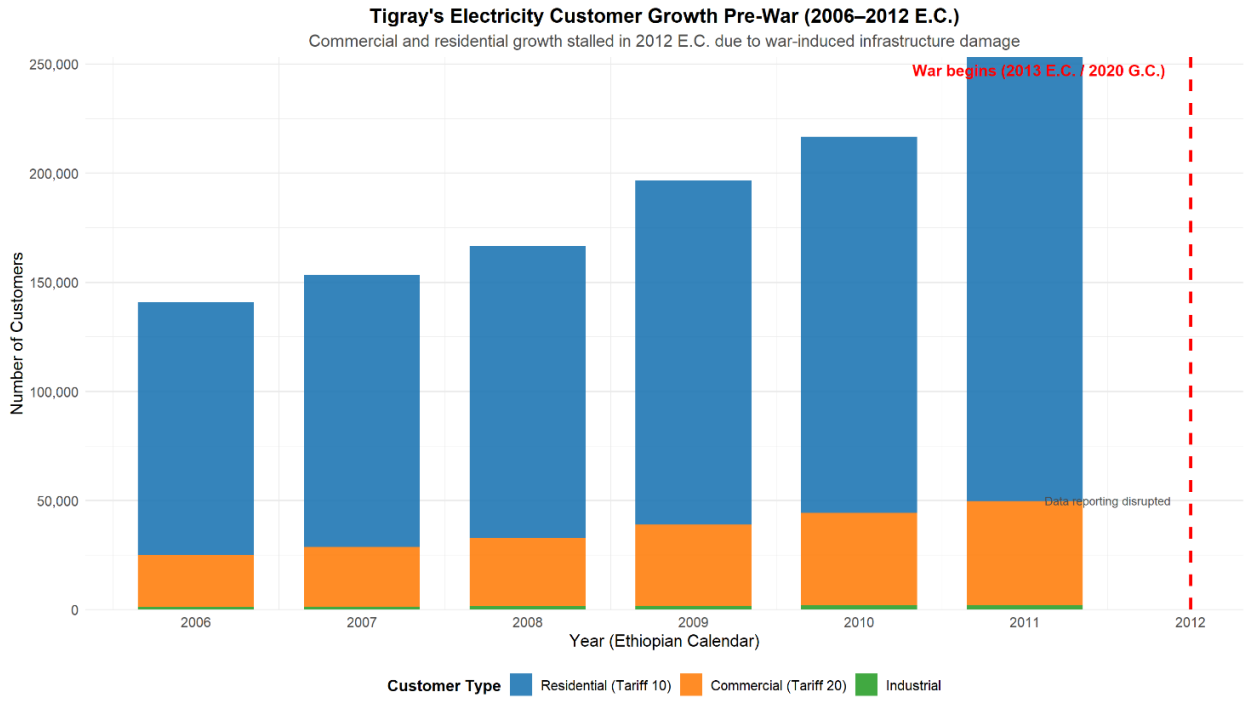

Figure 6-1: Pre-War Customer Growth in Tigray's Electric Utility (2013/2014 - 2018/2019)
Source: CITG, 2022

The Ethiopian Electric Utility (EEU) generated USD 18.7 million in revenue from its Tigray operations during 2019/2020, demonstrating the commercial viability of the pre-war energy sector. The core business of electricity sales was strong, bringing in USD 14.8 million and exceeding its target by 7%. However, revenue from other services was only USD 3.9 million, falling significantly short of its goal. This revenue profile reveals a system that was effectively meeting core electricity demand and collecting revenue reliably, while ancillary service offerings were underperforming. The robust electricity sales established a clear financial baseline for calculating subsequent economic losses.

Ethiopian Electric Power generates revenue through its operation and maintenance of high-voltage transmission infrastructure, which delivers electricity from power plants to distribution networks. In Tigray, this revenue, totaling USD 9 million in 2019/2020, was primarily earned

through bulk power sales to the Ethiopian Electric Utility, leasing of transmission lines, and service fees for grid maintenance. As the national grid operator, EEP manages critical infrastructure like substations and high-voltage lines, ensuring reliable power flow across regions.

Ethiopian Electric Power generated USD 9 million in revenue from its Tigray transmission operations in 2019/2020. This revenue stream was derived from:

- ✓ Bulk power sales to the Ethiopian Electric Utility (EEU)
- ✓ Leasing of transmission lines
- ✓ Grid maintenance service fees

This revenue demonstrates the financial value and operational activity of Tigray's high-voltage transmission network immediately before the war. As the backbone of the regional energy system, its destruction would represent both a physical and a significant financial loss to the national power utility.

6.4. Damage and Loss Assessment

6.4.1. Damage Value

A. Overview of Sector Damage

The war on Tigray inflicted severe and widespread damage across Tigray's energy infrastructure, fundamentally disrupting the region's power generation, transmission, and distribution systems. Critical components of the electrical grid suffered extensive destruction, leading to prolonged blackouts that paralyzed essential services and economic activity. The sector experienced systematic targeting of its core infrastructure, with particularly devastating impacts on transmission networks and distribution facilities.

Assessment findings reveal distinct patterns in the nature and scale of destruction across different elements of the energy system. Generation plants, substations, and transmission corridors all sustained heavy damage, though with varying degrees of severity. The impacts extended beyond immediate physical destruction to include significant operational disruptions and loss of technical capacity. These damages have compounded Tigray's pre-existing energy challenges, dramatically setting back development progress in the sector.

The comprehensive damage assessment demonstrates how the war on Tigray strategically undermined Tigray's energy infrastructure, with long-term implications for the region's recovery and development trajectory. The scale of destruction indicates not just collateral

damage but deliberate targeting of energy systems as part of the broader war on Tigray dynamics.

Geographic distribution of damage

The documented cases of war-related infrastructure damage across Tigray amounts close to 1,864 incidents reported by Ethiopian Electric Power and Ethiopian Electric Utility. The results are shown in Figure 6-2 revealing striking spatial patterns when visualized geographically. This map synthesizes three critical dimensions of the crisis: damage locations and perpetrator attribution offering a comprehensive view of the war on Tigray's asymmetric impacts.

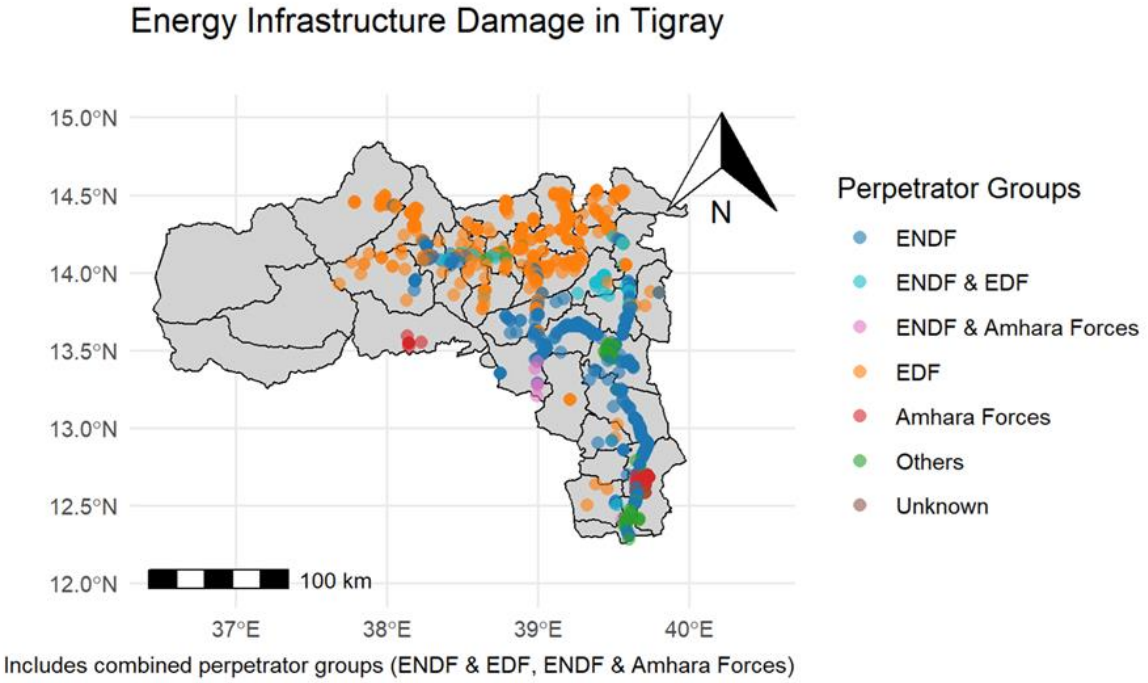

Figure 6-2: War Damage to Tigray's Energy – Geospatial Patterns of Perpetrator Distribution

The analysis reveals catastrophic damage to Tigray's energy infrastructure, with near-total destruction observed across most administrative zones (Table 6-1: War damage severity level across Tigray's zones). The Central Zone suffered the most severe impacts with reported 521 cases of which 98% were complete destruction followed by Eastern Zone 366 cases with 97% and North-Western 334 cases with 96% destruction rate (Figure 6-3 and Table 6-1). Critical transmission infrastructure, classified as "Common" due to their cross-zone nature, 441 cases of critical transmission infrastructure were destroyed with a 37% destruction rate. These findings demonstrate systematic targeting of the region's energy grid, with particular devastating consequences for zonal towns and rural areas.

Urban centers showed marginally lower damage levels and documented cases, though still extremely severe. Mekelle, the regional capital, experienced fewer cases of 64 reports accounting 84% destruction rate - slightly less than surrounding zones but still representing near-complete infrastructure collapse. The South Eastern region near to the capital also sustained relatively lower cases with 33 reports of 76% destruction rate.

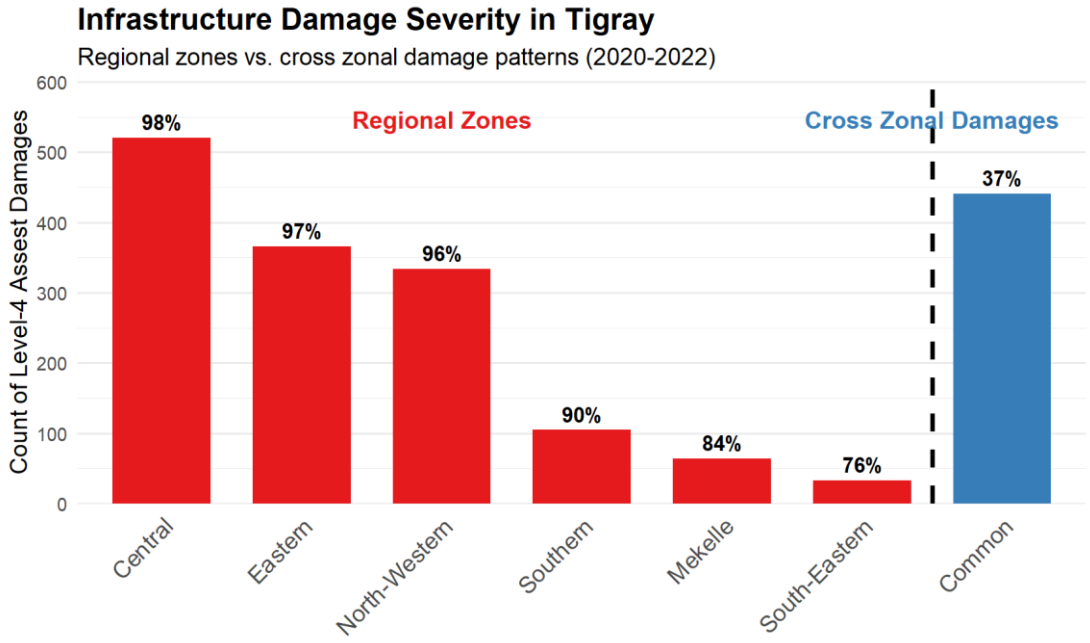

Figure 6-3: War Damage Zonal Distribution across Tigray

Source: CITG,2022

These results highlight the unprecedented scale of infrastructure destruction in Tigray. The near-uniform severity across zones, combined with the complete elimination of transmission networks, indicates a systematic dismantling of the region's energy capacity. The data underscores the need for significant reconstruction rather than repair, particularly for the cross-zone transmission lines that are critical for regional power distribution.

Table 6-1: War Damage Severity Level across Tigray's Zones Determined by Number of Counts of Reported Incidents.

Zone	Total	Low	Medium	High	Very High	% Very High
Central	521	4	1	6	510	98%
Eastern	366	4	6	0	356	97%
North-Western	334	1	5	8	320	96%
Southern	105	0	0	11	94	90%
Mekelle	64	0	3	7	54	84%
South-Eastern	33	0	3	5	25	76%
Common	441	0	26	254	161	37%

Source: CITG, 2022

B. Type of Damage and Mechanism

Asset destruction pattern

The damage assessment reveals a comprehensive targeting strategy that crippled Tigray's energy grid at every level. The pattern shows simultaneous attacks on both high-volume distribution components and critical, high-value transmission infrastructure.

Figure 6-4 demonstrates that destruction focused heavily on the grid's most fundamental elements. The extremely high incident count for workhorse components like AAAC(ASH) 180MM2 conductors (106 incidents) reveals a priority on causing immediate, widespread service disruption to end-users by overwhelming repair capacity.

Financially, the impact was dramatically skewed towards high-value targets. For instance, while MV 33kV AAC 95mm2 concrete poles accounted for only 35 incidents, they incurred the single greatest financial loss (USD 7.3 million), dwarfing the per-incident cost of more frequently damaged items. This created an asymmetric economic burden, where a single destroyed OPGW 48 Fiber system costs over USD 1.4 million per incident to replace, compared to the widespread but lower-cost conductor damage.

The systematic nature of this destruction - targeting everything from 86 distribution transformers to specialized communication gear - confirms the intent was a complete and lasting grid collapse, ensuring reconstruction would be both logistically complex and prohibitively expensive.

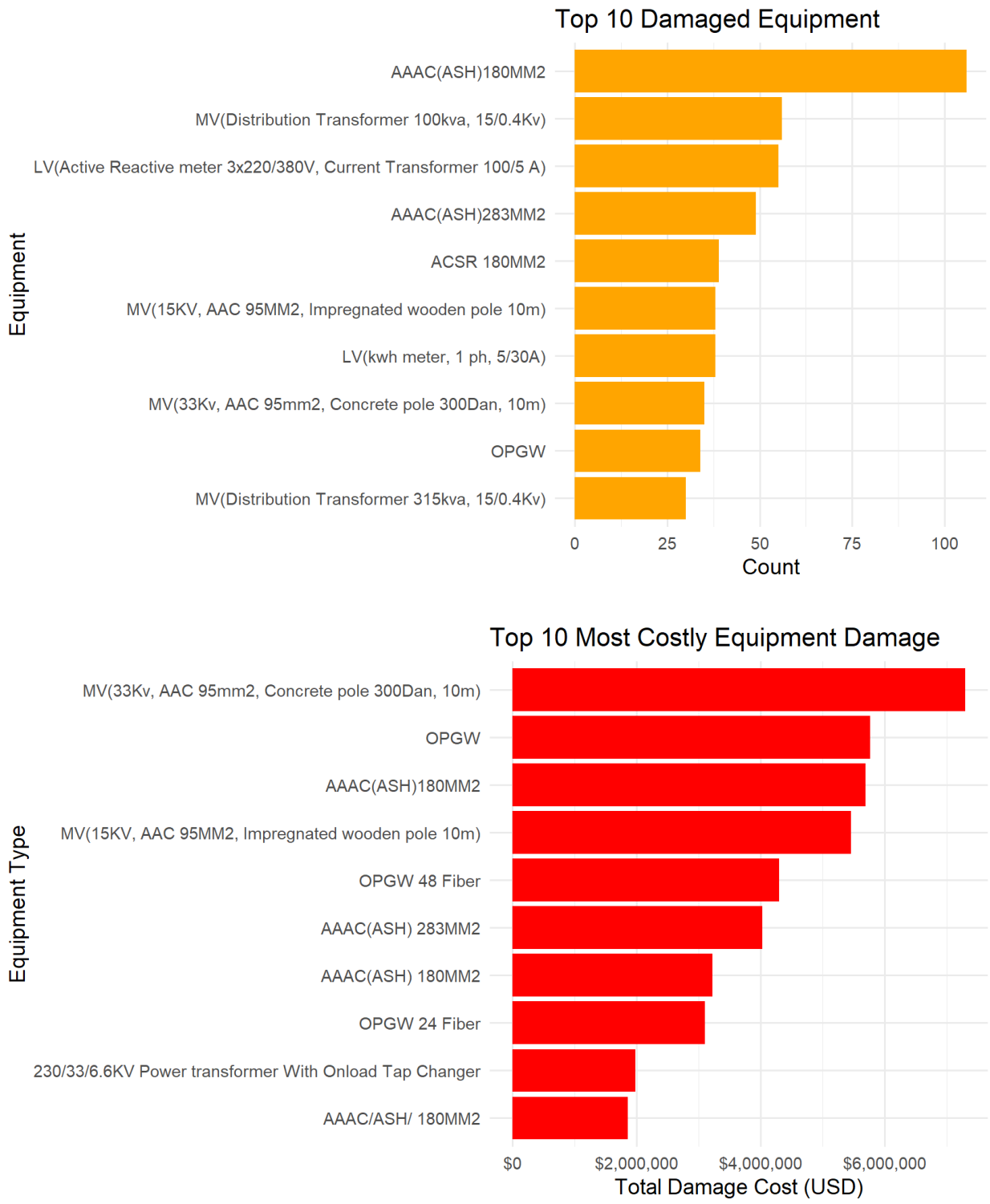

Figure 6-4: Distribution of Damage across 10 most Critical Equipment Types.

(Showing the most frequently Destroyed Components in terms of Counts and Cost. Source: CITG,2022)

Damage cases

Tekeze Hydropower

The Tekeze hydroelectric substation, a critical node in the national grid, was systematically targeted in a series of aerial attacks by the Ethiopian National Defense Forces (ENDF) between 2020 and 2021. The facility was destroyed by warplanes and drone attacks, an act that turned public infrastructure into a military target.

Figure 6-5: Tekeze Substation Engulfed in Flames following Drone Strike (2020-2022 War)

Source: CITG, 2021

Figure 6-6: Destroyed 25MW Transformer at Tekeze Substation following Drone Strike

Source: CITG, 2022

The assault caused catastrophic damage to the plant's core components. As evidenced in Figure 6-5 and Figure 6-6, the attacks deliberately targeted and destroyed high-value assets, including 25MW power transformers, transmission lines, and control systems, leading to a permanent power disconnection. This assessment attributes 100% of the damage to the ENDF.

Ashegoda Wind Farm

This was caused by both physical damage to the facility and its disconnection from the National Grid. The facility's decline and near-total shutdown were a direct consequence of the war, driven by three simultaneous factors 1) The physical destruction that targeted damage to critical infrastructure, including the T1 steel tower of an ECO-74 turbine, directly impaired its power generation capacity. 2) Grid isolation that resulted in the complete disconnection of Tigray from the national grid in 2020 severed the essential connection to distribute power, rendering the plant's output useless regardless of its operational status. 3) The comprehensive blockade imposed on Tigray prevented the delivery of essential spare parts, specialized maintenance equipment, and fuel, making any repairs or continued operation impossible and leading to further deterioration.

C. Level of Damage

This analysis examines the relationship between damage severity levels, incident frequency, and associated costs across four damage categories. The data reveals significant patterns in how damage severity correlates with both incident occurrence and financial impact. Figure 6-7 illustrates the average cost per incident across different damage severity levels, revealing a non-linear relationship between damage severity and financial impact. Medium damage incidents (26-50%) demonstrate the highest average cost per incident at USD 44,407, significantly exceeding the average costs of both high damage (USD 28,322) and very high damage (USD 37,953) categories. This counterintuitive pattern suggests that medium damage events may involve more complex repair scenarios or specialized response requirements that drive up per-incident costs.

