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Original Paper

The Effect of War, Reconstruction Needs, and Post-War Reconstruction Priorities on the Manufacturing Firms in Mekelle City, Tigray, Ethiopia

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Abstract

Effective post-war reconstruction is crucial for achieving sustainable development. This study assesses the impact of war on manufacturing firms in Mekelle, Tigray; estimates reconstruction needs; and identifies priority areas for post-war recovery in the sector. Using secondary data from 726 small, medium, and large manufacturing firms, the analysis employed descriptive statistics, the replacement cost approach, and the World Bank's damage, loss, and needs assessment tool. Results show that the war severely disrupted firm performance, reducing sales revenue by 97%, profit and loan repayment by 100%, and employment by 91.4%. Total damages were valued at over US$1.4 billion, with reconstruction needs estimated at US$1.7 billion. Key recovery priorities include: (i) targeted post-war policies and programs, (ii) recovery packages with free or low-interest working capital, (iii) duty-free imports, (iv) improved access to foreign currency, and (v) income tax waivers and grace periods.

Keywords: War, Manufacturing, Firm Performance, Reconstruction Needs, Tigray, Ethiopia

1. Introduction

1.1 Background of the Study

Industrialization has historically been a key driver of global economic growth, with the manufacturing sector widely regarded as the engine of modern economies. The shift from agrarian to industrial societies hinges on the manufacturing sector's contribution. The economic success of the Asian Tigers—Singapore, Hong Kong, South Korea, and Taiwan—demonstrates the role of increased productivity and technological advancement in manufacturing-led growth. Across all firm sizes—micro, small, medium, and large—the sector contributes significantly to technology development, job creation, export growth, and GDP (Chow, 2010).

Globally, manufacturing is a major employment source, accounting for 12.8% of the global workforce in 2018. According to the IMF, while advanced economies saw a steady decline in manufacturing jobs from 1970 to 2015, the share in emerging and developing economies remained relatively low (IMF, 2018). Manufacturing also supports capital accumulation, a core engine of economic growth less prevalent in agriculture and services (Szirmai, 2009).

Ethiopia achieved strong economic growth between 2002 and 2016, averaging over 10%, but growth slowed to 6.1% in 2019, 5.4% in 2020, and 5.1% in 2021. The economy rebounded slightly to 7.1% in 2022/23, led by the services sector (40% of GDP), while industry and agriculture contributed 28% and 32%, respectively (African Economic Outlook, 2024). However, ongoing challenges—including conflict, inflation, foreign currency shortages, and reduced foreign direct investment—have affected performance. The manufacturing sector remains underdeveloped, contributing only 4.6% to GDP and 5% to employment in 2023, down from 5.9% in 2022. Approximately 450 of nearly 5,000 firms ceased

operations due to these shocks. Local manufacturing meets only 38% of domestic demand, and export participation remains minimal, with only 5% of firms exporting between 1995 and 2020 (UNDP, 2023).

In Tigray, the industrial sector accounted for an average of 29.9% of regional GDP between 2010 and 2018. The region hosts over 15,000 manufacturing enterprises across various subsectors, including metal and woodwork, textiles and leather, agro-processing, construction materials, chemicals, and energy (TSA, 2020). From 2010 to 2020, the combined contribution of cottage, small, medium, and large firms to RGDP averaged 8.5%, with small firms recording the highest growth (11.05%), followed by medium and large firms (9.13%) and cottage industries (5.4%). Despite this, the sector's RGDP share remained low, with medium and large firms contributing just 4.9% during the Second Growth and Transformation Plan (GTP-II) period. Overall, the sector employed about 9.6% of the regional labor force.

1.2 Statement of the Problem

Conflicts worldwide have devastating consequences—ranging from human casualties and economic disruption to the breakdown of social cohesion, ecological damage, displacement, and political instability. Among the hardest-hit economic sectors is manufacturing, which often suffers from disrupted supply chains, loss of productivity, and diminished market performance.

Existing literature presents mixed findings regarding the impact of conflict on manufacturing firms. On one hand, numerous studies report that conflict significantly reduces firm performance, including profits, sales, and employment, while also disturbing supply chains and limiting export capacity. For instance, conflict in Côte d'Ivoire led to a 16–23% decline in total factor productivity among firms (Klapper et al., 2015). Similarly, during the Russia-Georgia war, firms—especially small and young ones—faced declines in sales, exports, and employment, with many forced to shut down (Petracco & Schweiger, 2012). In Sudan, ongoing conflict has caused agro-processing firms to downscale production, lay off employees, relocate operations, and face rising input costs (Oliver et al., 2023).