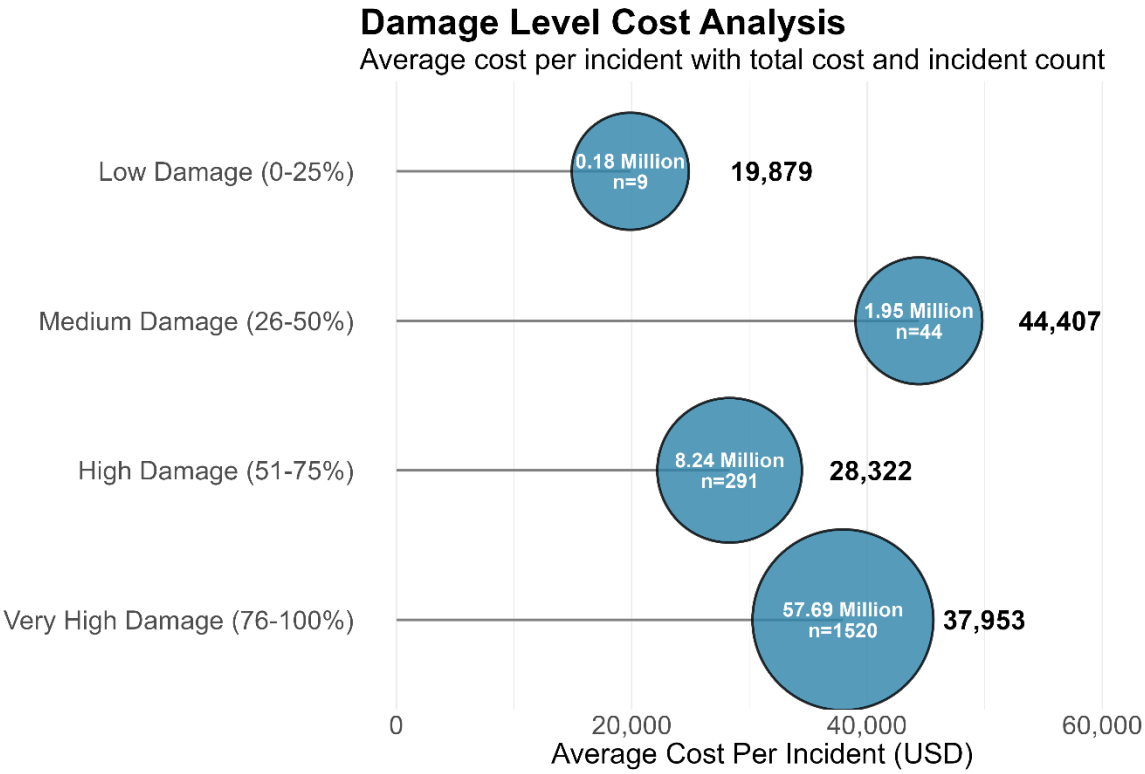

Figure 6-7: Average Cost per Incident by Damage Level, Showing Total Costs and Incident Counts.

(Medium Damage Incidents have the Highest per-Incident Cost Despite Lower Frequency, Source: CITG,2022).

The distribution of total costs tells a different story. Very high damage incidents, while having a lower average cost per incident than medium damage events, account for the overwhelming majority of total financial impact at USD 57.69 million. This represents 84.8% of all costs despite comprising 81.5% of incidents (Figure 6-10).

Figure 6-8 demonstrates a clear positive correlation between damage severity and incident frequency, with very high damage incidents occurring 1520 times compared to only 9 low damage incidents. However, the relationship between incident frequency and total cost is even more pronounced. Very high damage incidents generate costs that are disproportionately higher than their frequency would suggest, indicating that severity amplifies financial consequences beyond simple incident counts.

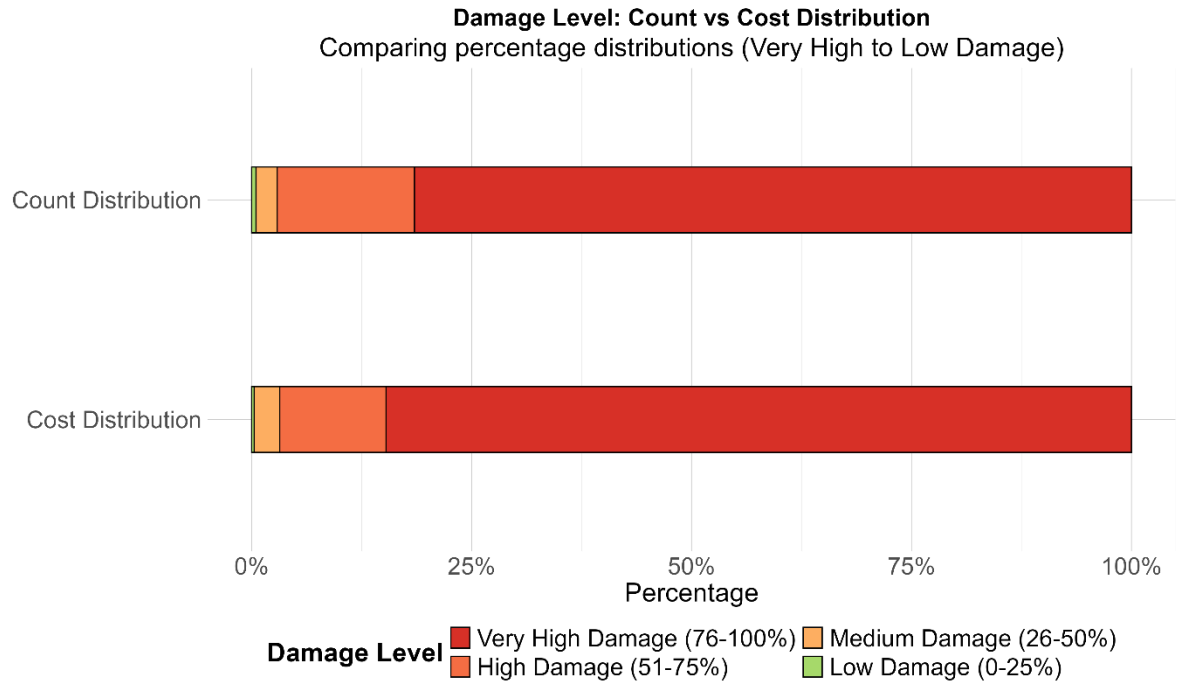

Figure 6-8: Percentage Distribution of Incidents and Costs Across Damage Levels.

Very high damage incidents dominate both frequency (81.5%) and total costs (84.8%). Source: CITG,2022

The data reveals an interesting efficiency in high damage incidents, which maintain relatively lower average costs (USD 28,322) while still accounting for 15.6% of all incidents. This category may represent an optimal target for standardized response protocols and cost containment measures.

D. Perpetrators

The analysis of 1,864 documented damage cases reveals distinct perpetrator strategies and their devastating financial impacts on Tigray's energy sector, with total damages exceeding USD 68 million.

Financial Impact and Targeting Strategies

As shown in Figure 6-9, the Ethiopian National Defense Forces were responsible for the vast majority of the financial damage, inflicting USD 51.8 million in costs. However, Figure 6-10 reveals a critical distinction in tactics: while the ENDF caused the highest average cost per incident (around USD 83,000), the Eritrean Defense Forces were responsible for the highest number of incidents (953) but at a far lower average cost (around USD 8,000). This indicates a fundamental difference in targeting, with the ENDF focusing on high-value assets and the EDF on a larger number of lower-value targets.

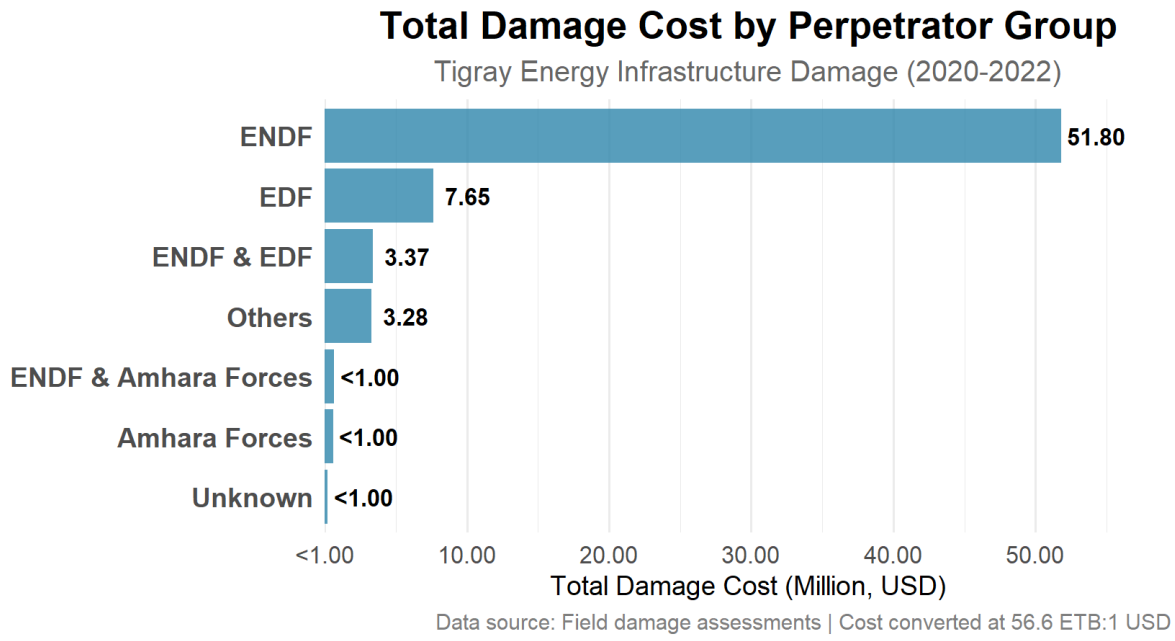

Figure 6-9: Average Cost per Incident by Perpetrator

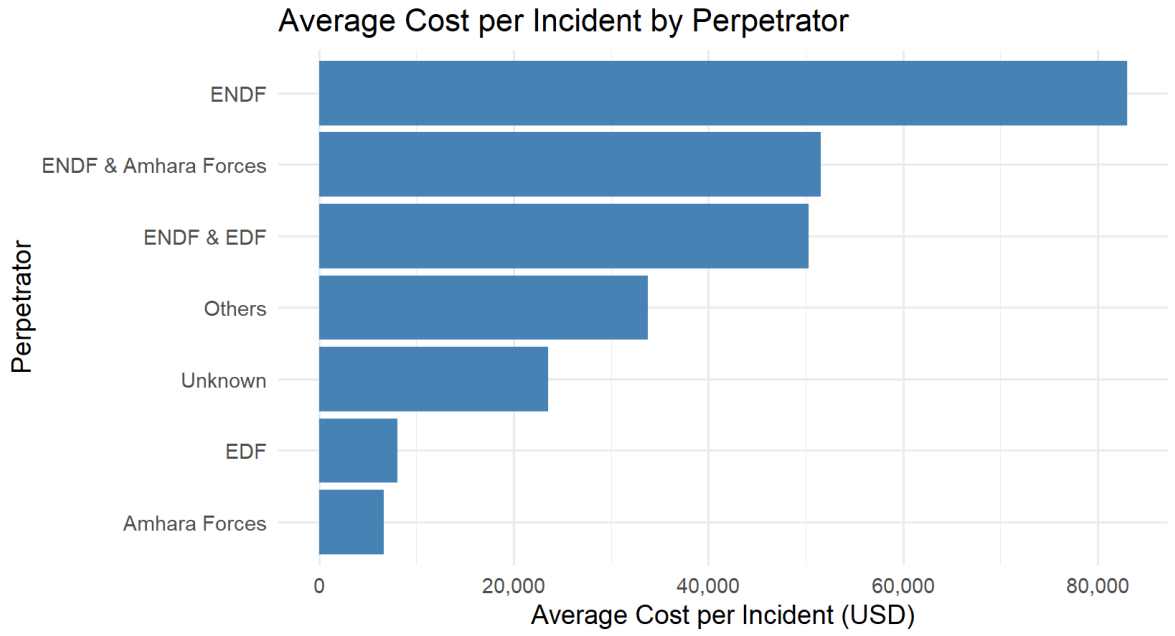

Figure 6-10: Financial Impact of Energy Infrastructure Destruction by Perpetrator

Source: CITG,2022

Destruction Efficiency and Methods

Figure 6-11 illustrates the alarming efficiency of destruction across all armed groups. The ENDF recorded a 95.8% complete destruction rate. The EDF and Amhara forces were even more thorough, with near-total destruction rates of 98.1% and 100%, respectively. This

systematic eradication is further detailed in Figure 6-12, which shows that deliberate damage was the predominant mechanism across all perpetrator groups.

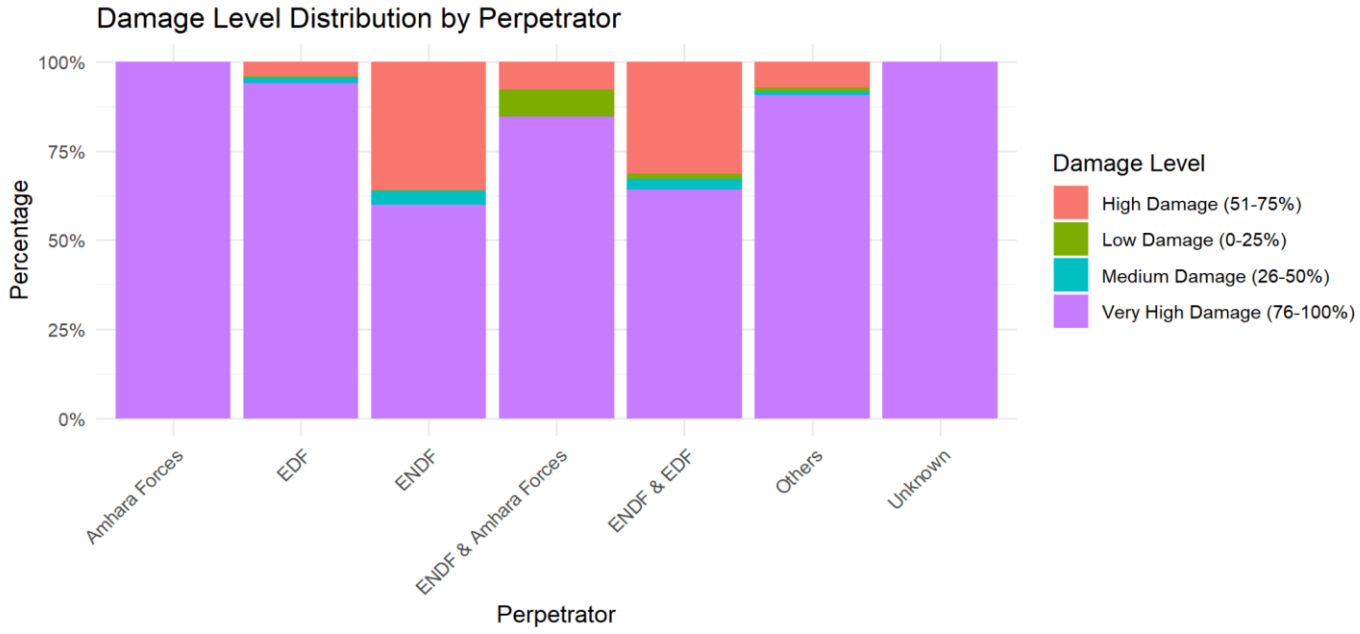

Figure 6-11: Comparative Analysis of War Damage Attribution across Perpetrators.

Source: CITG 2022

Economic Impact and Infrastructure Targeting

The economic consequences of these different damage mechanisms are stark. Figure 6-12 demonstrates that deliberate destruction, despite potentially lower frequency, incurred the highest reconstruction costs, underlining the intentionality behind the infrastructure collapse. The strategic focus of this destruction is clear in Figure 6-14, which shows that transmission and distribution systems—the backbone of the grid—bore over 90% of the total financial damage of USD 68.0 million, ensuring the collapse would be comprehensive. The largest cost for transmission damages account for USD 34.69 million and USD 28.12 million. The detailed values for the generation are for the Tekeze Hydropower and Ashegoda Wind Farm with the following cost breakdowns USD 5.20 million and USD 0.049 million respectively.

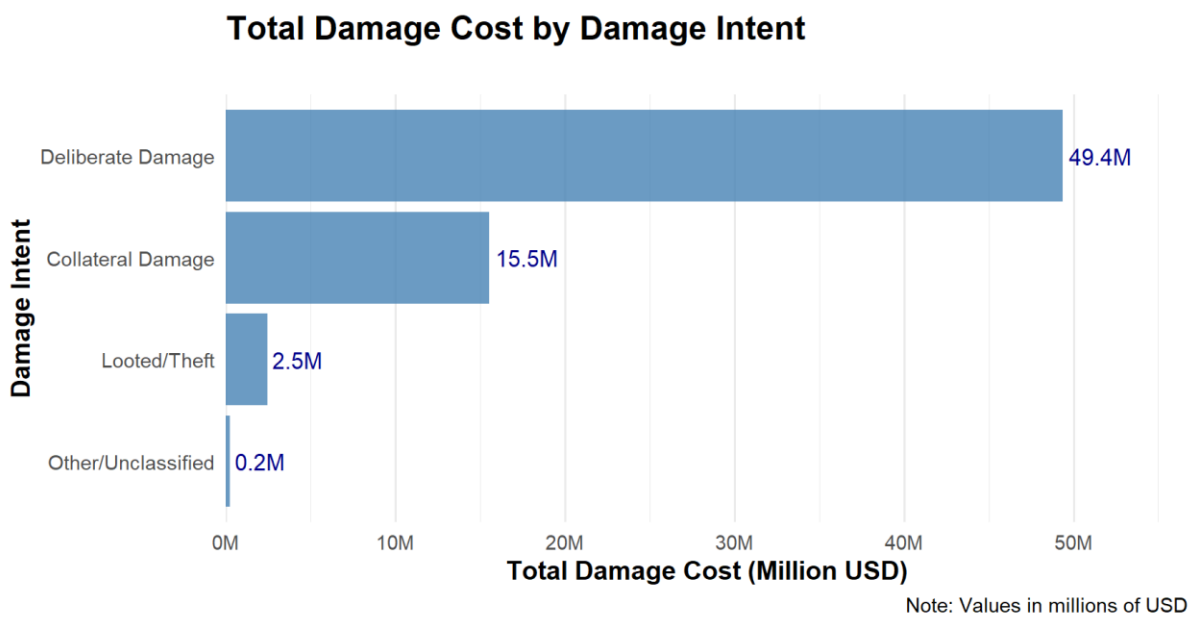

Figure 6-12: Economic Impact of Different Damage Mechanisms

(Deliberate Damage Methods Incurring the Highest Costs). Source: CITG,2022

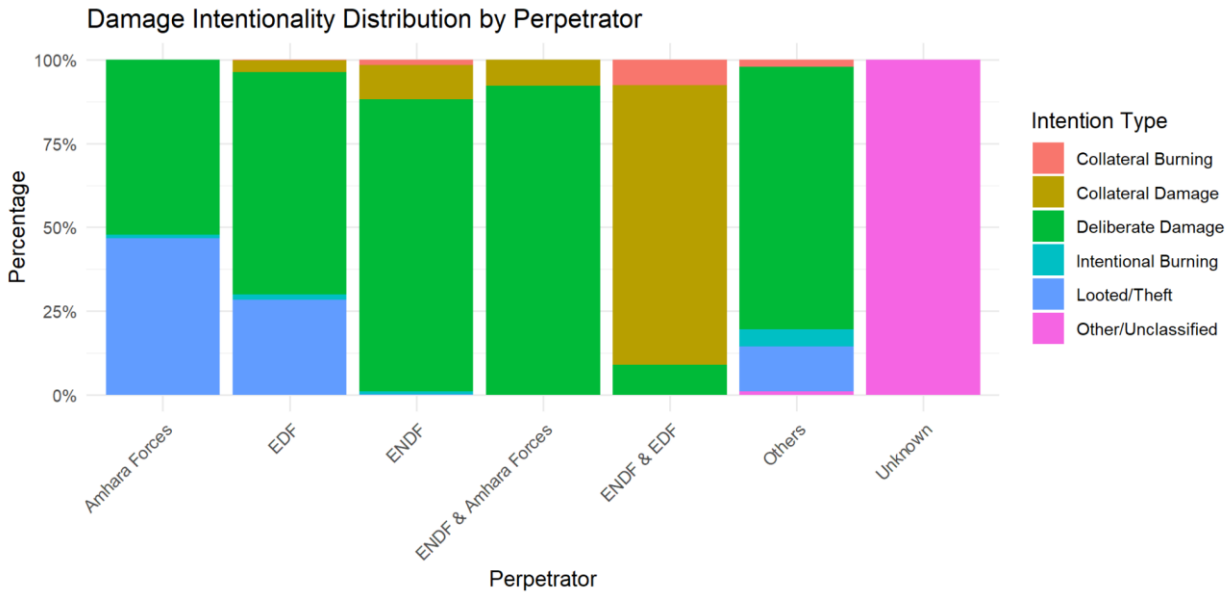

Figure 6-13: Damage Intentionality Distribution across Perpetrator

(Distinct Patterns of Collateral Versus Deliberate Destruction Methods, Source: CITG,2022).

The combined evidence from these figures reveals a coordinated, multi-pronged assault on Tigray's energy grid. The ENDF's high-value targeting, combined with the EDF's widespread destruction and the near-total destruction efficiency of all groups, points to a unified strategy of systemic collapse. This data provides a critical evidence base for reparations claims and

underscores that reconstruction must address both the widespread damage to distribution networks and the strategic loss of high-value transmission assets.

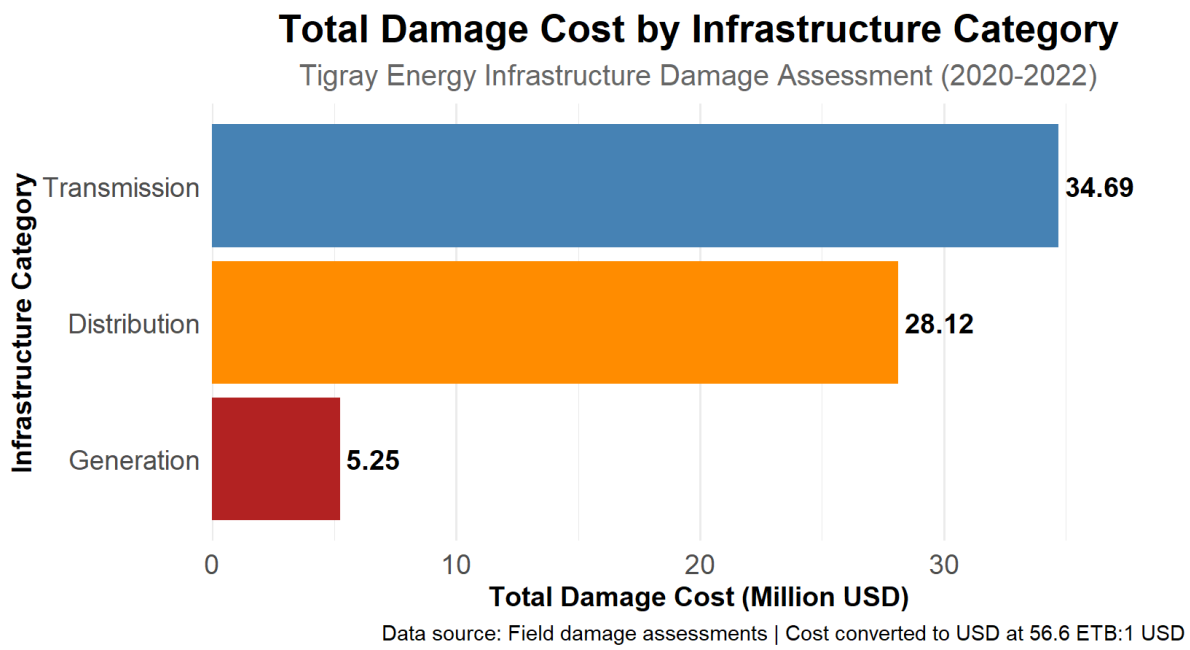

Figure 6-14: Replacement Cost Distribution across Energy Infrastructure Components

Source: CITG,2022

Transmission lines

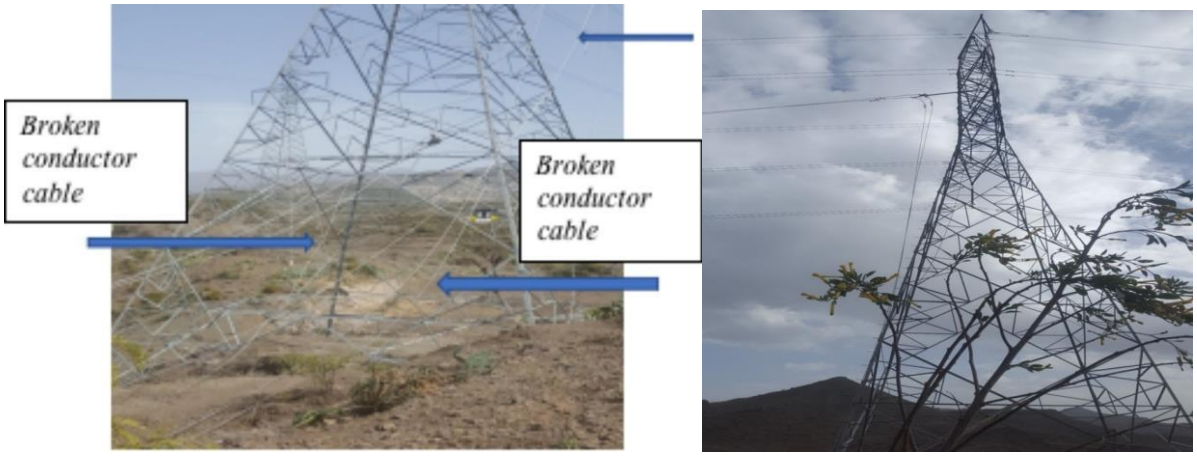

Figure 6-15: Severed 230kv Conductor on the Mekoni-Mekelle Transmission Line

Source: CITG,2022

The severity of damage to transmission infrastructure directly correlated with war intensity. Critical findings reveal that the Endaslasse-Sheraro 230kV line and Mekelle-Adwa 132kV line sustained the most extensive damage (both at 87% destruction), resulting in catastrophic failures that triggered prolonged regional blackouts.

High-voltage corridors bore the brunt of attacks, with severe damage disproportionately affecting 230kV systems, the backbone of Tigray's grid resilience. The financial assessments underscore both the immediate operational collapse and the long-term economic burdens imposed by this systematic destruction.

Figure 6-16: Failure of 230kv Transmission Infrastructure on Tekeze-Mekelle Line
Source: CITG,2022

The assessment of three critical 230kV transmission corridors, Alamata-Mekoni-Mekelle, Ashegoda-Alamata, and Tekeze-Shire-Humera-Sheraro corridors, reveals extensive war-induced damage to electricity infrastructure. The inventory shows severe destruction of conductors (AAAC and OPGW cables), 209 collapsed towers, and over 55,000 damaged spacer dampers. Particularly notable is the loss of 48-fiber OPGW cables, representing both physical infrastructure and telecommunications capacity damage. These losses have crippled the backbone transmission network connecting Tigray's major population centers.

Damage assessments for the strategic Mekelle-Tekeze corridor reveal targeted destruction of specialized components: 283MM2 conductors, fiber optic cables, and 114 collapsed towers by Ethiopian Defense Forces as can be seen in Figure 6-15 and Figure 6-16. Component-level losses show consistent patterns of damage to vibration dampers (8,496 units), midspan joints (1,037 units), and porcelain insulators (52,896 discs). The identical damage patterns across corridors suggest systematic targeting of transmission infrastructure.

The compounded damage across these corridors has severely degraded Tigray’s power transmission capacity. The inventory documents over thousands of meters of destroyed conductors and 383 collapsed towers, with ancillary components (dampers, joints, insulators)

suffering proportional losses. The operational consequences - including disrupted electricity supply to millions and compromised grid stability - far exceed the direct costs. These findings provide both a technical basis for reconstruction planning and evidentiary support for assessing violations of international humanitarian law regarding critical infrastructure protection.

Substations

Critical Infrastructure Damage and Systemic Consequences

The targeted destruction of electrical substations in Tigray has caused severe, multi-layered disruptions to the regional power grid. Attacks on transformers and distribution nodes have compromised voltage regulation, triggering prolonged blackouts. The Mekelle substation, a pivotal hub, sustained critical damage despite being classified as only "partially damaged" after drone strikes, as shown in Figure 6-17.

Figure 6-17: Drone Attack Damage to Mekelle Substation.
(A Critical 230KV Hub Linking Tekeze Hydropower to the National Grid). Source: CITG,2022

Figure 6-18: Destroyed Transformer at Mekoni Powerhouse, showing War-Induced Damage
Source: CITG,2022

Distribution networks

The Ethiopian Electric Utility (EEU) suffered catastrophic damage during the war, with targeted attacks destroying medium-voltage lines, low-voltage lines, and transformers, plunging the region into darkness. The photographic evidence presented in Figure 6-22 through Figure 6-21 provides visual documentation of the systematic destruction inflicted upon Tigray's energy infrastructure during the war period. These images capture the extensive damage across multiple infrastructure components, including destroyed transformers at the Mekoni Powerhouse (Figure 6-18), damaged distribution transformers in Yechila (Figure 6-19), shattered concrete distribution poles near educational facilities (Figure 6-20), and ravaged substation equipment at military installations (Figure 6-21). The widespread nature of this destruction, affecting both civilian and strategic locations, demonstrates the comprehensive targeting of energy systems. These visual records substantiate the qualitative damage assessments and highlight the need for coordinated rehabilitation of critical energy assets to support economic revival.

Figure 6-19: Destroyed Distribution Transformer in Yechila

Figure 6-20: Destroyed Distribution Transformers and Concrete Poles at Edaga Arbi.

Figure 6-21: Destroyed Distribution Equipment at Shire

Source: CITG,2022

6.4.2. Loss Value

6.4.2.1. Tekeze hydropower

The total documented financial loss from the destruction at Tekeze exceeds USD 35.44 million, as detailed in Table 6-2. This comprehensive figure includes both direct financial losses and long-term opportunity costs. The largest component is the USD 29.6 million in losses from service disruption. This was calculated for the period of power generation disruption, using a tariff per kWh for 2020 and 2021, applied to a planned generation in GWh, with the final value deducted from actual wartime performance. The Additional cost of USD 0.08 million covers raw materials, maintenance, rentals, and professional fees. The Foregone value on projects (USD 4.28 million) accounts for planned maintenance, spare parts, and concrete and asphalt works, while the Foregone value for salaries (USD 1.48 million) represents payments for permanent and temporary employees.

Table 6-2: Financial Loss on Tekeze Hydropower

Category	Value (Million USD)
Loss values due to service disruption	29.60
Additional cost of raw material and maintenance	0.08
Foregone value on projects	4.28
Foregone value (Salaries and other payments)	1.48
Total Financial Loss	**35.44**

Source: CITG, 2022

The targeting of this essential civilian infrastructure represents a grave violation of international humanitarian law, with devastating consequences for the region's energy security, economic stability, and public health.

6.4.2.2. Ashegoda Wind Farm

The total documented financial loss of the war on the Ashegoda Wind Farm is USD 2.17 million, as detailed in Table 6-3. The most significant loss was the USD 1.60 million in revenue from the inability to generate electricity, directly resulting from the war-induced operational collapse. Furthermore, the facility incurred a Foregone value of USD 0.21 million from its planned substation expansion and USD 0.36 million for salaries and other payments to employees.

Table 6-3: Financial Loss at Ashegoda Wind Farm

Category	Value (Million USD)
Loss value due to service disruption	1.60
Additional Cost	--
Foregone value from projects	0.21
Foregone Value (Salaries)	0.36
Total Financial Loss	**2.17**

Source: CITG, 2022

The Ashegoda Wind Farm data reveals a severe and escalating performance crisis, with actual energy generation collapsing from 221.8 GWh in 2016 to a mere 0.97 GWh in 2021 - representing a 99.6% reduction in operational capacity (Figure 6-22). This catastrophic decline resulted in cumulative financial losses exceeding USD 4.8 million USD across both operational periods, with the most devastating impacts occurring during the war years of 2020-2021. The wind farm's performance shows a clear and disturbing trajectory: initial success and meeting of generation targets (2014-2016) were followed by a sharp deterioration (2017-2018) and culminated in near-total operational failure by 2021. This pattern suggests that initial technical or maintenance challenges were dramatically exacerbated by the war, transforming what began as manageable performance gaps into a complete systemic collapse of Ethiopia's flagship renewable energy project, with profound implications for both energy security and renewable energy investment confidence in the region.

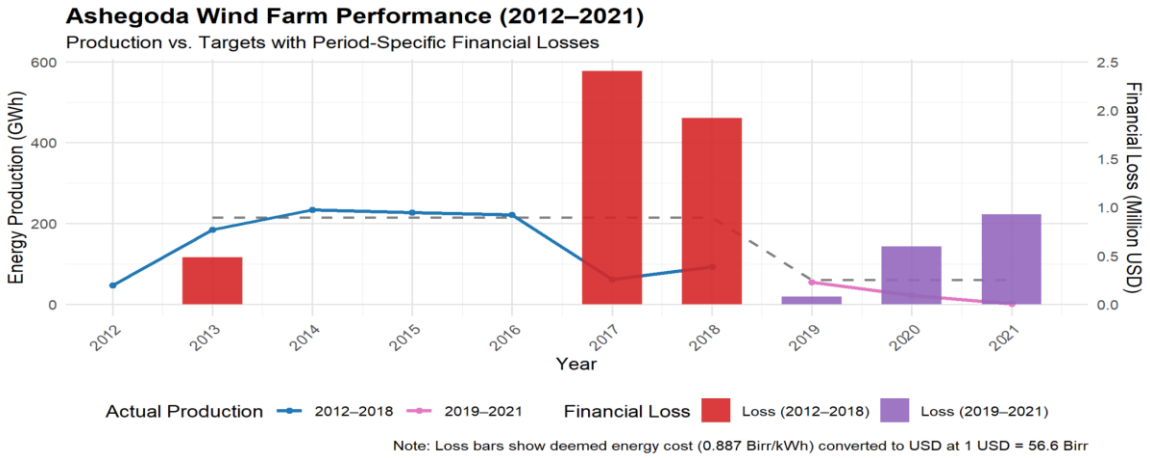

Figure 6-22: Performance Collapse and Financial Losses at Ashegoda Wind Farm

(From 2012/2013 - 2022/2023, Showing Critical Disruptions during 2017/2018 - 2018/2019)

Source: CITG,2022

The recovery effort faces a severe infrastructure damage challenge, hampered by several interconnected obstacles, including the need for specialized repairs on the Alstom and Vergnet turbines, which require manufacturer-specific parts and expertise. This is compounded by the complete exit of Vergnet SA, which has created a void in essential technical knowledge and maintenance protocols. Furthermore, the plant requires complex technical work to safely reconnect and synchronize with the national grid, presenting a significant grid re-synchronization hurdle.

The destruction of the Ashegoda Wind Farm is a clear example of how pre-existing institutional weaknesses were weaponized by wartime tactics to ensure the complete and lasting collapse of critical civilian infrastructure.

6.4.2.3. Transmission Lines and Substations

The war inflicted significant verified damages across Tigray's substations totaling USD 343.5 million.

Table 6-4: Financial Loss for Tigray's Substations.

Category	Value (Million USD)
Loss value	35.31
Additional Cost	0.25
Foregone Value	306.87
Foregone Value (Salaries)	1.02
Total Financial Loss	**343.45**

Source: CITG,2022

The Loss value of USD 35.31 million stems from the complete disruption of electricity distribution at the substations. An additional cost of USD 0.25 million was incurred for fuel and spare parts. The most substantial impact, a foregone value on projects of USD 306.87 million, represents the cancellation of critical high-voltage projects, including a 400kV line at the Mekelle Industrial Park, 230kV substations in Mekelle and Quiha, and the construction of numerous other transmission lines and office buildings. A foregone value of USD 1.02 million is attributed to unpaid salaries.

6.4.2.4. Distribution Network

The total financial impact on Tigray's distribution network amounted to USD 100.56 million, as shown in Table 6-5.

Table 6-5: Financial Losses in Tigray's Distribution Network (Million USD)

Category	Value (Million USD)
Loss value	32.92
Additional Cost	5.27
Foregone Value	56.47
Foregone Value (Salaries)	5.90
Total Financial Loss	**100.56**

Source: CITG,2022

The Loss value of USD 32.92 million is from the lost sales of electricity to end-users. Additional Costs of USD 5.27 million were accrued for materials, consumables, and other expenses related to emergency maintenance and building repairs. The Foregone Value of USD 56.47 million resulted from the disruption of over 270 projects, including new buildings, substation expansions, distribution line extensions, rehabilitation works, and new user electrification. A further USD 5.90 million in Foregone Value is for salaries and other payments to employees.

The financial data for EEU reveals a dramatic collapse in electricity revenue following the war's onset, with actual income plummeting from USD 11.6 million in 2020 to zero in 2021, representing a complete disruption of energy sector operations as shown in Figure 6-23. This catastrophic decline occurred despite initial expectations of USD 24.1 million in 2020 electricity revenue, highlighting the severe underestimation of the war's economic impact. The parallel collapse in 'Other' revenue streams, which also fell to zero in 2021 after generating USD 2.88 million in 2020, demonstrates the comprehensive nature of the financial devastation across all utility operations. This total revenue loss underscores the complete breakdown of energy service delivery and revenue collection systems, reflecting both the physical destruction

of infrastructure and the broader economic paralysis that prevented any meaningful financial recovery during the war period.

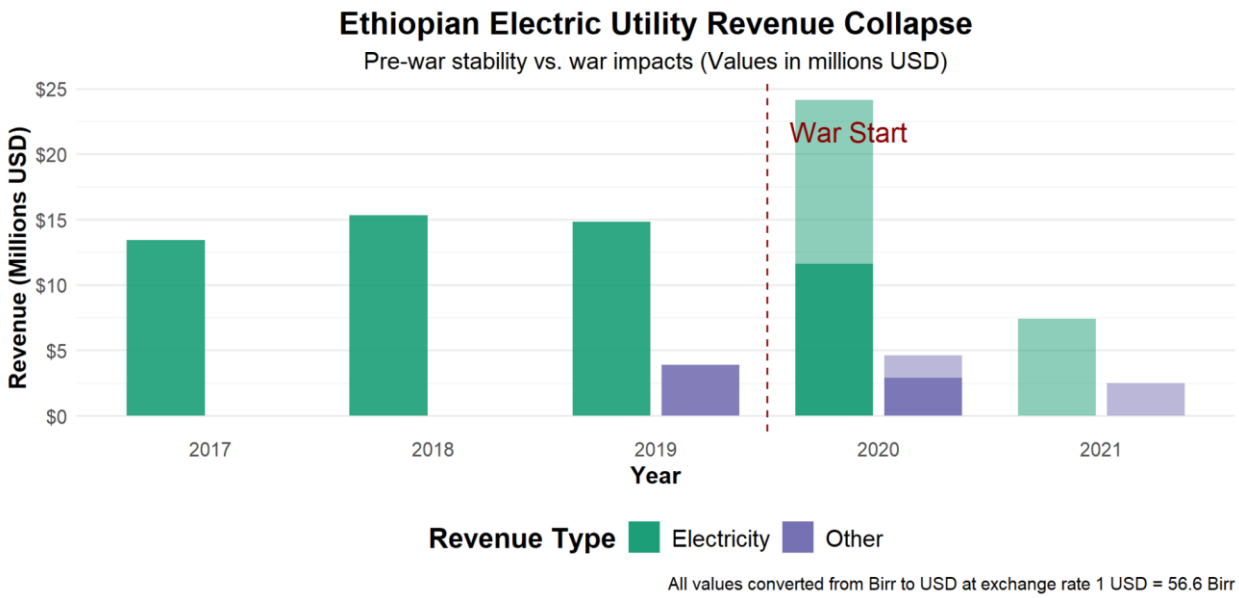

Figure 6-23: Utility Revenue Collapse During War.