Conversely, some studies suggest that conflict can create unexpected opportunities. In Libya, while some firms experienced revenue loss due to input shortages, others benefited from reduced competition and saw increased profits (Del Prete et al., 2021). In Palestine, conflict-induced import restrictions led over 70% of firms in high-conflict areas to substitute imports with locally produced inputs, boosting local employment (Amodio & Di Maio, 2018). In Tigray, although the war severely damaged the manufacturing sector, it also prompted a limited emergence of new firms, especially in food processing and spare-part substitution, fostering local innovation (Hailesilassie, 2023).

Despite these observations, there is a clear research gap in understanding:

(i) the war's impact on the performance of manufacturing firms in Tigray,
(ii) the accurate estimation of reconstruction needs, and
(iii) the identification of post-war reconstruction (PWR) priorities.

Existing reports by the Tigray Bureau of Industry and firm owners are fragmented and lack rigorous methodologies. Damage assessments are often based on outdated purchase values, with no systematic estimation of losses or reconstruction requirements.

Following the signing of the Pretoria Peace Agreement on November 3, 2022, between the Ethiopian government and Tigray regional forces, there is a growing need for evidence-based post-war reconstruction strategies. To support the recovery of Tigray's manufacturing sector, it is essential to identify damage levels, assess reconstruction needs scientifically, and establish clear priority areas. This study aims to fill these gaps and provide a foundation for effective post-war recovery planning.

1.3 Objectives of the Study

(1) Major objective

The major objective of the study is to assess war impacts on manufacturing firms, estimate reconstruction needs, and identify post-war recovery priorities.

(2) Specific objectives

(i) To estimate the damage sustained by small, medium, and large manufacturing firms.

(ii) To evaluate the war's impact on the performance of manufacturing firms.

(iii) To identify post-war recovery strategies for manufacturing firms in Tigray.

1.4 Scope of the Study

This study focuses on small, medium, and large manufacturing firms located in Mekelle city, Tigray. Micro-manufacturing firms are excluded from the analysis. Firm performance is measured using selected indicators: profit, revenue, savings, employment, and loan repayment. Other performance metrics—such as import-export capacity, tax contributions, and productivity—are beyond the scope of this study. The study is also limited in its temporal scope, relying on data collected during the first wave of the war through a 2022 survey. It excludes data and damage assessments from the second and third waves of the conflict, as well as the siege period.

1.5 Organization of the Study

This paper is structured into five sections: the introduction, followed by the literature review, methodology, results and discussion, and finally, the conclusion and recommendations.

2. Literature Review

2.1 Theoretical review

2.1.1 What is war?

War has been defined from multiple perspectives by various scholars. Stone (1959) defines war as "the relation of one or more governments to at least one other government, in which at least one of such governments no longer permits its relations with the others to be governed by the laws of peace." Sorokin (1937) describes war more broadly as "the breakdown of the crystallized system of relationships" between nations. According to Butler (2014), war is "a conflict carried on by force of arms, as between nations or states, or between parties within a state, often involving a series of battles or campaigns."

Thus, war is an organized and systematized pursuit of defined goals through formalized violence involving at least two actors. It is a goal-oriented activity, limited in scope and duration, governed by rules and regulations—such as the laws of war—that regulate the conduct of armed combatants.

2.1.2 Firm-Level Performance Measures

Performance measurement is a systematic approach aimed at improving organizational effectiveness to achieve strategic objectives, vision, mission, and values. It emerged in the late 1970s in response to the limitations of traditional backward-looking accounting systems, with manufacturing firms initially using financial metrics to evaluate performance relative to previous periods (Gomes et al., 2004).

Traditionally, managers relied mainly on financial (accounting-based) measures. However, recognizing their limitations, researchers and practitioners have increasingly considered non-financial performance indicators (Yeniyurt and Townsend, 2003; Paulson Gjerde and Hughes, 2007).

- **Performance Pyramid:** Lynch and Cross (1991) introduced the performance pyramid, which integrates financial indicators—such as profitability, cash flow, and return on capital—with non-financial metrics, including customer satisfaction, operational flexibility, and organizational productivity. This model links performance measurement to day-to-day operations, making it suitable for operational performance assessment.

- **Balanced Scorecard Approach:** Kaplan and Norton (1992) proposed the balanced scorecard, which evaluates organizational performance from four perspectives:

(1) *Customer Perspective* – assessing how customers perceive and rate the organization's products.

(2) *Internal Business Perspective* – ensuring operational efficiency to satisfy customers.