(Actual Revenues (Solid Bars) versus Projections (Transparent)), Source: CITG,2022

6.4.2.5. Summary Loss

The war inflicted devastating and comprehensive financial losses on Tigray's energy infrastructure, crippling the region's power system. The total documented impact amounts to approximately USD 482 million, with certain asset classes bearing disproportionate losses due to their strategic value and centrality to grid operations.

As illustrated in Figure 6-24, the financial impact is heavily skewed towards long-term economic disruption rather than immediate physical damage. Foregone value and service disruption account for the vast majority of losses, demonstrating that the war most damaging effect was the systematic cessation of economic activity and energy-dependent services.

Key findings from the loss assessment include:

- ✓ Substations sustained the highest total financial impact (USD 343.5 million), reflecting their role as the critical nodes connecting generation to distribution.
- ✓ The Distribution Network incurred massive losses (USD 100.6 million), primarily from foregone revenue and widespread physical destruction, directly impacting end-users.
- ✓ Tekeze Hydropower, a flagship generation asset, suffered a total impact of USD 35.4 million, largely from the permanent loss of its power generation capacity.

- ✓ While smaller in total amount, the destruction of the Ashegoda Wind Farm (USD 2.2 million) eliminated a critical renewable energy source and symbolized the eradication of modern infrastructure.

The data reveals a consistent pattern: the systematic targeting of infrastructure was designed to maximize long-term economic paralysis, not merely cause temporary disruption. This evidence provides a definitive financial baseline for reparations and underscores that reconstruction must address both physical repair and the restoration of the sector's economic viability.

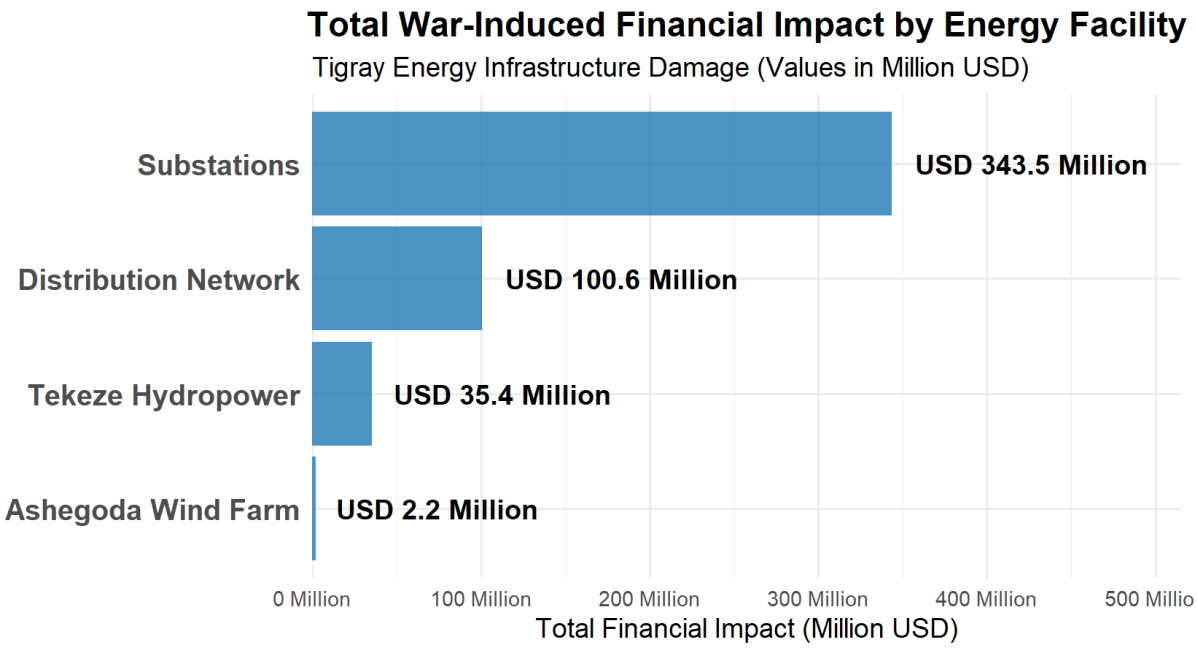

Figure 6-24: Breakdown of Financial Impacts on Tigray's Energy Facilities by Cost Category (Million USD)

Source: CITG,2022

6.5. Impact

The systematic destruction of Tigray's energy infrastructure during the two-year war did more than disable power lines and substations; it triggered a catastrophic collapse of the region's entire socio-economic and environmental foundation. The failure of the electrical grid acted as a primary shock, from which cascading failures radiated outwards, paralyzing every pillar of modern society. This section highlights the profound and often disproportionate consequences of this engineered darkness, examining how the loss of power weaponized public health, dismantled education and industry, intensified the suffering of women and children, and accelerated an environmental crisis.

6.5.1. Health

The complete breakdown of Tigray's electricity grid during the war triggered a catastrophic collapse of medical services across the region. Hospitals and clinics were plunged into darkness, rendering essential equipment like ventilators, dialysis machines, and neonatal incubators inoperable. Without reliable power, surgical procedures were delayed or canceled entirely, while critical care units became functionally useless. The failure of refrigeration systems caused widespread spoilage of temperature-sensitive medications, including vaccines, insulin, and blood products - creating dangerous shortages during a time of heightened medical need.

The health crisis extended beyond hospital walls as water treatment plants ceased functioning, cutting off access to clean water for both medical facilities and communities. This breakdown in sanitation infrastructure led to outbreaks of cholera and other waterborne diseases, while the inability to sterilize equipment increased infection risks. The compounded effects - from disabled medical equipment to spoiled medicines and contaminated water - created a perfect storm of preventable suffering and mortality. Health workers reported being forced to make impossible triage decisions without adequate lighting, sterilization capabilities, or functioning diagnostic equipment, with the most vulnerable populations - including newborns, surgical patients, and those with chronic conditions - paying the highest price. The systematic destruction of energy infrastructure effectively weaponized public health, transforming hospitals from places of healing into sites of desperation.

6.5.2. Education

The deliberate targeting of Tigray's electricity infrastructure systematically dismantled the region's education system at all levels. Classrooms were plunged into darkness, eliminating the use of digital tools, projectors, and laboratory equipment essential for modern pedagogy. Teachers reverted to chalk-and-blackboard methods when possible, but chronic outages made lesson planning unreliable and forced cancellations of evening study sessions critical for exam preparation. At universities, the destruction of server infrastructure erased years of research data and disabled online learning platforms, while science faculties reported the spoilage of biological specimens and chemicals in unpowered storage units.

6.5.3. Industry

The systematic dismantling of Tigray's electricity grid during the war annihilated the region's industrial base, with manufacturing productivity collapsing between 2020-2022. Critical production lines for textiles, food processing, and construction materials ground to a halt as

factories lost power for months at a time. The cement industry, once a regional leader, suffered catastrophic failures. Manufacturers reported irreversible damage to industrial automation systems, with spoilage of perishable commodities (like dairy and pharmaceuticals). The few facilities relying on diesel generators faced production costs tripling, rendering their goods uncompetitive.

The human capital devastation proved equally severe. Factory workers lost jobs as plants shuttered. Those remaining faced dangerous working conditions. The collapse of local manufacturing created shortages of essential goods, from medical supplies to building materials, inflating prices by 300-500% for basic commodities. Foreign investors abandoned planned industrial projects, while existing multinationals like garment manufacturers terminated contracts. The destruction of Tigray's industrial ecosystem erased a decade of economic development, regressing the region to pre-industrialization productivity levels with no short-term recovery pathway.

6.5.4. Women and children

The deliberate dismantling of Tigray's electricity grid weaponized pre-existing gender inequalities, imposing disproportionate suffering on women and children. With almost all health facilities inoperable, maternal mortality rates tripled as delivery rooms went dark and neonatal incubators failed. Pregnant women were forced to undergo C-sections by cellphone light, while postpartum hemorrhage deaths surged due to non-functional suction machines and blood banks. Children suffered acutely—vaccine spoilage in unpowered refrigerators caused immunization rates to plummet, triggering measles outbreaks that disproportionately killed girls kept from clinics due to safety concerns.

The collapse of the electrical infrastructure exponentially increased women's labor burdens. Daily firewood collection trips exposed women to sexual violence, while the impossibility of electric grain milling forced them to manual grinding, time stolen from childcare or income generation. School dropout rates increased among girls, now tasked with water fetching in place of their mothers. Even energy reconstruction threatens to deepen inequality.

6.5.5. Deforestation

The destruction of electrical infrastructure during war forced communities to rely entirely on firewood, triggering severe deforestation as trees were cut down for cooking, heating, and lighting. The shift to wood-burning stoves and open fires accelerated forest loss, degrading ecosystems that regulate climate, prevent soil erosion, and support wildlife. Without

sustainable forestry practices, unchecked logging led to biodiversity loss and long-term ecological imbalances, with permanent damage to soil quality and water resources.

Deforestation caused by prolonged power cuts disrupted natural regeneration, leaving lasting scars on the landscape. The loss of tree covers worsened air pollution, reduced carbon sequestration, and destabilized water cycles, compounding environmental degradation in war-affected regions. Without intervention, the damage to forests and ecosystems could persist for decades, hindering recovery efforts and exacerbating climate vulnerabilities.

6.6. Conclusion and Recommendation

6.6.1. Conclusion

The findings of this study reveal the devastating and systematic destruction of Tigray's energy infrastructure during the recent war on Tigray. The comprehensive damage assessment, which documented close to 1,864 verified incidents of war-induced damage, demonstrates how critical components of the electrical grid - including generation plants, transmission lines, and distribution networks - were deliberately targeted, leading to near-total collapse of the region's power systems. The near-uniform severity of destruction across zones, with over 97% of assessed infrastructure severely damaged or completely destroyed, illustrates a coordinated strategy to induce a total grid collapse. This has created unprecedented challenges for recovery, with impacts extending far beyond physical damage to include severe disruptions to economic activity, essential services, and quality of life across Tigray.

The scale of the loss is quantifiable not just in physical damage but in profound economic terms. The assessment records a total documented financial impact of approximately USD 482 million, with the substations (USD 343.5 million) and distribution networks (USD 100.6 million) bearing the greatest financial losses. The updated quantification of immediate physical damage now totals USD 68 million, with transmission (USD 34.70 million) and distribution (USD 28.13 million) systems accounting for over 92% of this cost. This economic impact is heavily skewed towards long-term economic disruption (foregone value and service disruption) rather than immediate physical damage, demonstrating that the war’s most damaging effect was the systematic cessation of economic activity and energy-dependent services. This has not only erased years of development progress but has also created a reconstruction challenge that will require a phased, inflation-adjusted rebuilding framework.

Moving forward, the rebuilding of Tigray's energy sector must address both immediate needs and long-term resilience. The findings underscore the urgent need for coordinated action from

national and international stakeholders. Furthermore, this assessment exposes a clear pattern of destruction with a distinct division of roles: the Ethiopian National Defense Forces (ENDF) inflicting the highest financial damage through high-value targets, and the Eritrean Defense Forces (EDF) carrying out the highest number of incidents to ensure widespread devastation. This systematic targeting raises serious questions about compliance with international humanitarian law. Therefore, reconstruction must be grounded in principles of rendering of justice, ensuring that these documented findings serve not only as a roadmap for recovery but also as essential evidence for future reparation claims and for holding perpetrators responsible.

6.6.2. Recommendation

To address the energy crisis in Tigray, reconstruction must move beyond mere restoration and embrace the principle of building back better system. The following actionable recommendations are proposed to guide national and international stakeholders in supporting a recovery that is both effective and transformative.

1. Prioritized infrastructure rehabilitation and modernization
    - ✔ Launch emergency repairs: Immediately restore critical transmission corridors and substations to re-establish a functional backbone for the regional grid.
    - ✔ Adopt a building back better system: Integrate modern, resilient technologies into all reconstruction projects. Actively promote decentralized renewable energy systems, such as solar mini-grids, to power rural health centers, schools, and communities, thereby reducing future vulnerability.
2. Urgent mobilization of financial and technical resources
    - ✔ Federal government of Ethiopia: Provide substantial financial reparations and grants specifically for the energy sector and facilitate the unhindered import of necessary equipment, materials, and fuel.
    - ✔ International development partners and NGOs: Mobilize urgent financial support and technical assistance for renewable energy projects, grid modernization, and capacity-building programs for local institutions.
3. Institutional strengthening and community-centered recovery
    - ✔ Tigray energy bureau and utility offices: Develop a comprehensive energy sector recovery master plan. This should include programs for staff training, digitizing records, and enhancing crisis response capabilities.

- ✔ Ensure an inclusive recovery: Prioritize energy restoration for essential services (health, water, education) and actively engage affected communities in planning to ensure solutions meet local needs and support livelihood restoration.

4. Uphold accountability and justice
   - ✔ Investigate and prosecute: Conduct transparent investigations into the deliberate destruction of energy infrastructure and hold all responsible actors accountable through appropriate legal mechanisms. This is crucial for deterrence and rebuilding public trust.
5. Foster coordinated multi-stakeholder action
   - ✔ Establish a coordination framework: Create a formal collaboration framework between the Tigray National Regional Government, the Federal Government of Ethiopia, international partners, and local communities to align resources, share information, and ensure a coherent and efficient reconstruction process.

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Chapter 7. MEDIA, TELECOM, and ICT

7.1. Summary

The two-year war on Tigray inflicted unprecedented destruction on the media, telecommunications, and ICT sector, dismantling a critical foundation for communication, governance, and socio-economic development. Globally, access to ICT and media is recognized as a fundamental right, yet in Tigray, these lifelines were deliberately targeted and disabled, leading to severe economic losses and a grave denial of justice.

A comprehensive Damage and Loss Assessment (DaLA), carried out in line with international standards, estimated the overall cost of damages and losses at USD 326.23 million. Beyond financial destruction, a total of 82 deaths of employees have been registered as a result of direct killings, famine, and the lack of access to medical supplies. This human toll reflects the systematic and deliberate nature of the assault on the sector.

The assessment documented the extensive damage across the main institutions that provide media, telecom, and ICT services in Tigray. State-owned television and radio, together with government communication offices, were looted and intentionally destroyed. Private Mainstream and newspaper, DW international, and Gazeta Woyen, were forced to close their operations. In telecommunications, mobile and internet services were deliberately shut down, towers destroyed, and exchanges dismantled, severing millions of people from family contact, humanitarian support, and financial transactions. ICT services, including ATMs, digital financial platforms, consultancy, and IT-enabled services, also collapsed, intensifying the humanitarian and economic crisis.

The Ethiopian National Defense Forces (ENDF), Eritrean Defense Forces (EDF), and allied forces from Amhara and Afar regional states were identified as the principal perpetrators of these destructions. Their deliberate targeting of communication infrastructure formed part of a wider strategy of isolation and control. This blackout not only crippled institutions and businesses but also stripped citizens of their basic right to information and communication.

Looking ahead, reconstruction efforts must prioritize the full restoration of ICT, telecom, and media infrastructure. Ensuring equitable access for both urban and rural communities is vital, alongside the adoption of resilient digital technologies that can withstand potential future disruptions. Reconstruction must also be grounded in a rights-based approach, recognizing communication as a fundamental human right and an indispensable pillar of peacebuilding.

The findings of the Damage and Loss Assessment demonstrate that restoring Tigray's ICT, telecommunications, and media infrastructure is not merely about rebuilding damaged systems. It is also about restoring justice, dignity, and the right to communication for the people of Tigray. Figure 7-1 reveals that the north region Ethio-telecom (NRET) experienced the largest share of damage and losses, amounting to a total of over USD 230 million. DW International and Tigray Mass Media Agency (TMMA) together also sustained significant damage and loss, valued at nearly USD 90 million, reflecting the widespread destruction and looting of broadcasting and publishing facilities.

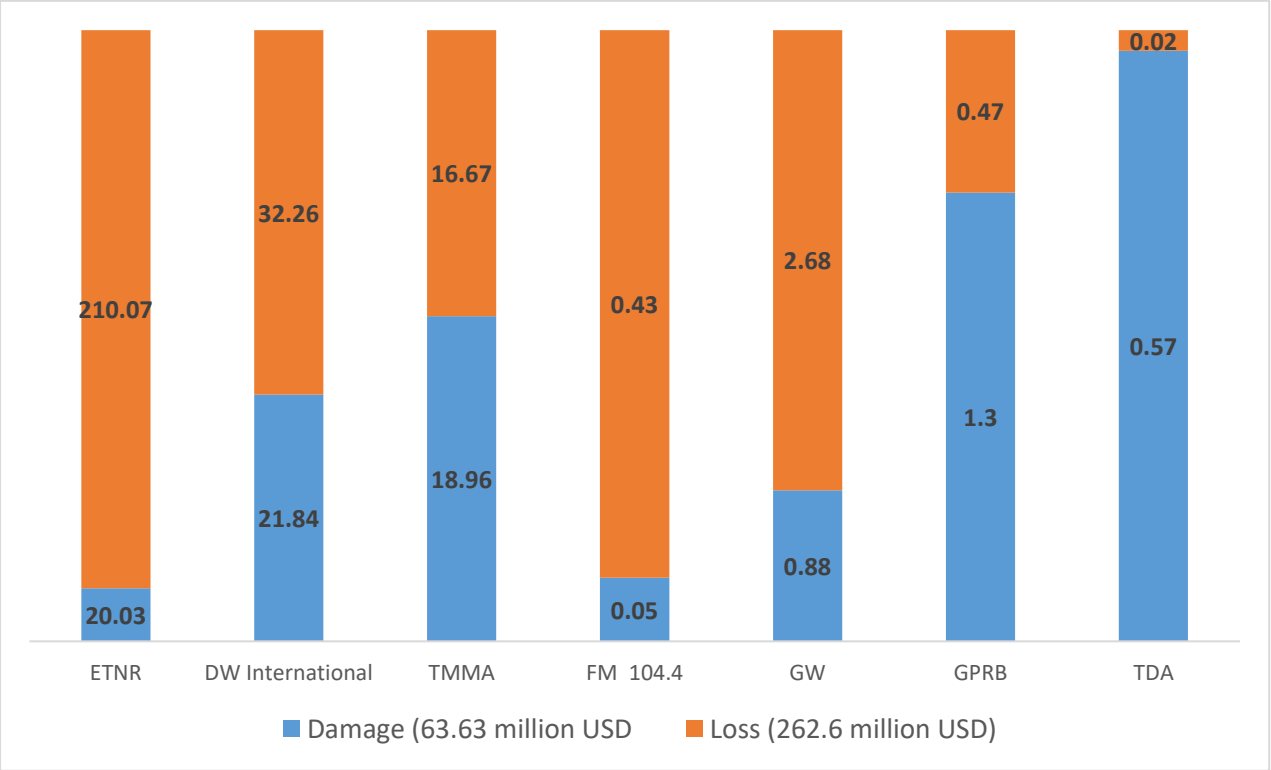

Figure 7-1: Summary of Damage and Loss for Media, Telecom and ICT in million USD

Source: CITG,2022

7.2. Introduction

In the age of globalization and technology, ICT, media, and telecommunications are recognized as indispensable drivers of economic growth, social development, and democratic participation. Access to reliable communication and digital services is increasingly considered a fundamental human right, comparable to essential services such as water, education, and housing. (UNESCO & ITU, 2021)

The United Nations Human Rights Council (2012) has affirmed that "the same rights that people have offline must also be protected online, in particular freedom of expression"

(Resolution 20/8). Similarly, the United Nations (2011) Principles on Access to the Internet emphasize that universal, affordable, and open internet access is vital for exercising human rights and achieving inclusive development. The International Telecommunication Union (ITU, 2020), together with the UNESCO Broadband Commission for Sustainable Development (UNESCO & ITU, 2021), highlights that broadband and digital connectivity are essential enablers of the Sustainable Development Goals (SDGs), from quality education and healthcare to gender equality, economic growth, and peacebuilding.

Societies and governments are highly dependent on ICT infrastructure such as mobile networks, internet services, broadcasting systems, and data platforms to facilitate governance, business operations, emergency response, and community engagement. For developing regions, ICT acts as a critical equalizer, bridging gaps in service delivery, enabling good governance, and expanding opportunities for economic participation. Conversely, when these systems collapse, the consequences extend far beyond technological disruption, leading to economic stagnation, social exclusion, and weakened resilience.

In the context of Tigray, the two-year war led to unprecedented destruction of media institutions, telecommunication facilities, and ICT infrastructure. Mobile networks, internet services, broadcasting stations, and data centers were either destroyed or rendered non-functional, creating an information blackout that isolated communities from the rest of the world. This collapse severely disrupted family communications, hindered humanitarian coordination, paralyzed business operations, and interrupted essential public services such as education, healthcare, and financial systems.

A comprehensive Damage and Loss Assessment (DaLA) in this sector is therefore critical to quantify damages including the destruction of telecom towers, telephone exchanges, broadcasting equipment, and ICT hubs; estimate losses such as the interruption of services, loss of revenues from telecom and media operations, digital unemployment, and the collapse of service delivery systems; and guide recovery and reconstruction ensuring that interventions are evidence-based, inclusive, and aligned with global frameworks such as the UN Sustainable Development Goals (United Nations, 2015), the Broadband Commission's targets for universal connectivity (UNESCO & ITU, 2021), and the principle of ICT access as a human right (United Nations Human Rights Council, 2012).

Restoring ICT, telecom, and media infrastructure in Tigray is not merely a technical task; it is about re-establishing the right to communication, rebuilding social cohesion, and enabling

socio-economic recovery. Moreover, reconstruction presents an opportunity to "build back better" by investing in resilient, inclusive, and modern digital systems that can withstand future shocks, contribute to peacebuilding, and accelerate sustainable development in the region.

7.3. Pre-War Context

In Ethiopia, information and communication technology (ICT) has been a central pillar of the national growth strategy, recognized both as an industry in its own right and as a driver of socioeconomic transformation. The government invested heavily in expanding telecommunications infrastructure, extending access to telecommunication and internet services across cities and many rural areas.

Before the outbreak of war, Tigray's ICT and media sectors reflected this national progress while still facing notable challenges. The North Region Ethio-Telecom (NRET) was the sole telecom service provider for Tigray and adjacent areas along the Afar and Amhara borders. NRET mobile penetration exceeded 70% of the population nationwide (Ethiopian Communications Authority, 2020). Internet access in Ethiopia, though lagging in rural areas, showed potential through mobile data services and expanding fiber networks (International Telecommunication Union [ITU], 2022). Since November 2010, Ethio Telecom has operated under a new strategic framework focusing on advancing telecom services as a key development driver. Consequently, Ethiopia's telecom infrastructure and services have been modernized to meet international standards, representing a major sector shift. The company has adopted cutting-edge technologies, including 5G, LTE Advanced, 4G/LTE, NGN, 3G, DWDM, and broadband multimedia services.

The media landscape was diverse, with a mix of state-owned, private, party-affiliated, and community outlets. These included:

State-owned: Tigray Mass Media Agency, Radio FM Mekelle 104.4, Mekalih newspaper

Private: Dimtsi Weyane Tigray, Mekelle Fana FM 94.8, Finote Semen, and Wurayna magazines

Community media: Radio Setit Humera 106.9, Mekelle University's Community Radio Momona FM 96.4

Party-owned: Gazeta Weyen newspaper

Other newspapers: Hadush Business

The war abruptly disrupted this trajectory. Planned upgrades, such as the rollout of 4G in Tigray, were halted, and much of the information infrastructure was devastated. Generally, both telecommunication and media services were significantly stronger in urban areas compared to rural communities.

This vibrant environment fostered independent reporting, though journalists often faced harassment (Human Rights Watch, 2019). Despite progress, rural communities continued to

7.4. Damage and Loss Assessment

The main findings of the report will be presented in this section. It will examine the prevailing price of the damaged asset, the severity of the damage, and the identified perpetrators. It will also address the financial losses caused by service interruptions due to the damage or siege, the missed opportunities (or forgone values), and any additional costs incurred as a result of the damage.

7.4.1. Damage Value

7.4.1.1. Damage Value of Ethio-Telecom North Region (NRET)

The **NRET** covers the entire seven-zone of Tigray, managing its operations from major centers Mekelle, Shire, Axum, Adigrat, Maichew, and Humera. A total of 652 BTS are administered by NRET serving both mobile and fixed-line users, extending coverage even into some border areas of Afar and Amhara, 543 BTS were assessed during the data collection; the remaining BTS were not accessible due to different reasons. A total of 264 BTS have been damaged, representing approximately 45% of accessible infrastructure. Table 7-1 shows a summary of assessed and damaged BTS.

Table 7-1: Damage Category and Number of Damaged BTS in NRET

Category	Count
Total BTS in NRET	652
Assessed BTS in NRET	543
Damaged BTS in NRET	246
Percentage of damage out of the assessed BTS	45%

Source: CITG 2022

The war has had a profound and devastating impact on the region's communication infrastructure. Figure 7-2 below vividly illustrates the scope and severity of the destruction; the energy supply system was among the severely affected sections of the company. The damage

extends across multiple layers of the system. Key transmission towers have been destroyed, and fiber optic lines have been severed, causing widespread service interruptions. As a result, the region is facing significant challenges in maintaining essential communication links.

a b

Figure 7-2: Damaged Diesel Generator(a) and Burnt ATS (b) at Sheraro Keramdi Ethio-Telecom Site
Source: CITG, 2022

The telecom damages are classified into categories: wireless network, wired network, office facilities and civil works, vehicles, information systems, electrical power, and sales shop. The total estimated cost of damaged equipment is above 20 million USD.

As described in Table 7-2, the wireless network, electrical power supply, and wired communication networks are the most heavily targeted infrastructures of NRET, together accounting for nearly 90% of the total recorded damage. This concentration of destruction clearly demonstrates that the primary focus of the attacks was on the core communication systems and their supporting energy sources.

Table 7-2: Summary of Damage by Category in NRET Infrastructure

Damaged Item Category	**Estimated damage Value (Million USD)**
Building (civil work)	0.24
Electrical power equipment	6.31
Office Facility	0.19
Information Systems	0.03
Sales Shop	0.06
Wired network	5.07
Wireless network	6.59
Vehicles	1.55
Cash	0.01
Total	20.03

Source: CITG 2022

The administrative structure of NRET is distinct from the conventional regional administrative system. Instead of being organized by zones or Woredas, NRET operates through six main

service centers: Adigrat, Axum, Mekelle, Maichew, Shire, and Humera. Each center is responsible for managing operations and service delivery within its respective coverage area.

However, it is important to note that data from the Humera service center were excluded from this assessment due to inaccessibility. As shown in Figure 7-3, the Mekelle service center suffered the greatest extent of infrastructure damage, representing about 41% of the total destruction. This significant level of damage reflects Mekelle's strategic importance as both an operational hub and a target during the war, leading to extensive disruption in services and communication systems.

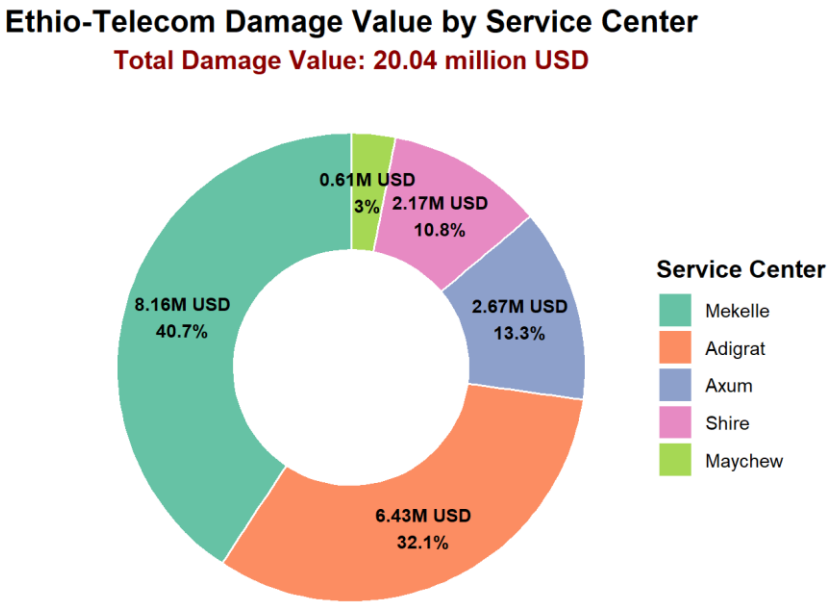

Figure 7-3: Damage Value Distribution of NRET Administrative Centers in million USD
Source: CITG 2022

A. Type of Damage and Mechanism

The type of damage assessment in NRET demonstrates how the specific infrastructures are affected and provides a clearer picture of the impact on telecom services. As illustrated in Figure 7-4, looting accounts for the largest share of the total damage registered in NRET, representing USD 12 million (60%). This indicates that the majority of damages were caused by the unlawful seizure of equipment, infrastructure, and other valuable assets. In addition, intentional destruction constitutes 39% of the overall damage, reflecting a significant portion of destruction intentionally inflicted through fire and destruction. Together, these forms of

damage reveal that the devastation was not accidental but largely the result of deliberate and coordinated actions.

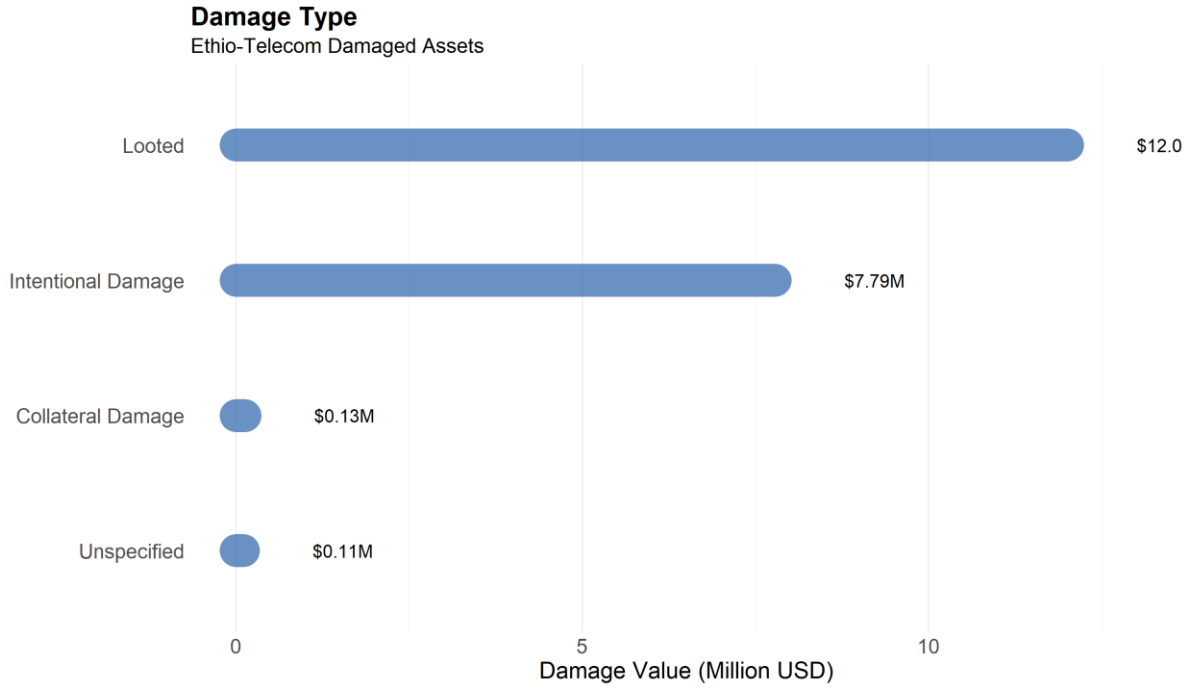

Figure 7-4: NRET Infrastructure Damage Type by Value
Source: CITG 2022

B. Level of Damage

The extent of damage inflicted on the NRET infrastructure as a result of the war is extremely severe, affecting nearly all components of its operational systems. Based on our assessment, the scale of destruction has been categorized into four levels to reflect the degree of severity.

Low damage refers to low-level impacts that require limited repair or replacement, with minimal disruption to services. Medium damage indicates partial impairment of infrastructure that hampers service delivery and necessitates more substantial repair efforts. High represents high-intensity destruction where key facilities or equipment are heavily affected, leading to significant service breakdowns and costly restoration needs. Finally, very high denotes critical severity, where infrastructure is either completely destroyed or rendered irreparable, causing long-term disruption and requiring full-scale reconstruction.

This classification framework provides a structured understanding of the damage patterns and helps prioritize the recovery and rehabilitation efforts according to urgency and resource demands.

As shown in the bar chart in *Figure 7-5*, an overwhelming 95% of NRET's property sustained very high damage, leaving the vast majority of telecommunication sites completely nonfunctional. This level of destruction indicates that the infrastructure was not only impaired but also, in most cases, rendered inoperable, thereby disrupting essential communication services across the region. The widespread devastation also reflects the scale of deliberate targeting of critical assets, as damage of this magnitude goes far beyond incidental loss. Consequently, the recovery of these sites will require extensive investment, including full reconstruction of facilities, replacement of advanced equipment, and restoration of supporting energy and transmission systems. This finding demonstrates the gravity of the crisis, as the near-total incapacitation of NRET's property significantly undermined the resilience and continuity of telecommunication services during and after the war.

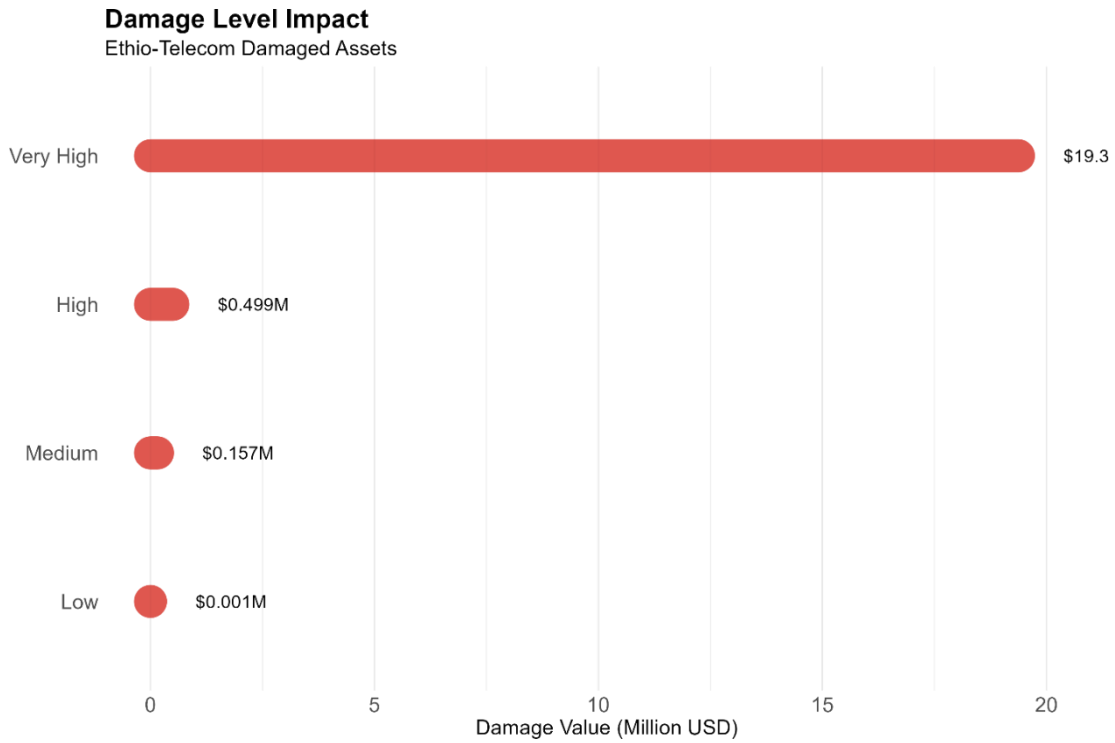

Figure 7-5: Level of Damage for NRET Properties by Value in Million USD

Source: CITG 2022

C. Perpetrators

A total of 4,049 items across NRET's infrastructure were reported as damaged, looted, or destroyed, indicating the severe impact on the sector. The total financial value of these damages is estimated to exceed 20 million USD. Table 7-3 presents the distribution of these damages across five service centers Shire, Axum, Adigrat, Mekelle, and Maychew disaggregated by

perpetrator groups and quantifying the associated financial damage values in USD. The analysis of identifying the perpetrators indicates that EDF attributes the largest share of destruction, accounting for 3,029 items, or roughly 75% of the total damage item-wise. Financially, their destruction resulted in values estimated at 10.22 million USD, approximately 51% of the overall monetary value. Damage caused by the EDF was predominantly concentrated in Axum, with 1,165 items, and Shire, which reported 1,019 damaged items.

The ENDF attribution was 480 items, representing about 12% of the total damage count. The damage value attributed to the ENDF was estimated at 7.34 million USD, or roughly 37% of the total financial impact. Mekelle, 216 items, and Shire, 149 items, were the most affected service areas by ENDF destruction, indicating that their attacks tended to target more valuable infrastructure.

Combined operations involving both EDF and ENDF accounted for 207 items, approximately 5% of total incidents, with a financial value of 0.6 million USD. This overlap reflects instances of coordinated or simultaneous involvement in attacks, amplifying the overall scale of destruction.

A service center breakdown reveals that Shire was the most heavily affected, with 1,405 items damaged, primarily due to EDF. Axum followed closely, with 1,292 items affected, also largely attributed to the EDF. Adigrat reported 600 items, with significant contributions from both unknown perpetrators and the EDF, while Mekelle suffered 589 items, with damages shared between the ENDF and EDF. The extent of destruction is illustrated in Figure 7-6, showing a damaged power generator at the May-Hanse telecommunication site in northwestern Tigray. This image reveals the severe impact of the war on critical energy infrastructure for communication services.

The EDF is the single largest perpetrator, both in terms of item count and financial impact, reflecting mass looting and widespread destruction. The ENDF is the second highest caused higher-value damage per item, indicating a strategic focus on critical and costly infrastructure. Combined EDF and ENDF operations added an additional layer of destruction, demonstrating coordination in attacks on essential assets.

Figure 7-6: Burned Power Generator in May Hanse Ethio-Telecom Site

Source: CITG,2022

Overall, the data emphasizes that the damage to NRET's infrastructure was systematic and heavily perpetrated by the EDF and ENDF, with Shire and Axum experiencing the most severe count destruction. The pattern indicates a strategic approach that combined mass looting by the EDF with high-value targeting by the ENDF, aimed at dismantling critical communication systems

Table 7-3: Perpetrators' Damage Share to the Damage Registered on NRET

Perpetrators	Item-based share of perpetrators in all service centers						Value (Million USD)
	Shire	Axum	Adigrat	Mekelle	Maichew	Total	
ENDF	149	16		216	99	480	7.34
EDF	1019	1165	493	319	33	3029	10.22
Amhara force (AF)	89	-	1	1	-	91	0.09
Afar force (AFR)	-	-	-	25	-	25	0.05
EDF & ENDF	59	103	-	17	28	207	0.61
Unknown	-	6	106	11	-	123	1.45
ENDF & AF	56	1	-	-	3	60	0.24
ENDF & AFR	-	1	-	-	-	1	0.00
EDF & AFR	33	-	-	-	-	33	0.04
Total	**1405**	**1292**	**600**	**589**	**163**	**4049**	**20.03**

Source: CITG, 2022

To provide a clearer understanding of the types, levels, and perpetrators of damage discussed above, the following case study focuses on Ethio-Telecom site in Hawzen. This example offers a detailed illustration of the extent of physical damage, the deliberate nature of destruction, and the perpetrators involved.