(3) *Innovation and Learning Perspective* – fostering continuous improvement, learning, and innovation.

(4) *Financial Perspective* – measuring profitability and market share.
This approach balances financial and non-financial metrics to provide a comprehensive view of performance.

- **Operational Performance:** Operational performance reflects the efficiency and effectiveness of manufacturing processes in meeting organizational goals. Effectiveness relates to fulfilling customer needs, while efficiency concerns resource utilization. Accurate measurement requires designing, implementing, and maintaining systems that assess effectiveness, efficiency, quality, and productivity (Oakland, 2000). A robust performance measurement system is essential for operational excellence in manufacturing.

2.1.3 Definition and Classification of Manufacturing Firms

An enterprise is any undertaking engaged in producing or distributing goods and services for commercial benefit beyond subsistence. Ownership structures vary from single households to partnerships, groups, or institutional bodies. There is no universal classification of firms by size; classifications differ across countries.

A manufacturing firm engages in extracting, processing, assembling, or producing goods and includes related facilities such as storage, research and development, and distribution (Devon, 2023).

According to the United Nations (2008), the manufacturing sector includes industries such as leather, wood and furniture, paper products, printing, petroleum refining, chemicals, pharmaceuticals, rubber and plastics, food and beverages, textiles, metals, electronics, machinery, transport equipment, and others.

In Ethiopia, manufacturing firms are classified by size as follows:

- *Micro-enterprise:* up to 5 employees and assets under US$2,032.5
- *Small enterprise:* 6–30 employees and assets between US$2,032.54 and US$30,487.8
- *Medium enterprise:* 31–100 employees and assets between US$30,487.8 and US$406,504.1
- *Large enterprise:* more than 100 employees and assets exceeding US$406,506.1

In Tigray, manufacturing firms operate mainly in six sectors:

(i) metal and wood works,

(ii) textile/garment and leather

(iii) construction materials

(iv) agro-processing

(v) mining, energy, and ornaments

(vi) chemicals and packaging (TBoTI, 2023).

2.1.4 Manufacturing and the Tigray Economy

Tigray's Industry Development Strategy prioritizes agricultural-led industrialization, export-led growth, and labor-intensive industries. To support this, incentive packages—both financial and non-financial—include free or low-lease land, tax holidays up to five years, duty-free imports of inputs, and loans from government and private banks.

The regional government has actively sought foreign direct investment and encouraged local investors, aiming for manufacturing to grow over 20% annually under the First Growth and Transformation Plan (GTP-I), though actual growth fell short. Tigray hosts over 15,000 manufacturing enterprises across all size categories, spanning the sectors mentioned above.

According to the Tigray Region Industry Bureau (2019), micro-enterprises account for 62% of firms, small enterprises 32%, medium 5.2%, and large enterprises only 0.35%. The sector's contribution to the national manufacturing output increased from 2.8% to 9.8% by 2017 but dropped to around 7% in 2018, as other regions expanded their industries (MoIE, 2018).

Despite government focus, manufacturing's contribution to Tigray's regional GDP (RGDP) remains low. During GTP-I, the sector grew by 9.18%, substantially below national averages and planned targets. In GTP-II, the average growth was 9.6%. The construction sector leads the industry sector in RGDP share. Key challenges include limited finance, land, infrastructure, weak governance, and low local investor capacity (TSA, 2020).

Subsector contributions vary: the three major manufacturing categories (cottage, small, medium/large) grew by 8.5% on average. Small firms led growth at 11.05%, followed by medium/large firms at 9.13%, and cottage industries at 5.4% (TSA, 2020). Yet, despite growth, the manufacturing sector's share of RGDP remains small, with medium and large firms contributing 4.9%, small firms 2.8%, and cottage firms 0.3% during the GTP-II period.

2.2 Empirical Literature

The destruction of physical capital, loss of lives, forced migration, and disruption of economic networks have had severe consequences for economic activity. The economic impact of conflict operates through multiple channels, each contributing to overall losses. However, physical destruction alone accounts for only a limited portion of the total economic damage.

Most conflict-related economic losses stem not from destroyed assets but from the underutilization of productive resources. Disruptions to economic organization can be more damaging than capital loss itself. Factors such as reduced connectivity, higher transportation costs, broken supply chains, increased rent-seeking, and erosion of social trust make production extremely difficult during active conflicts (Winter, 1975).

Post-conflict, the manufacturing sector often faces declines in output and increased production costs due to damaged assets, shortages of raw materials, interruptions in water and electricity supply, labor shortages, and lack of working capital. Even firms without direct physical damage may suffer if they depend on inputs from other affected sectors.

Changes in production flow reflect decreases in industrial output and potential rises in production costs, which increase intermediate consumption and affect macroeconomic estimates. Damage to manufacturing assets is first assessed physically and then converted to monetary value based on replacement or reconstruction costs, using pre-conflict unit prices for equivalent quality and quantity.

Empirical studies highlight these effects: Cerra and Saxena (2008) found that output contracted by an average of 18% immediately following civil wars across 190 countries. Abadie and Gardeazabal (2003) identified a 10% GDP per capita gap due to terrorism in the Basque country compared to a synthetic control region. In Cote d'Ivoire, conflict caused a 16–23% decline in firm total factor productivity, with an additional 5–10 percentage point drop for firms owned or employing foreigners (Klapper, 2013). In Ukraine, by July 2022, the war inflicted $8.1 billion in industrial damages, destroying or partially destroying 422 enterprises. Industry ranked third in total damage value after infrastructure and housing, accounting for 8.4% of overall losses caused by the Russian invasion (Markiian & Yevhenia, 2022).

Similarly, the war in Sudan heavily impacted employment. In Khartoum, 46% of firms placed workers on unpaid leave. Other firms reduced staff hours or laid off employees entirely. These impacts varied by location: 63% of firms operating only in Khartoum put employees on unpaid leave, whereas among firms operating both in Khartoum and other states, 29% put employees on unpaid leave, and another 29% kept workers on reduced schedules and production (Oliver et al., 2023).

2.3 Conceptual Framework

A *conceptual framework* is basically the representation of a particular study or survey topic that drives the investigation being reported based on the problem statement (McGaghie and Shea, 2001). The effect of the war on the performance of the manufacturing firms is expressed using the following conceptual framework diagram.