Description of the Site

The Hawzen Ethio-Telecom site housed multiple layers of critical infrastructure. It included a Main Distribution Frame (MDF), a Base Transceiver Station (BTS), and a power house, all of which were central to the provision of telecom services. In addition, the site hosted a fully

equipped sales shop for Ethio-Telecom devices such as mobile phones, SIM cards, and routers, as well as customer support services.

The MDF served as the central hub where external telephone and internet lines converged before being distributed to internal networks. It played a key role in line assignment, service activation, and fault testing. For landline services, copper lines terminated at the “A” side of the MDF and were linked via jumper wires to internal lines on the “B” side. For internet services, the MDF connected customer lines to DSLAMs for DSL services and terminated fiber cables in Fiber-to-the-Building (FTTB) deployments, ensuring reliable distribution to users (Cisco Systems, 2020; ITU, 2019).

The BTS was equally significant, providing the direct wireless link between mobile devices and the wider telecommunications network. It transmitted and received radio signals, converted them into digital signals for routing, and defined the coverage area of a cell. BTS units supported seamless handovers as users moved between cells and managed radio resources efficiently to maintain service quality (Garg, 2010; Nokia Networks, 2017).

The power house was essential in maintaining continuous service. It connected the site to the national electricity grid and was equipped with an alternative energy source, including a generator, to power all telecommunication equipment and the sales shop. Together, the MDF, BTS, and power house represented indispensable infrastructure for voice, data, and internet services.

This facility was not only a hub for telecommunications but also a lifeline for the surrounding community, serving both the town of Hawzen and nearby rural areas. Its destruction reflects the deliberate targeting of critical infrastructure, with far-reaching consequences for communication, social life, and economic resilience.

Context of Occupation

Hawzen was occupied by Eritrean Defense Forces (EDF) on November 25, 2020, following war with Tigray forces. Immediately after the occupation, the EDF declared a state of emergency, which severely restricted civilian movement. Residents reported that after 6:00 p.m., no one was permitted to move freely in the town. Attempts to do so often resulted in arbitrary arrest or extrajudicial killing. The subsequent arrival of Ethiopian National Defense Forces (ENDF) further tightened restrictions, leaving the civilian population in a state of fear and isolation.

The Incident of Hawzen Ethio-telecom site deliberate burning

Eyewitnesses reported that on December 12, 2020, at approximately 3:00 a.m., the telecom site was deliberately set on fire. A dog's persistent barking alerted its owner to the movement of a double-cabin pickup truck around the compound. Looking through his window, the witness observed a double-cabin pickup truck circling the area. Moments later, flames erupted from the site. The resident immediately alerted neighbors using the community's signaling method.

Witnesses described seeing two armed men moving inside the compound. One of them was overheard urging the other in Tigrigna, saying, *"Marks, hurry up"* (ማርክስ ቀልጥፍ). Shortly afterward, the two men fled the compound in the pickup truck, leaving the site fully ablaze.

Identification of Perpetrators and Intention

The perpetrators were identified as Eritrean Defense Forces soldiers. Eyewitnesses based this identification on three factors: the men were dressed in EDF uniforms, they spoke Tigrigna with an Eritrean accent, and the area at the time was firmly under EDF control. Importantly, there was no active fighting in Hawzen on the night of the incident, ruling out the possibility of collateral damage. Witnesses further confirmed that the soldiers used fuel to deliberately ignite the fire, leaving no doubt that the destruction was intentional.

The deliberate destruction of the Hawzen Ethi-Telecom site forms part of a broader pattern of systematic attacks on critical infrastructure across Tigray. Broadly, by targeting telecommunications, the EDF not only destroyed essential facilities but also exacerbated the isolation of civilians at a time when access to information and communication was critical. The loss of this site disrupted emergency communications, undermined social and economic activities, and deepened the vulnerability of the population. Figure 7-6 indicates the damage level and extent intension by the perpetrators. The picture of damage shows the entire destruction of the site from the sales shop to the main telecom infrastructure.

Figure 7-7: Burned Hawzen Ethio-Telecom site

(a) sales shop (b) Main Distribution Frame (MDF) (C) power house

Source: CITG,2022

This case demonstrates how the destruction of infrastructure was used as a tool of war, with the explicit aim of weakening civilian resilience and aggravating the humanitarian crisis in the region.

7.4.1.2. Damage value of Median and ICT infrastructure

This section presents an assessment of the damages sustained by mainstream and publishing media organizations, the Government Public Relations Bureau (GPRB), and the Tigray Digital Agency (TDA). For clarity, damages are categorized into broadcasting systems, including television and radio machinery and archives, buildings, vehicles, information systems, and office facilities, such as electronics and furniture.

The findings reveal extensive and multidimensional destruction, affecting not only physical infrastructure but also the technological backbone and content archives that are critical for media operations. Damage to broadcasting machinery and archives is particularly significant, as it severely undermines the ability to disseminate information and preserve institutional memory. Similarly, destruction of office facilities, vehicles, and ICT systems disrupted operational continuity, limiting the capacity of these institutions to function effectively. The total estimated cost of damages in the media sector is approximately 43.60 million USD,

showing the severity of the impact and the scale of resources required for reconstruction. Of this total, 20.88 million USD (48%) was sustained by public institutions, while 22.72 million USD (52%) was affected by private organizations, illustrating the disproportionate vulnerability of private (party-affiliated) media and information agencies.

Among the damage categories**,** broadcasting systems, including television and radio machinery, archives, and related equipment, were the most heavily impacted, with damage value estimated at 29.75 million USD, representing nearly 68% of total damages**.** Vehicles**,** essential for mobility and operational logistics, were damaged or looted with an estimated value of 5.54 million USD. Similarly, Office facilities, including electronics, furniture, and equipment, accounted for 3.69 million USD in damage, indicating widespread destruction of institutional workspaces. Information systems incurred damage of 3.17 million USD, reflecting the disruption of digital platforms and critical technological assets**.** Buildings still incurred significant damage value estimated at 1.44 million USD**.**

Overall, the damage profile demonstrates a clear concentration on broadcasting systems, which alone represent nearly 68% of the total value. Private sector (party-affiliated) institutions bore the majority of the damages, emphasizing their exposure to deliberate attacks, while public institutions, though smaller in scale, also suffered meaningful disruptions. Table 7-4 provides a comprehensive summary of damages across the media and ICT sector, presenting the distribution of damage by category and type (public or private) of institution.

Table 7-4:Total Damage Value of Media and ICT Sector in Million USD

Damage category	Damage Value (Million USD)		
	Public	Private	Total
Broadcasting system	13.18	16.57	29.75
Information System	2.78	0.39	3.17
Vehicles	2.3	3.24	5.54
Buildings	0.38	1.06	1.44
Office Facility	2.24	1.45	3.69
Total	**20.88**	**22.72**	**43.6**

Source: CITG 2022

Institutional damage analysis

DW International was founded on 11 October 1979 in Sahel, Eritrea, under the Tigray People's Liberation Front (TPLF). Its original mission was to support the struggle against the Derg regime (the then Ethiopian government) by informing and mobilizing the people and

boosting the morale of fighters. Over four decades, DW International (DW) evolved from a wartime communication tool into the first and most influential electronic media in Tigray, shaping the region's political, social, and cultural development.

After becoming a private company in 1998, DW achieved financial independence and technological growth, expanding broadcasting power, upgrading to 100 kW short and medium-wave systems in 2012, and launching FM radio in 2015. By 2017, DW had added television broadcasting in Tigrigna, Amharic, and Oromifa, becoming the first Ethiopian media to use 4K technology**.** It also built an extensive digital and analog archive of around 400,000 hours of historical and cultural recordings, serving as a central repository of Tigrayan identity and history.

DW became deeply rooted in Tigrayan society for most of the farmers relied on it for information, and more than half trusted it over government agents. It reached audiences through AM, FM, TV, online, and mobile platforms, giving Tigray the highest media literacy in Ethiopia. DW dominated the regional market share and partnerships with over 400 organizations, earning recognition as one of Ethiopia's top taxpayers and self-financed media institutions.

Before the war on Tigray, DW had also faced economic and political discrimination from the Ethiopian federal government, including funding delays and exclusion from national media markets. The war compounded these challenges, resulting in the death and displacement of staff, including the general manager.

DW International has sustained severe destruction estimated at 21.84 million USD as a result of deliberate attacks during the war. Figure 7-7 demonstrates the distribution of damage in the main stream company. Among the most heavily targeted assets was its broadcasting system mainly historical archive, one of the organization's most valuable and irreplaceable resources. Before the damage, DW maintained an average broadcasting production capacity of 14 hours per day, which has now been reduced to only 3 hours, reflecting an operational decline of nearly 80 percent and severely limiting its ability to inform and serve the people of Tigray.

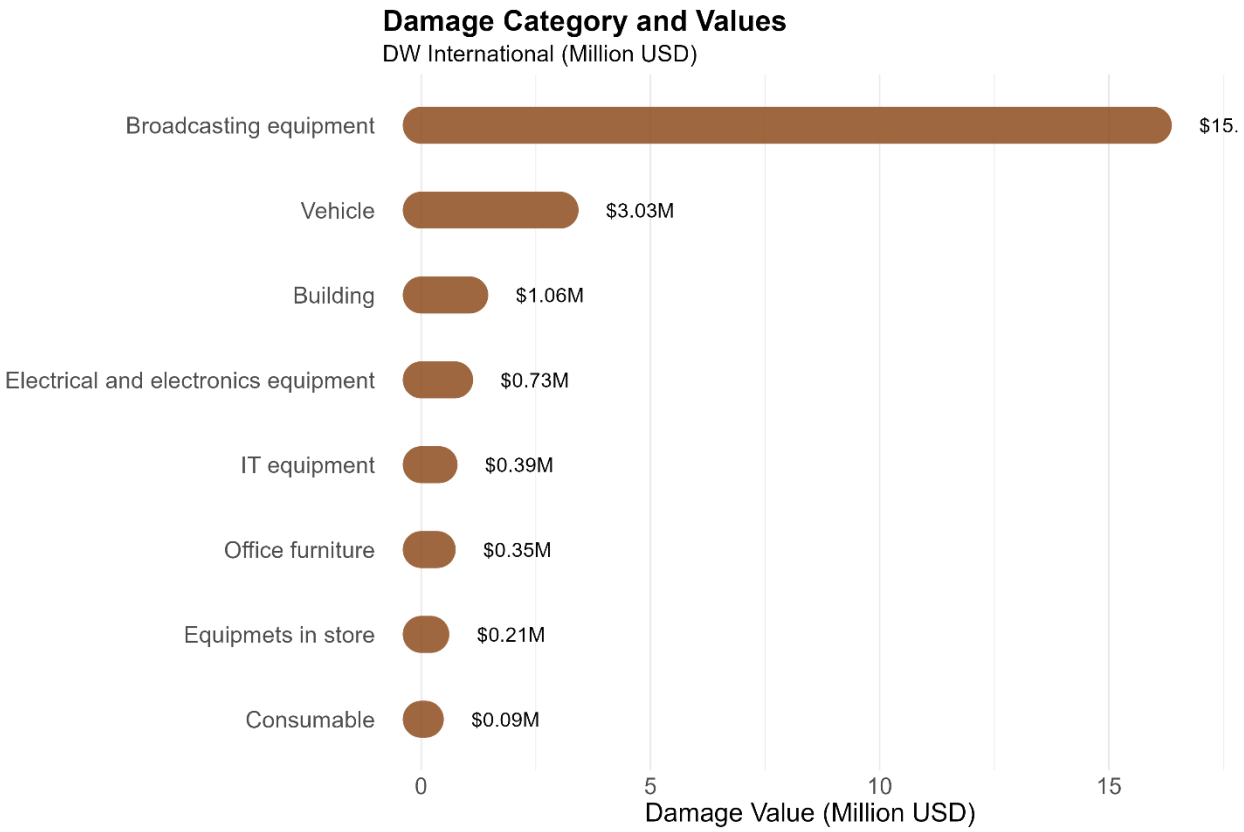

Figure 7-8: DW International Damage Values by Category in Million USD
Source: CITG, 2022

Since its establishment, DW had accumulated an extensive collection of digital and analog media that documented the historical, cultural, and political evolution of Tigray. These archives formed the backbone of the institution's identity and served as both a media resource and a cultural heritage repository. However, the deliberate targeting and destruction of its storage facilities resulted in the total loss of this archive. The damage included the destruction of main data servers, 220 TB of cloud storage, and the data center infrastructure, as well as the loss of 40,000 cassettes, 5,000 reels, 10,000 books, and over 100,000 other hardcopy materials. In addition, the organization lost 211,700 hrs of finished radio programs, 7,300 hrs of finished television programs, and 146,000 hrs of raw television footage. AS depicted in *Figure 7-9*, the primary perpetrator responsible for the destruction of DW International is the Ethiopian National Defense Force (ENDF). It is estimated that over 85% of the total damages inflicted on the company were caused by the ENDF.

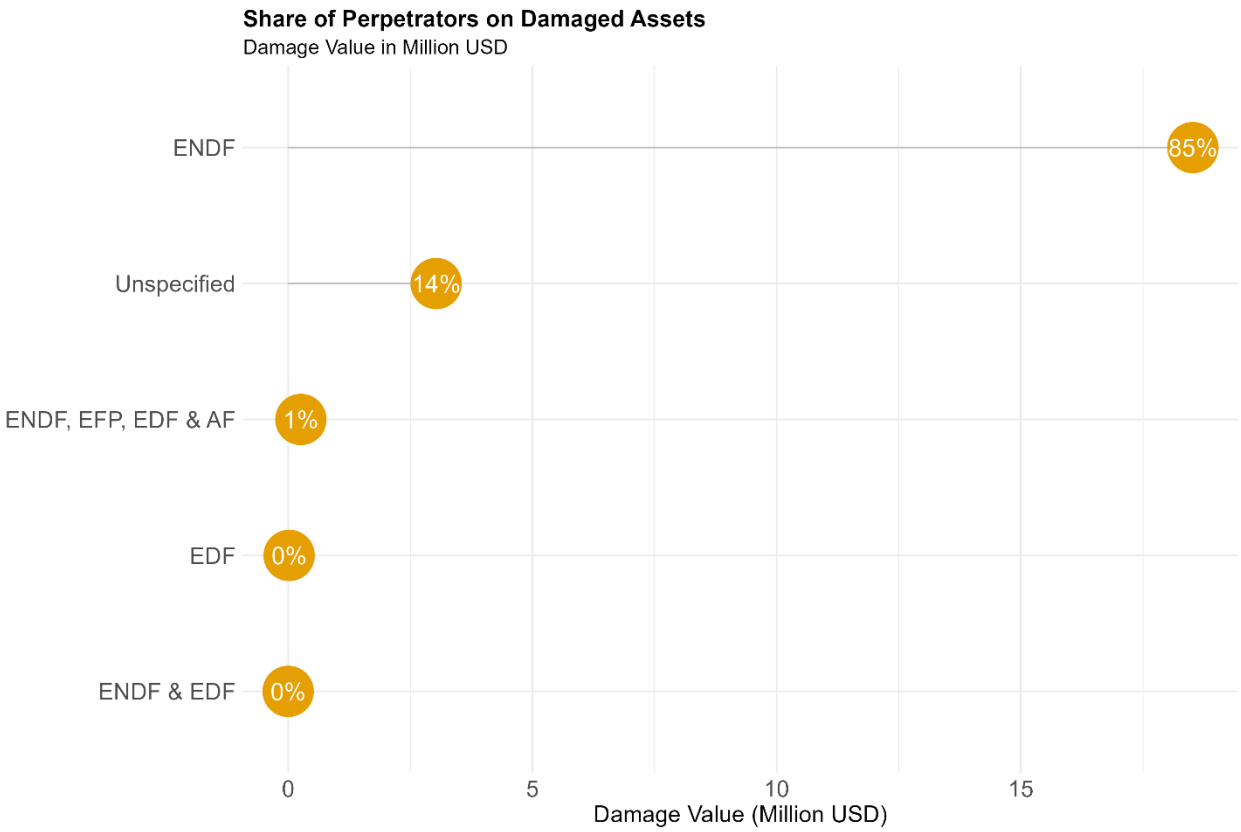

Figure 7-9: Share of Perpetrators to the Damage Registered on DW International in Million USD
Source: CITG,2022

According to post-damage assessments, only about 20 percent of the destroyed archival resources can potentially be reconstructed, simulated, or dramatized using available backups and secondary sources. The loss of these archives not only represents an immense financial setback but also signifies the erasure of invaluable historical and cultural records that embodied the collective memory and identity of the Tigrayan people.

DW's destruction left the people of Tigray voiceless, erasing vital historical archives and silencing one of the region's most trusted and independent media voices. Its loss also meant the disappearance of crucial evidence and cultural heritage documenting the struggle and identity of the Tigray people.

The Tigray Mass Media Agency (TMMA): was also the most severely impacted institution within the media sector, accounting for more than 43% of the total sectoral damage. The bulk of the destruction was concentrated on broadcasting systems, encompassing television and radio machinery, transmission equipment, and archives, which constitute the core operational

infrastructure of the agency. The financial value of these damages surpasses the magnitude of the impact, indicating TMMA as one of their primary focuses of the sector's damage.

The extensive damage inflicted on TMMA critically lowered the capacity of broadcasting throughout Tigray. With the destruction of key broadcasting equipment and archives, the agency's ability to disseminate information, maintain institutional continuity, and provide public service messaging was effectively halted.

This targeted dismantling of TMMA represents more than a loss of physical assets; it signifies a deliberate disruption of public broadcasting services, with profound implications for governance, civic engagement, and community cohesion. By incapacitating the agency, access to verified news, educational content, and governmental communication channels was severely restricted, creating an information vacuum that aggravated social and economic challenges during the war. The destruction of TMMA therefore illustrates the broader strategy of undermining regional broadcasting networks and highlights the urgent need for comprehensive reconstruction and investment in resilient, inclusive media infrastructure.

The Tigray Mass Media Agency (TMMA) stands out as one of the most heavily impacted media organizations, with estimated damages reaching approximately USD 18.96 million. As illustrated in Figure 7-9, broadcasting systems alone account for 72% of the total damage. This includes the destruction of television and radio transmission machinery, archives, and related equipment that are central to the agency's operations.

Key components of the media and information systems were physically dismantled, burned, or looted, effectively crippling TMMA's capacity to operate. Beyond the broadcasting systems, additional damages were registered in information systems, office facilities, and vehicles, further undermining the agency's institutional capacity.