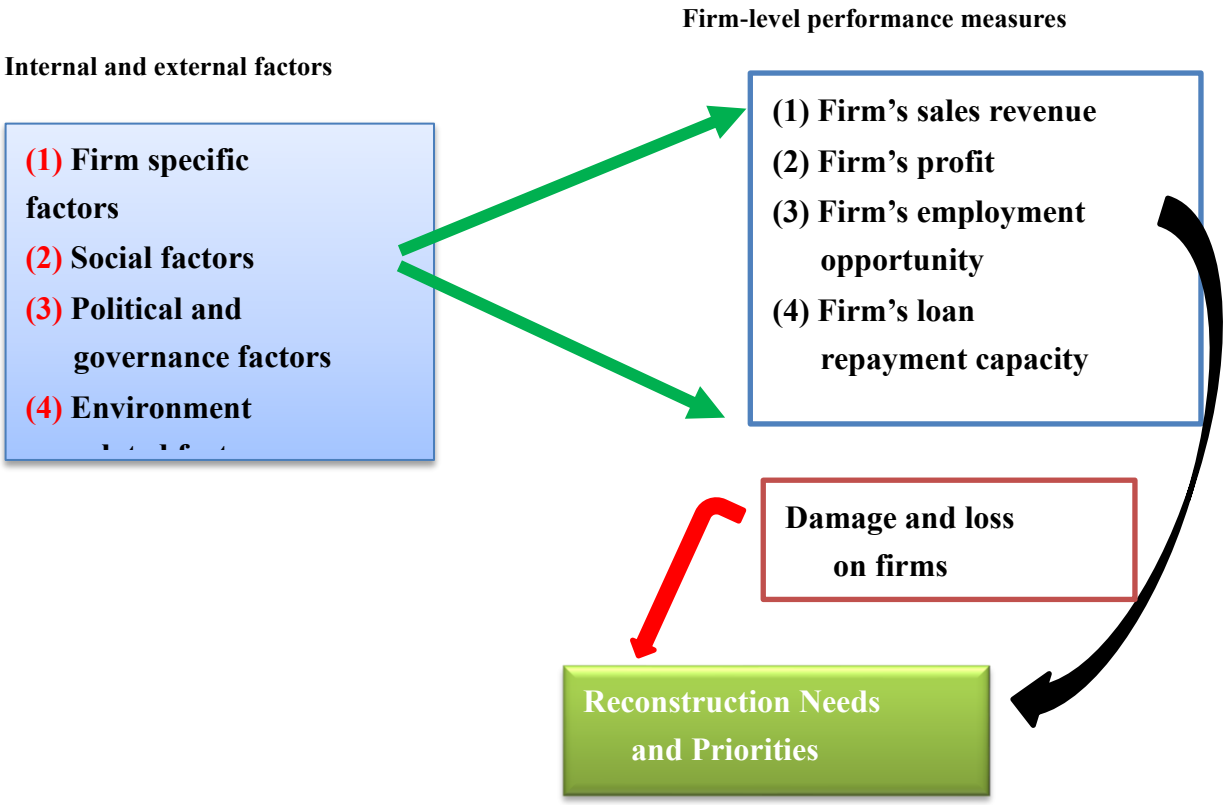

Figure 1. Conceptual Framework

3. Methodology

3.1 Description of Study Area

Mekelle is the capital city of the Tigray region and serves as its economic center, hosting many key economic, social, and political institutions. Administratively, Mekelle is divided into seven sub-cities—Kedamay Weyane, Ayder, Quiha, Hawelti, Hadnet, Semien, and Adihaqui—and 13 large kebelles. Covering an area of 109 km², the city is rapidly expanding by absorbing neighboring parts of Enderta Woreda in the Southeast zone. According to the Tigray Statistics Agency (2019), Mekelle's population exceeds 460,000. The war in Tigray has caused a sharp increase in the city's population, making it home to many internally displaced people.

The Tigray Industry Bureau (2023) reports that over 70% of the region's micro, small, medium, and large manufacturing firms operate within Mekelle and its surrounding areas.

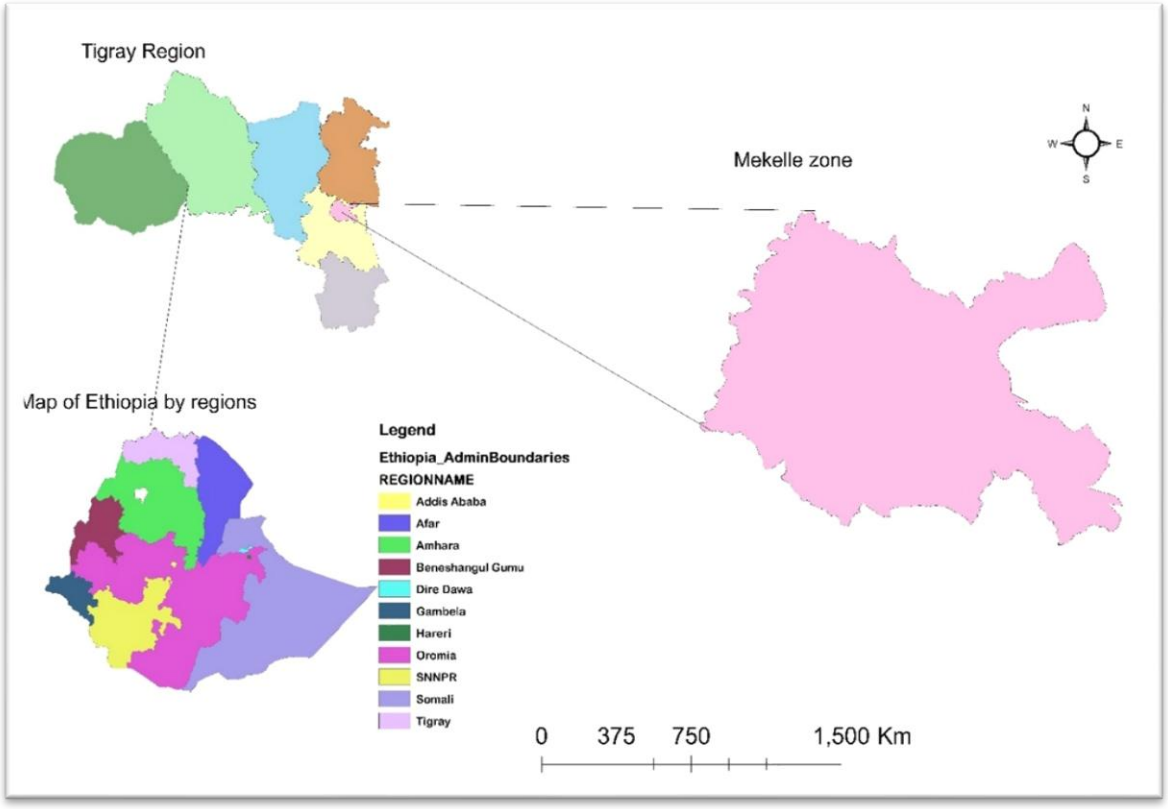

Figure 2. Location map of study area (Mekelle)

Source: Developed by the author using shape files from the Global Administrative Data Base (GADB)

3.2 Nature and Source of Data

This study utilized both quantitative and qualitative data, collected from primary and secondary sources. The primary data was designed to complement the secondary data, which served as the main data source for the study. Secondary data were obtained from the Tigray Statistics Agency (TSA) and the Tigray Institute of Policy Studies (TIPS). The dataset comprises information on over 4,000 manufacturing firms, classified as micro, small, medium, and large enterprises, and operating in six key sectors: agro-processing, textiles, construction materials, wood and metal works, mining and energy, and chemical and packaging industries.