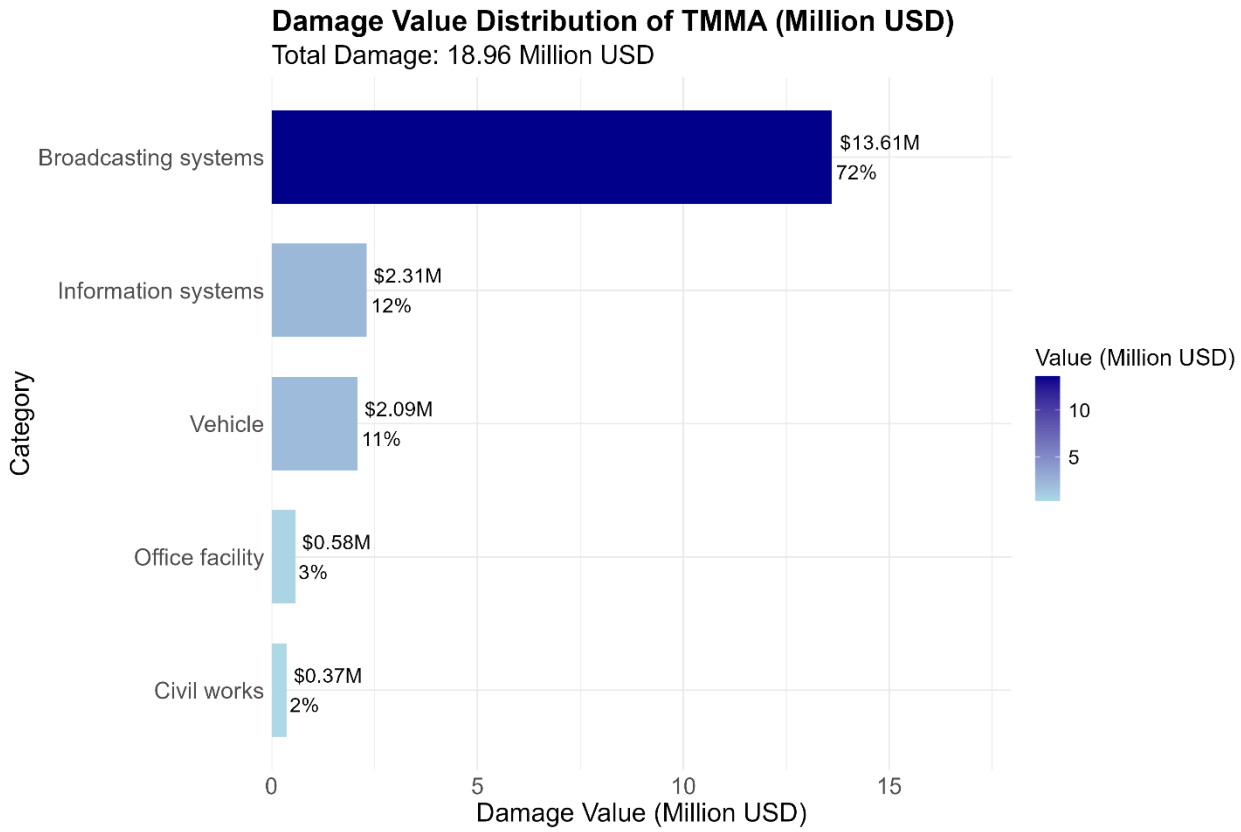

Figure 7-10:TMMA Damage Distribution by Category

Source: CITG,2022

Gazeta Woyen (GW): as the sole private media (Newspaper) institution included in the dataset, accounted for approximately 2% of the sector's total damage. Despite its smaller scale compared to total damage, the physical damage sustained by GW was significant, particularly in publishing systems and office facilities. This pattern notifies the vulnerability of private media to war-related disruptions, demonstrating that even smaller, independently operated organizations are susceptible to targeted attacks or collateral damage. The damages experienced by GW not only affected its operational capacity but also constrained the diversity of media voices and independent reporting within the region, underscoring the broader implications of infrastructure destruction on media plurality and information access.

The Tigray Digital Agency (TDA): sustained damages primarily concentrated in its information systems and digital facilities, reflecting the agency's heavy reliance on ICT infrastructure for its operations. Although the absolute value of these damages is relatively modest, accounting for approximately 1.3% of the sector's total, the impact on digital service delivery and information management has been substantial, disrupting the agency's ability to provide critical support on online services and others.

The Government Public Relations Bureau (GPRB): was also faced with notable destruction, particularly in its information systems, office facilities, and vehicles. These damages significantly impaired the Bureau's capacity to coordinate government messaging and conduct crisis communication, representing roughly 3% of the total sectoral losses. The disruption undermined the institution's ability to maintain effective public communication and governance functions during and after the war.

FM Mekelle 104.4: Although registering a relatively small financial loss, it experienced a disruption in city-level radio broadcasting. This interruption curtailed an important local platform for information dissemination, limiting access to news, educational content, and community updates.

The overall analysis of the media and ICT sector highlights several key observations. DW International dominates the damage profile. The total damage recorded across all assessed media and ICT institutions is summarized in Table 7-5, providing a comprehensive view of the sector-wide impact of the war.

Table 7-5: Damage Value of Media and ICT Sector by Organization (Million USD)

Name of organization	Damage value	
	Public	Private
DW international	-	21.84
TMMA	18.96	-
GW	-	0.88
TDA	0.57	-
GPRB	1.3	-
FM Mekelle 104.4	0.05	-
Total	**20.88**	**22.72**

Source: CITG, 2022

A. Damage Type on Media and ICT Assets

The assessment of the media and ICT sector categorizes damages into intentional destruction, looting, and unspecified damages. This classification provides a detailed understanding of both the scale and nature of destruction, clarifying whether damages were the result of deliberate targeting, collateral incidents, or damages that could not be precisely categorized. Analysis demonstrates that the vast majority of damages were deliberate and systematic, reflecting targeted attacks on critical infrastructure rather than incidental or random damages.

Looting emerged as the predominant form of destruction, with damages valued at 20.9 million USD, representing approximately 48% of the total losses recorded in the sector. The looting primarily targeted movable and high-value assets, including vehicles, electronic devices, broadcasting tools, and specialized machinery. Beyond the immediate financial loss, this

widespread plundering severely disrupted institutional functionality by depriving organizations of critical equipment necessary for daily operations, production, and recovery efforts.

Intentional destruction constituted the second most significant category of damage, valued at 18.92 million USD, or roughly 43% of the total. This form of damage was concentrated on essential infrastructure such as broadcasting systems, transmission equipment, ICT hardware, and archival resources assets that are central to the continuity of media and communication services. The magnitude and precision of this destruction reflect a deliberate effort to dismantle institutional capacity, thereby restricting the ability of media and ICT entities to operate effectively, disseminate information, and sustain governance functions.

Burning (3.41 million USD), while less frequent, caused irreversible damages to key facilities and archival records. Fires destroyed transmission rooms, office spaces, and historical archives, erasing invaluable institutional memory and operational data. The consequences of these burnings extend beyond physical loss, as they undermine service continuity, public accountability, and the preservation of content critical for historical and administrative reference.

Unspecified damages, valued at USD 0.38 million, point to high-value assets destroyed through mechanisms that could not be clearly identified. Despite their limited number, these incidents underscore the high cost of individual attacks within an already devastated sector.

Overall, nearly half of the total sectoral damage resulted from looting, followed closely by intentional destruction. The distribution of damages shows the deliberate and multifaceted nature of the war, which aimed to incapacitate institutions, paralyze operations, and erode the communication backbone of the region. Restoring functionality will therefore require not only extensive reconstruction but also strategic investment in resilient infrastructure and institutional capacity-building.

In conclusion, the combined analysis of damage types, perpetrators, and institutional impacts highlights that the destruction was both planned and targeted. Recovery will require not only financial investment but also strategic planning to rebuild critical infrastructure, preserve institutional memory, and strengthen resilience against future war. Figure 7-11 provides a detailed summary of damages by type and illustrates the scale and intentionality of the destruction across the sector.

destruction across the sector.

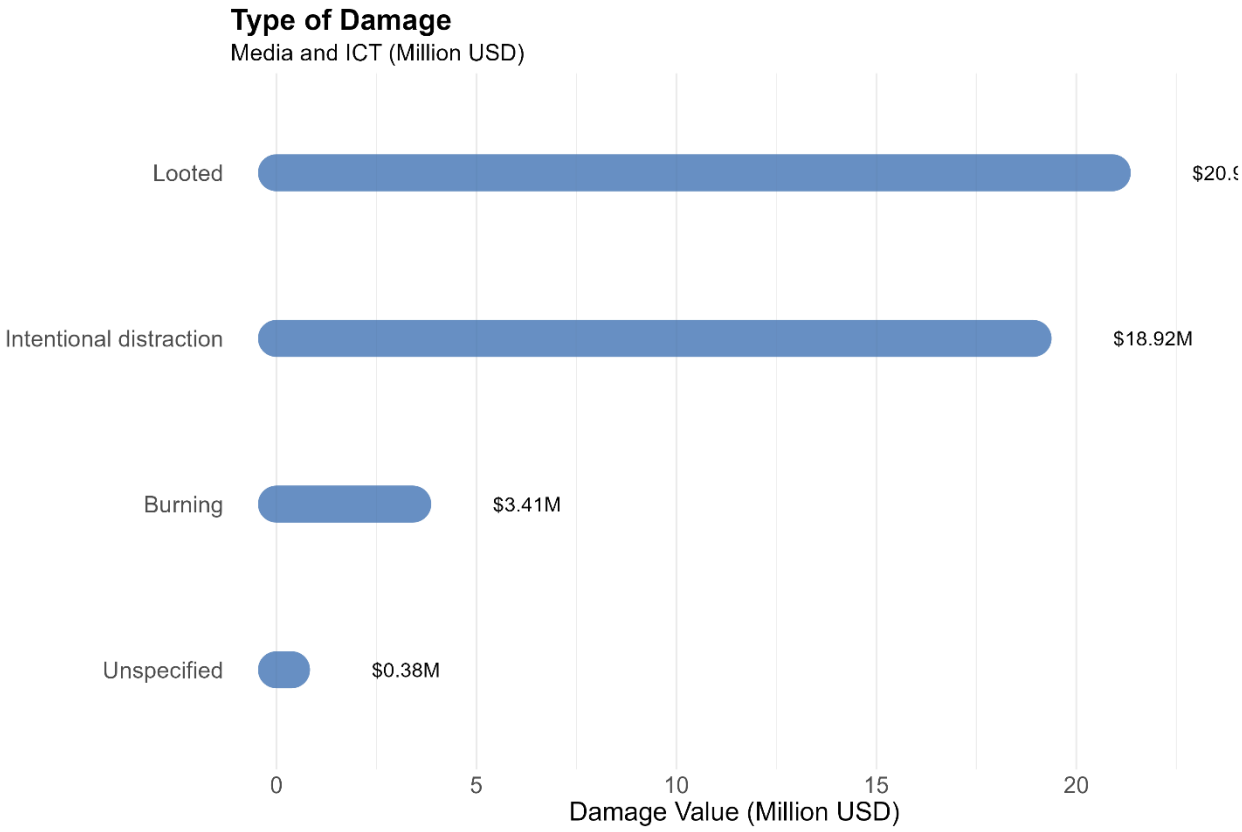

Figure 7-11: Type of Damage in Media and ICT Sector in Value (Million USD)

Source: CITG, 2022

B. Damage Level of Media and ICT Assets

The extent of damage inflicted on the Media infrastructure as a result of the war is extremely severe, affecting nearly all components of its operational systems. Based on the assessment, the scale of destruction has been categorized into four levels to reflect the degree of severity. Low damage refers to low-level impacts that require limited repair or replacement, with minimal disruption to services. Medium damage indicates partial impairment of infrastructure that hampers service delivery and necessitates more substantial repair efforts. High damage represents high-intensity destruction where key facilities or equipment are heavily affected, leading to significant service breakdowns and costly restoration needs. Finally, very high damage denotes critical severity, where infrastructure is either destroyed or rendered irreparable, causing long-term disruption and requiring full-scale reconstruction. Figure 7-12 shows the level of damage for the media and ICT infrastructure in terms of monetary value in million USD. Nearly USD 39 million worth of the damages are categorized as severe, requiring major repairs or complete replacement of the affected assets.

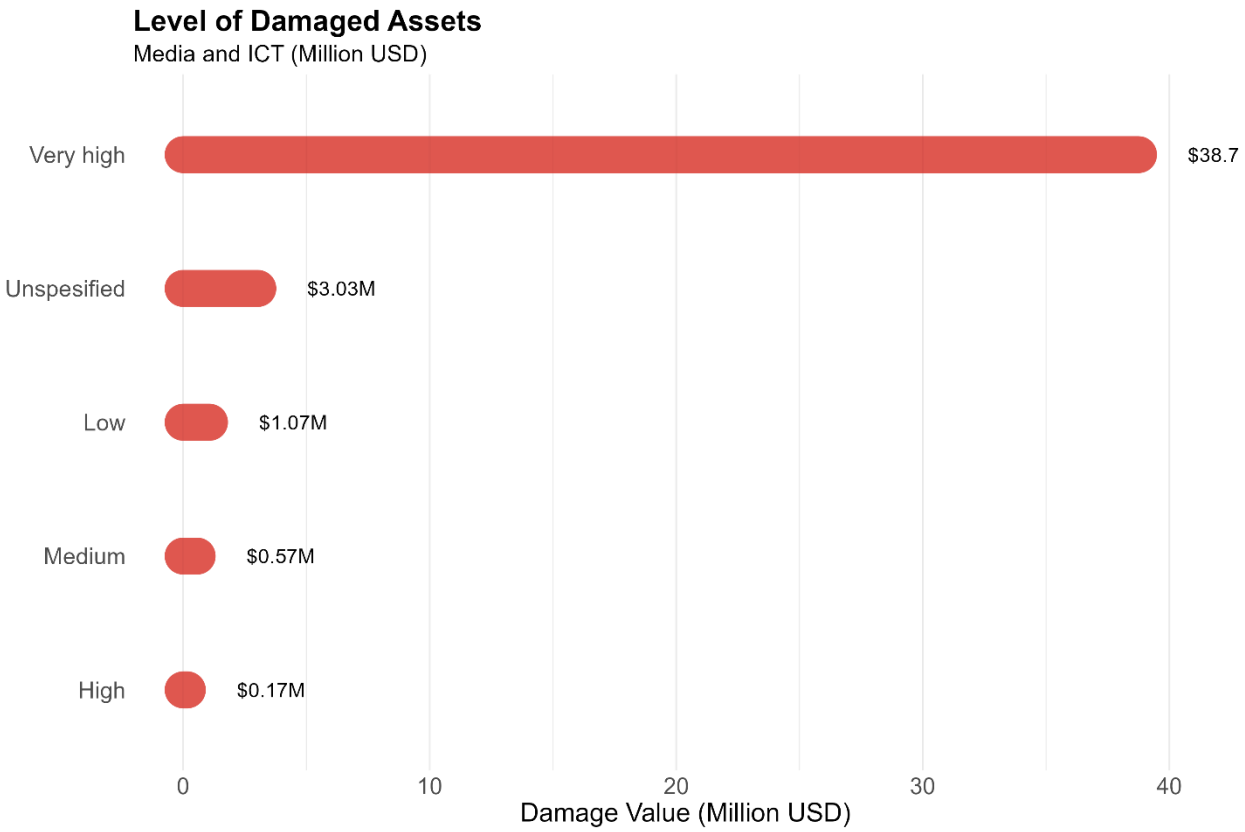

Figure 7-12: Level of Damage for Media and ICT Infrastructure in Value (Million USD)

Source: CITG 2022

C. Share of perpetrators of the damage registered in the Media and ICT Assets

The destruction and disruption of media infrastructure did not occur in isolation but were the result of deliberate actions by various actors during the war. Understanding the perpetrators is essential to identifying patterns of violation, accountability, and the broader implications for freedom of expression and access to information. The damages inflicted ranged from intentional attacks on physical assets and facilities to the looting and burning of equipment, offices, and transmission sites. These acts were carried out to silence independent voices, restricting communication channels, and undermining the capacity of media institutions to serve the public. Documenting the responsible parties provides critical insight into the motives behind the destruction and highlights the urgent need for accountability, reconstruction, and stronger protections for media infrastructure in war settings. Figure 7-3 shows the summary of share of perpetrators for the damage registered in the media infrastructure in monetary value and percentage.

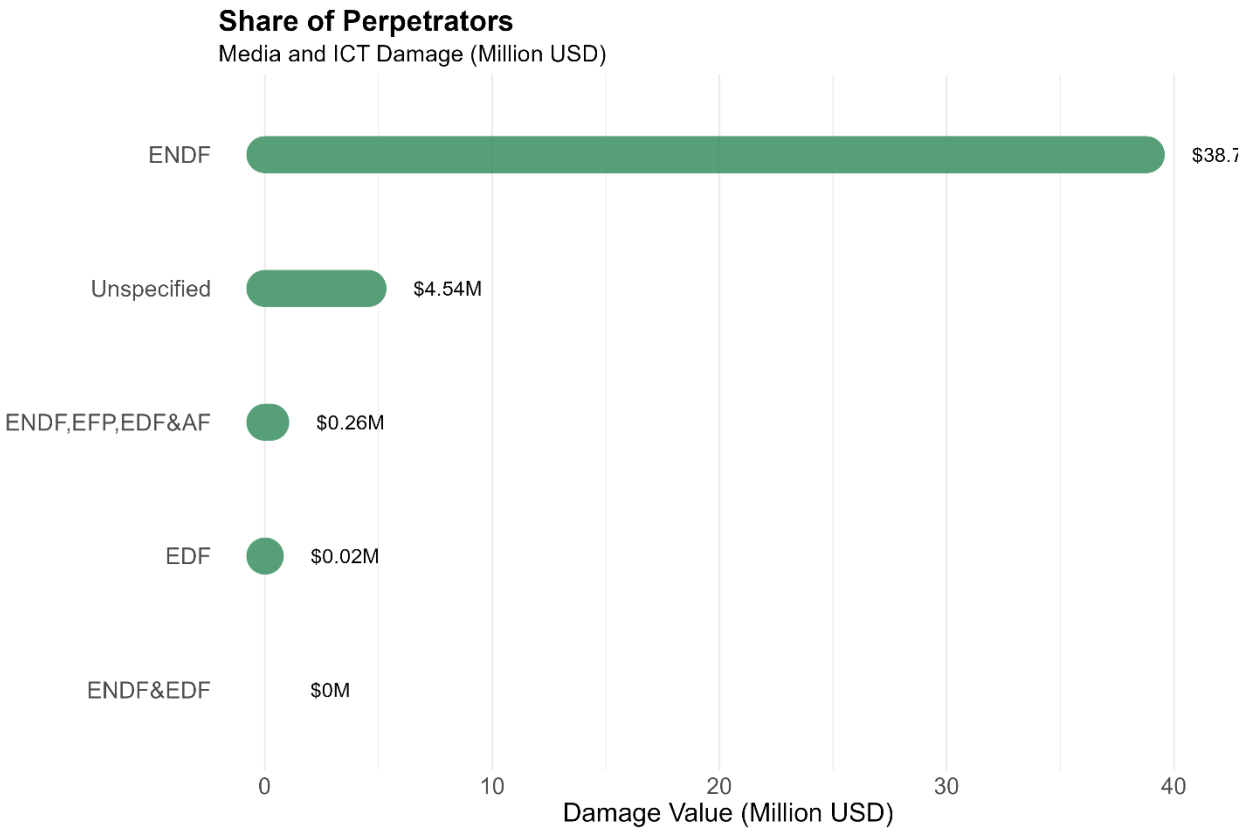

Figure 7-13: Share of Perpetrators in Media and ICT Infrastructure (Million USD)

Source: CITG 2022

The damage assessment indicates ENDF accounts for the largest share, with damages valued at more than USD 38 million, representing 89% overwhelming majority. The findings show that ENDF is the primary contributor to the damages, both in financial value and number of items, while other actors represent a much smaller portion.

D. Summary of estimated damage to the media, telecom, and ICT sector

The total damage value sustained by media, ICT, and ETNR amounts to USD 63.63 million. The broadcasting systems sector incurred the largest share, approximately 49% (USD 29.14 million), followed by vehicles with more than 11% (approximately USD 7.11 million), and electrical power systems with more than 11% (USD 7.04 million). Wireless networks also contributed significantly, with nearly 10% (approximately USD 6.6 million). Other notable damages include wired network (7.8%), office facilities (6%), and information systems (5%). Minor categories such as civil works (2.6%) accounted for very small portions. Table 12 shows the overall physical damage of media and NRET infrastructures in million USD.

Overall, the data highlights that the bulk of damage is concentrated in broadcasting, communication networks, and power systems, which together make up over three-fourths of the total damage.