The dataset includes a wide range of variables such as firm characteristics, performance indicators, damage assessments, and information on perpetrators. For the purpose of this study, relevant firms and variables were extracted and analyzed. Specifically, data from 726 manufacturing firms operating across the seven sub-cities of Mekelle were selected.

To supplement and validate the secondary data, primary data were collected through focus group discussions (FGDs), key informant interviews (KIIs), and a detailed case study. Participants included manufacturing firm owners/operators, sector experts, and relevant stakeholders. In total, five KIIs, four FGDs, and one in-depth case study were conducted. The secondary data were collected through a structured questionnaire, using a census approach in woredas where access and security conditions permitted comprehensive coverage.

3.3 Research Design

The study adopted a descriptive research design to evaluate the effects of war on the performance of small, medium, and large manufacturing firms in Mekelle city. A mixed-methods approach was employed, integrating both quantitative and qualitative data collection and analysis techniques.

3.4 Method of Data Analysis

Both quantitative and qualitative methods were applied in the analysis. Descriptive statistical techniques were used to examine the impact of the war on firm performance. Results are presented in the form of percentages, means, and standard deviations, supported by graphs, charts, and tables. Quantitative data were analyzed using STATA 16, while qualitative data analysis was conducted to contextualize and enrich the quantitative findings.

The magnitude of the damage was estimated using the *market value approach,* where the monetary value of the damage was estimated based on its current/market value of the damage. It is estimated using the price one month before the damage was faced (World Bank, 2010). The market value reflects the current value of the damaged item in the market and/or the repair cost or replacement cost for the specific damaged item.

The *Manufacturing Reconstruction Needs* (MRN), defined as the monetary replacement value of the damaged item/asset under consideration, was calculated using the following formula (World Bank, 2010):

$$Manufacturing\ Reconstruction\ Needs\ (\boldsymbol{MRN}) = Value\ of\ damage(D) + \sum_i^n Costs \quad (1)$$

The transformation of *value of damage* in the equation 1 is represented as:

$$\boldsymbol{MRN} = D \times \boldsymbol{\varphi} + D \quad (2)$$

$$\boldsymbol{MRN} = D\ (\boldsymbol{\varphi} + 1) \quad (3)$$

where $\boldsymbol{\varphi}$ represents a disaster-resilient coefficient.

The "Costs" in the formula encompass and address the "Building Back Better" principle by considering quality improvement, technological modernization, relocation when needed, risk reduction features, and multi-annual inflation. According to different studies, in the manufacturing sector, $\boldsymbol{\varphi}$ is estimated and approximated at 0.21. Thus, the manufacturing reconstruction needs for the firms is given as:

$$\boldsymbol{MRN} = 0.21 \times D + D \quad (4)$$

$$\Rightarrow \quad \boldsymbol{MRN} = (1 + 0.21)D = 1.21 \times D$$

4. Results and Discussions

4.1 Characteristics of the Firms

The study categorized firms into four legal types: (i) sole proprietorship, (ii) partnership, (iii) private limited company (PLC), and (iv) cooperative. The majority of the firms (81.96%) operated as sole proprietorships, followed by partnerships at 13.77%. Private limited companies accounted for 3.99%, while cooperatives represented only 0.28% of the total sample. These firms were established between 1983 and 2021.

With respect to the period of establishment, 18.6% of the firms were founded before the Ethiopian Millennium (2008), while 64.04% were established between 2008 and 2018. The remaining 17.36% were founded during the period from 2018 to 2021 (see Annex Table 1 for details). The average startup capital of the sampled manufacturing firms was approximately US$113,284, with a wide variation (standard deviation of US$757,778), ranging from a minimum of US$1.10 to a maximum of US$13.3 million.

Table 1. Startup capital of the manufacturing firms in Mekelle

Variable	No.	Share (%)	Mean ($)	Std. Dev. ($)	Min. ($)	Max. ($)
Cooperative	2	0.28	141,411	114,284	60,600	222,222
PLC	29	3.99	1,320,000	3,444,444	33.3	13,333,333
Partnership	100	13.77	65,955	282,222	4.4	2,444,444
Sole proprietorship	595	81.96	62,285	228,889	1.1	3,111,111
Total	726	100	113,284	757,778	1.1	13,333,333

Source: Extracted and computed from the TIPS's data set 2020 and 2024.