Table 7-6: Physical Damage Summary of Media, NRET, and ICT

Damage category	Total damage value in USD			Share %
	Public	Private	Total	
Wireless network	6.59		6.59	10.36%
Wired network	5.07		5.07	7.96%
Broadcasting systems	13.17	15.97	29.14	45.80%
Electrical power	6.31	0.73	7.04	11.06%
Information systems	2.81	0.39	3.2	5.02%
Civil works	0.6	1.06	1.66	2.61%
Office facility	2.42	1.33	3.76	5.90%
Vehicle	3.87	3.24	7.11	11.18%
Sales shop	0.06		0.06	0.09%
Lost cash	0.01		0.01	0.01%
Total	**40.91**	**22.72**	**63.63**	**100%**

Source: CITG 2022

7.4.2. Loss Value

The most significant loss, accounting for nearly 99% of the total estimated USD 232.21 million between 2021 and 2023, stems from a decline in service provision during the war and siege. While minor losses were recorded in other categories like additional operating costs, the decline in service dwarfs these figures. It's important to acknowledge that this data is based on estimates from Ethio Telecom's northern region and the Tigray Regional State's Media and Broadcasting Service, and the actual losses could be even higher. Table 7-7 reveals a devastating effect of the war on Tigray on the Media and Communication sector. Overall, the war has caused a significant financial blow to the Media, telecom, and ICT sectors in Tigray.

Table 7-7: Total Estimated Loss of Media, Telecom, and ICT (Million USD)

Loss category	Sector		Total loss
	Public	Private	
Production loss		23.77	23.77
Loss due to declined service (2021-2023)	224.7	7.51	232.21
Total loss due to additional operating costs	2.68	1.61	4.29
Total loss due to unexpected expense	0.19		0.19
Forgone Salary		1.67	1.67
Governance loss	0.41		0.41
Risk and Vulnerability loss	0.06		0.06
Total	**228.04**	**34.56**	**262.6**

Source: CITG 2022

Media, Telecom, and ICT institutions in Tigray endured unprecedented financial losses during the war and siege, stemming from the total suspension of services, unpaid salaries and benefits, disrupted contracts, and other governance-related challenges. Together, these losses reflect the near-collapse of the sectors essential for communication, governance, and public service delivery.

For NRET, the primary source of loss was service unavailability (deliberate blockage). Using the pre-war three-year average revenue (2018–2020) as a baseline, the forgone income between 2021 and 2023 is estimated at more than USD 200 million. This figure reflects the complete shutdown of telecom services during the war and siege, underscoring the centrality of NRET in regional connectivity and economic activity.

Media and ICT institutions, though smaller in financial scale compared to NRET, suffered disproportionately severe impacts relative to their institutional capacity. The total financial loss sustained by media and ICT organizations is estimated at USD 40 million. The suspension of salaries was particularly devastating for media and ICT institutions. DW International, the Tigray Mass Media Agency (TMMA) faced a 17-month suspension, while the Government Public Relations Bureau endured 15 months without salaries. Private and city-based institutions such as Gazeta Woyen and FM Mekelle 104.4 were hardest hit, with staff unpaid for 24 consecutive months. These prolonged suspensions not only undermined the survival of employees but also crippled institutional capacity, leading to halted projects and the collapse of day-to-day operations.

Together, these losses underscore the war's deliberate and multifaceted assault on communication systems. NRET's financial devastation highlights the macroeconomic costs of service unavailability, while the media sector's collapse illustrates the social and institutional costs of silencing public discourse. Both cases demonstrate that recovery will require not only massive financial investment but also deliberate efforts to rebuild trust, restore institutional functions, and re-establish the role of communication as a cornerstone of governance and social resilience.

7.5. Impact

The war on Tigray inflicted severe and widespread disruption to telecommunications, media, and information and communication technology (ICT) systems. The deliberate disabling of telephone and internet services, coupled with the destruction or looting of media devices and intermittent electricity outages, left millions of residents without reliable access to

communication channels. This blackout not only isolated communities from critical information and services but also profoundly affected the social, economic, and psychological well-being of the population.

a. Professional/Expert losses

The war on Tigray has resulted in the loss of hundreds of thousands of lives, and among these were skilled professionals whose expertise and commitment had been central to sustaining critical communication services. Prior to the outbreak of the war, NRET employed 2,302 staff members, consisting of 764 permanent employees and 1,538 contracted (temporary) workers. This workforce was not only responsible for maintaining the technical and operational backbone of telecommunications in the region but also represented decades of accumulated knowledge, training, and institutional memory.

During the war, NRET endured a devastating human toll. Forty-five staff members were killed, 30 died as a result of lack of access to medication under the siege, 6 were left permanently disabled, and 8 remain missing. These losses represent far more than statistics; they signify the erasure of professional capacity that had been painstakingly built over years. Many of those killed or disabled were engineers, technicians, and field operators who had specialized knowledge of the region's telecom infrastructure. Their absence has left an irreplaceable gap in the sector, as they carried not only technical skills but also invaluable experience in managing and maintaining complex systems under challenging conditions.

Detailed data further reveal the perpetrators behind these losses. Of the 45 staff members killed, 82% of the fatalities were attributed to the Eritrean Defense Forces (EDF), while the remaining 18% were linked to the Ethiopian National Defense Force (ENDF) and the Amhara Forces (AF). The targeting of telecom staff by armed groups underscores the deliberate assault on human resources as part of the broader strategy to dismantle the region's communication systems. The chart in Figure 7-14 illustrates the distribution of responsibility for these deaths, reflecting the overwhelming role of the EDF in this targeted violence.

In essence, the destruction of lives within NRET magnifies the already severe material and economic damages. It illustrates that the war was not only an attack on physical infrastructure but also on the professionals who sustained it. This dual destruction of both systems and the people who managed them has created a compounded crisis, leaving the path to recovery far more complex and demanding.

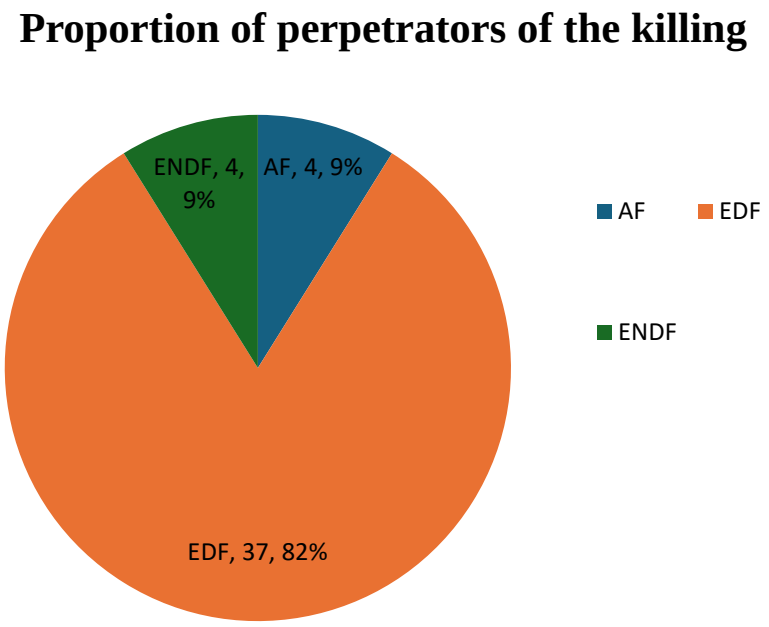

Figure 7-14: Share of Perpetrators Participated in the Killing of Professionals

Source: CITG 2022

As a summary of the human toll, Table 7-8 presents the number of staff members who lost their lives, became disabled, or remain missing across different organizations as a result of the devastating war on Tigray. This table captures the profound human suffering endured by institutions and their personnel, highlighting the irreversible loss of skilled professionals and the long-lasting social and institutional impact of the war.

Table 7-8: Summary of Professional Toll, Disability, and Missing

Sector type	Name of Organization	Pre-war total employees	Employee death record	Disabled Employee	Missing Employee
Telecom	NRET	2,255	75	6	8
	TMMA	583	1	10	21
Media and ICT	GPRB	102	6	4	1
	Gazeta Woyen	56			
	FM Mekelle 104.4	54		1	
	Total	**3,050**	**82**	**21**	**30**

Source: CITG, 2022

b. Humanitarian Implications

The collapse of communication networks significantly hindered humanitarian operations. Relief organizations struggled to coordinate and deliver essential assistance to affected

communities. For individuals and families, the inability to communicate with loved ones created heightened distress and a pervasive sense of vulnerability. The isolation imposed by the blackout contributed to widespread psychological stress and weakened social cohesion, compounding the humanitarian crisis.

c. Economic Consequences

The disruption of telecom and ICT services had immediate and far-reaching economic effects. Many households lost sources of income that depended on mobile communication, internet connectivity, or digital platforms, while others faced additional costs in attempting to restore basic communication or access information. Local businesses and institutions, reliant on digital transactions and online services, experienced interruptions that exacerbated financial instability. The blackout amplified economic vulnerability and reversed progress in local livelihoods and commercial activity.

d. Institutional Disruption

Telecom and ICT systems constitute the critical backbone of governance, education, and health service delivery. The deliberate and widespread disruption of these systems during the Tigray war resulted in total blackout, effectively paralyzing institutional operations across the region. Health services were brought to a standstill: telemedicine platforms could not operate, coordination for the distribution of medical supplies was impossible, and emergency responses were totally stopped. Educational services were similarly crippled; radio and television learning programs, along with digital and online educational platforms, were suspended or rendered inaccessible, depriving students of continued instruction and deepening educational disruption.

Administrative and governance functions were profoundly affected as authorities lost the ability to communicate with citizens or coordinate essential services. Routine governmental operations, public service delivery, and oversight mechanisms were effectively halted, leaving communities without access to critical information, guidance, or support. The total blackout of telecom and ICT not only amplified immediate suffering but also weakened institutional capacity, undermined organizational resilience, and significantly delayed post-war recovery and reconstruction efforts. The absence of communication and information channels created a vacuum that hindered both operational coordination and strategic planning, compounding the broader humanitarian, social, and economic crises caused by the war.

Media and Information Landscape

Local media organizations, including Dimtsi Weyane and Tigray TV, were deliberately targeted, effectively silencing the dominant sources of information. In the absence of these outlets, Ethiopian state and allied media leveraged the information vacuum to disseminate hate speech and propaganda, contributing directly to acts of violence and ethnic targeting. International media coverage, while highlighting key atrocities and human rights violations, remained insufficient to counter the widespread manipulation and misinformation experienced by local communities.

Social and Psychological Impacts

The communication blackout eroded social cohesion and disrupted interpersonal networks. Families and communities were unable to maintain regular contact, and the lack of reliable information fostered mistrust and fear. The isolation imposed by the interruption of telecom and ICT services intensified psychological distress, creating long-term social and emotional challenges for affected populations.

Long-Term Development Implications

The destruction and disruption of telecommunications, media, and ICT infrastructure represent a major setback to development in Tigray. Years of progress in digital inclusion, e-governance, economic growth, and media development were reversed. Beyond physical reconstruction, restoring access to reliable information, rebuilding local media capacity, and addressing the societal impacts of propaganda and disinformation will be essential for sustainable recovery and long-term stability in the region.

7.6. Conclusion and Recommendation

7.6.1. Conclusion

The war on Tigray has left behind a profound legacy of destruction, loss, and trauma that continues to affect individuals, institutions, and the broader social fabric of the region. The assessment reveals the extensive scale of damage sustained by the NRET, encompassing human losses, institutional collapse, and severe economic setbacks.

The human toll was especially devastating: among the 2,302 staff members employed prior to the war, 45 were killed, 29 died due to lack of access to life-saving medication, 6 were left disabled, and 8 remain missing. The evidence indicates that the majority of staff fatalities were not accidental but rather the result of deliberate acts of violence. Perpetrators identified include

the Ethiopian National Defense Force (ENDF), Eritrean Defense Forces (EDF), and Amhara Forces (AF), with data showing that 82% of staff deaths were attributed to the EDF. This deliberate targeting of professionals demonstrates the systematic nature of the violations and their broader impact on human capital and institutional resilience.

The material damages were equally severe. Intentional destruction, looting, and burning of facilities caused irreparable harm to infrastructure and service delivery systems. Equipment and assets valued in the millions of USD were lost, while the destruction of communication and media infrastructure paralyzed the flow of information, deepened isolation, and denied communities access to essential services during a critical period.

The economic consequences of the war extend beyond the immediate destruction of property. Prolonged service disruptions, unplanned operational costs, and forgone salaries and benefits compounded the financial strain on the institution and its staff. The cumulative effect has undermined institutional sustainability, reduced productivity, and weakened the region's overall socio-economic capacity.

Taken together, these findings illustrate that the impact of the war cannot be measured only in numbers or monetary terms. The psychological trauma endured by survivors, the loss of skilled personnel, and the erosion of public trust in institutions represent long-term challenges that will persist far beyond the end of active hostilities.

Reconstruction, therefore, must go beyond repairing physical damage. It requires a comprehensive and inclusive approach that addresses the needs of affected staff and communities, ensures accountability for human rights violations, and rebuilds trust in public institutions. Economic recovery efforts should prioritize restoring infrastructure, compensating losses, and investing in capacity-building to replace lost expertise. At the same time, psychosocial support and reconciliation initiatives will be essential in fostering healing and rebuilding social cohesion.

Ultimately, the findings of this report point to a stark but urgent truth: recovery in Tigray will not be possible without justice, accountability, and a commitment to holistic reconstruction. Only through coordinated efforts that integrate humanitarian, economic, and institutional recovery measures can the region begin to heal and chart a path toward sustainable peace and development.

7.6.2. Recommendation

In light of the extensive human, economic, and institutional damages documented in this report, urgent, comprehensive, and coordinated measures are essential to support recovery, restore services, and build long-term resilience across the affected sectors. The scale and depth of destruction, from the loss of life and livelihoods to the collapse of critical telecom, media, and ICT systems, demand interventions that are both immediate and strategic, addressing the short-term humanitarian needs while laying the foundation for sustainable development. The following recommendations are proposed as guiding actions for reconstruction, accountability, and the rebuilding of resilient institutions in the post-war period:

A. Reconstruction and Recovery

Priority must be given to rebuilding and modernizing damaged infrastructure, restoring telecommunications, ICT, and media services, and replacing looted or destroyed assets. This is essential not only to resume normal operations but also to re-establish connectivity, access to information, and the technological backbone necessary for governance, health, education, and economic activity. Reconstruction should be planned with resilience in mind, incorporating safeguards to mitigate future risks and ensure durability with the concept of build back better.

B. Humanitarian Support

Immediate assistance is required for affected staff and communities, including access to medical care, psychosocial support, and programs to restore livelihoods. The war has left many individuals traumatized, socially isolated, and economically vulnerable. Timely humanitarian interventions will address urgent needs, stabilize communities, and provide the foundation for recovery and reintegration.

C. Accountability and Justice

Thorough investigations into violations and the deliberate targeting of infrastructure, personnel, and civilians must be conducted, and perpetrators held accountable. Ensuring justice is critical not only to prevent recurrence but also to restore public trust in institutions and reaffirm the principles of the rule of law. Transparent accountability mechanisms will reinforce the legitimacy of recovery processes and strengthen societal cohesion.

D. Economic Rehabilitation

Measures must be taken to compensate for economic losses, address salary and benefit gaps, and invest in institutional capacity to sustain long-term operations. Restoring the economic stability of affected institutions and individuals is crucial for the resumption of services, the retention of skilled staff, and the reactivation of local economies that depend on telecommunications, media, and ICT systems.

E. Institutional Strengthening

Institutions must adopt strategies to improve resilience and preparedness, including staff training, enhanced crisis response capabilities, and the safeguarding of communication systems. Building institutional capacity will ensure that services can continue during future shocks, mitigate vulnerabilities, and support efficient and effective governance.

F. Inclusive Recovery

Reconstruction efforts must be people-centered, prioritizing the needs of vulnerable groups, including displaced persons, women, and staff with disabilities. Inclusive recovery ensures that all members of the affected population benefit equitably from reconstruction, promotes social cohesion, and addresses pre-existing inequalities exacerbated by the war.

By adopting these measures in a coordinated and systematic manner, recovery efforts can not only restore essential services and infrastructure but also create stronger, more resilient institutions capable of supporting sustainable development and safeguarding the rights, well-being, and livelihoods of the Tigrayan population in the post-war era.

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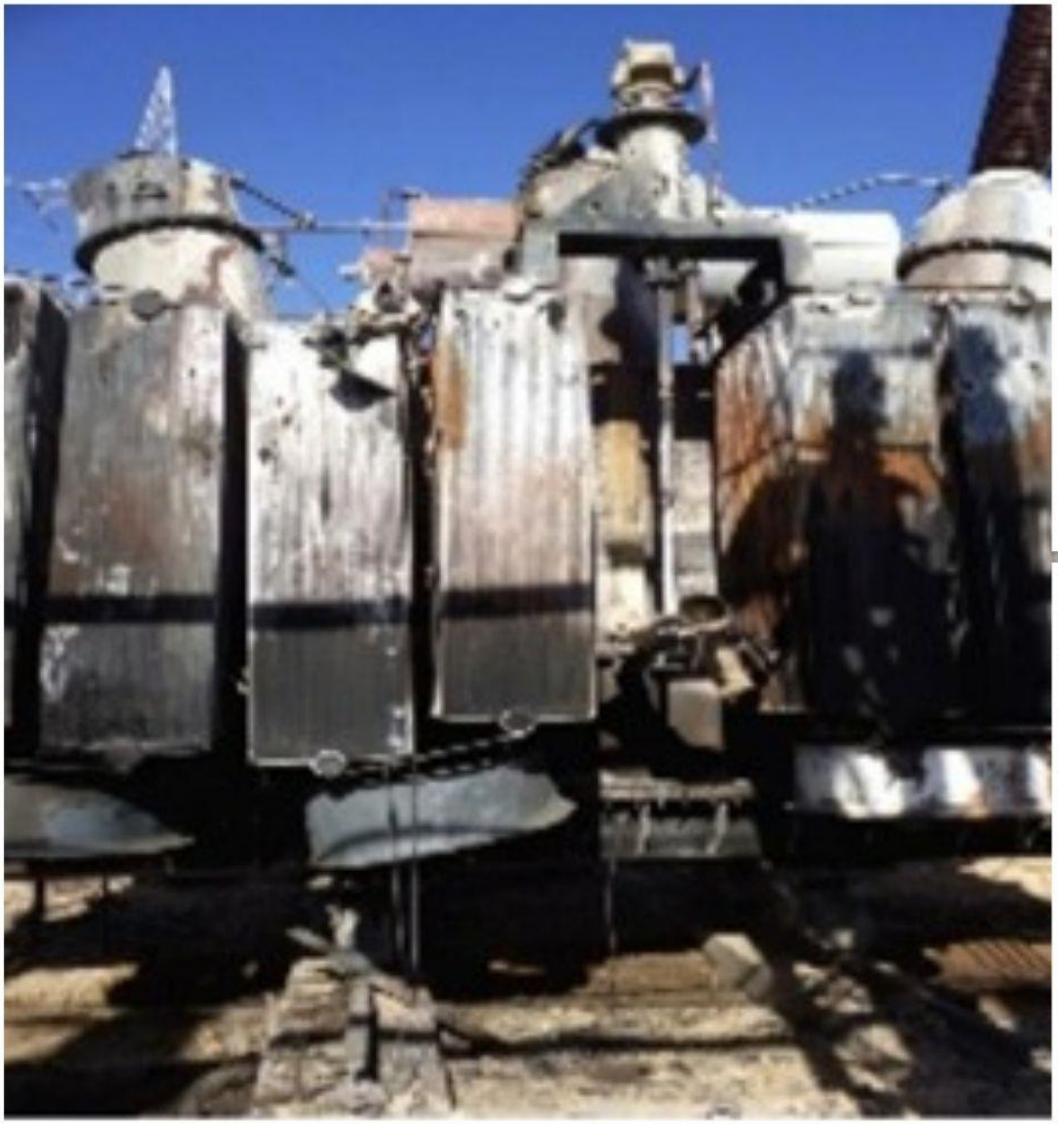

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