Among the sampled firms, 29 were private limited companies (3.99%), which had an average startup capital of approximately US$1.32 million, with a high standard deviation of US$3.4 million, indicating substantial variation among firms. The cooperative-type manufacturing firms, representing only 0.28% of the sample, had a mean startup capital of US$141,411 and a comparatively lower standard deviation of US$114,284, reflecting more consistency in their initial investment levels.

As shown in Table 1, the majority of the firms—595 sole proprietorships (81.96%)—began operations with an average capital of US$62,285. The minimum recorded startup capital among these firms was just US$1.10, while the maximum reached US$3.1 million. Similarly, partnership firms, which accounted for 13.77% of the sample, reported an average initial capital of US$65,955, with a standard deviation of US$282,222 and a minimum startup capital of US$4.40. These figures illustrate a wide disparity in initial capital investment across different forms of business ownership.

Furthermore, Table 2 indicates that the average number of permanent and temporary employees at the time of firm establishment was 7.2 and 6.2, respectively. The highest reported number of initial employees was 200, while the lowest was one—likely representing a sole proprietor managing the business alone.

Table 2. Average number of employment opportunities before the war

	Permanent job	Temporary job	Total
Initial employment	7.2	6.2	13.4
Employment in 2020	13.26	14.34	27.6
Change (%)	84.17	131.29	105.9

Source: Extracted and computed from the TIPS's data set 2020 and 2024

Before the outbreak of the war, the average number of permanent and temporary employees in the manufacturing firms increased to 13.26 and 14.34 persons, respectively. This indicates a notable improvement in employment generation, with the total workforce expanding by more than 105.9%. Specifically, permanent employment rose by 84.17%, while temporary employment experienced an even greater increase of 131.29%.

As noted earlier, these manufacturing firms provided job opportunities for both male and female workers. Among permanent employees, males constituted 68.8% and females 30.2%. Although male employees dominate in number, the participation of women in this sector is relatively favorable, especially when compared to agriculture, where employment is heavily male-dominated.

Moreover, manufacturing is often perceived as a male-oriented sector due to the physical demands of the work. Despite this perception, the representation of female workers is relatively substantial. These findings on employment creation in Tigray's manufacturing sector align with the employment patterns

and trends reported by the International Monetary Fund (IMF) in its 2018 labor statistics report.

4.2 Extent of Damage to the Firms

The war inflicted substantial damage on manufacturing firms, which can be broadly categorized into direct and indirect damages. This study specifically focuses on the direct damages incurred by firms as a result of the conflict, in line with the methodology and scope outlined.

As illustrated in Figure 3, 78.4% of the surveyed firms reported damage to office assets due to the war. Additionally, 66.3% experienced damage to their machines and machinery. Damage to vehicles, including bicycles, and related spare parts was recorded in 50.7% of the firms. Furthermore, 40.9% of firms suffered damage to their electrical and electronic equipment, 23.7% faced harm to their ICT infrastructure, and 11.2% incurred damage to civil works and buildings.

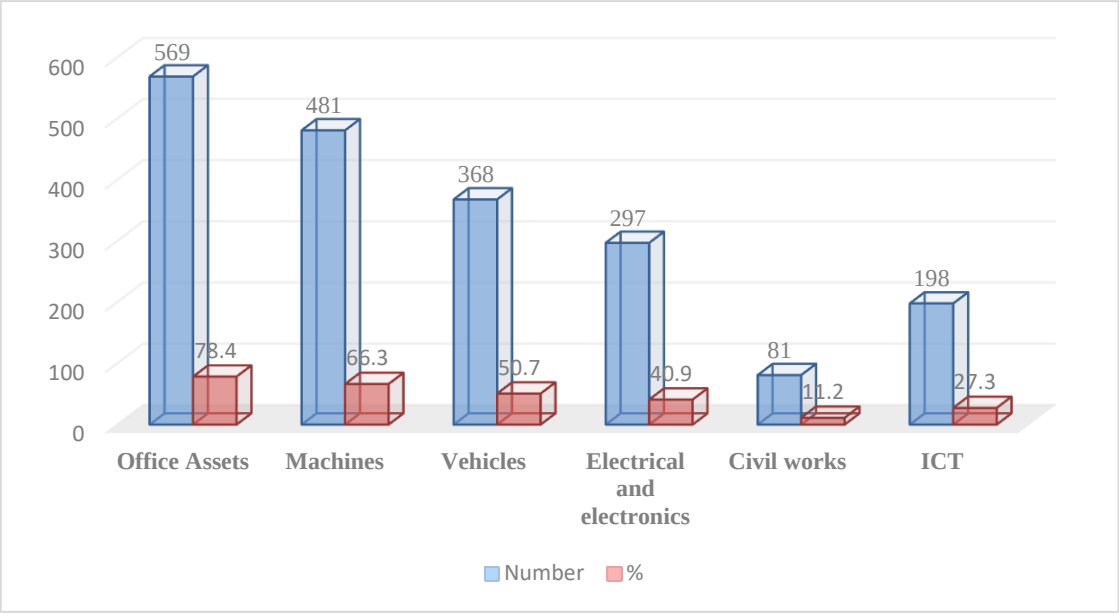

Figure 3. Number and percent of firms faced damage by category

Source: Extracted and computed from the TIPS's data set 2021 and 2024.

The total estimated direct damage resulting from the war amounted to approximately US$1.39 billion. Of this, 51% (equivalent to US$720 million) was attributed to damage sustained by vehicles and special-purpose equipment, including lorries, excavators, loaders, forklifts, rollers, and similar machinery. The second most affected category was machines and machinery, which accounted for 33.14% of the total damage. The estimated loss for machines and their components reached US$463.4 million.

Table 3. Monetary value of damage and reconstruction needs by type of asset (unit: US$)

Type of asset damaged	Direct damage				Reconstruction needs	
	No.	Mean	Total ($)	Share (%)	Mean ($)	Total ($)
Office Asset	726	2,069	1,502,033	0.11	2,504	1,817,073
Civil works and building	726	1,053	764,228	0.05	1,274	924,797
Vehicles and special-purpose vehicles	726	989,837	719,512,195	51.45	1,197,154	869,918,699
Electric and electronic	726	292,683	211,382,114	15.12	353,659	256,097,561
Machines and their components	726	640,244	463,414,634	33.14	774,390	560,975,610
ICT Infrastructure	726	375	272,358	0.02	453	329,268
Total damage	726	1,924,797	1,398,373,984	100	2,337,398	1,691,056,911

Source: Extracted and computed from the TIPS's data set 2021 and 2024.

As presented in Table 3, damage to electrical, electronic, and related equipment accounted for 15.12% of the total loss, amounting to approximately US$211.4 million, making it the third most affected category within the manufacturing sector. Estimated damages to office assets/equipment (0.11%), civil works and buildings (0.05%), and ICT infrastructure (0.02%) were valued at US$1.5 million, US$0.764 million, and US$0.272 million, respectively.

The substantial level of damage sustained by the manufacturing sector in Tigray underscores the severity of the conflict and highlights the vulnerability of this sector to wartime disruptions. This significant loss is consistent with findings from similar studies conducted in conflict-affected regions such as Ukraine and Sudan, as reported by Markiian and Yevhenia (2022) and Olive et al. (2023), respectively.

According to Table 3, the total estimated cost required for the rehabilitation and reconstruction of the damaged manufacturing firms, in line with the World Bank's "Building Back Better" framework, is approximately US$1.7 billion. The reconstruction costs correspond closely with the extent of damage sustained by each subcategory, with the highest costs associated with vehicle and special-purpose equipment, machines and their components, and electrical and electronic assets—these being the three most reconstruction-intensive categories.

4.3 Performance of Firms: Comparative Analysis

This section evaluates the impact of the war on firm performance, measured through key indicators such as profit, revenue, loan repayment capacity, employment levels, and social contributions, comparing the periods before and after the conflict.

As shown in Table 4, prior to the war, the average annual revenue of the manufacturing firms was US$24,985, ranging from a minimum of US$84.40 to a maximum of US$4.6 million. However, by 2021, during the war, average sales revenue plummeted to US$87.50, with the highest reported sales at US$6,690.89 and a minimum of zero for firms that ceased operations. This represents a drastic decline of 103.76% in average sales revenue relative to the pre-war period.

Similarly, average annual profits decreased significantly, from US$6,252.19 before the war—with profits ranging from zero to US$1.16 million—to merely US$23.88 during the conflict. The highest profit during the war was US$1,826.61, while many firms reported no profit. The overall reduction in profit was estimated at 99.62%. Notably, private limited companies experienced the largest decline in profits at 99.9%, whereas sole proprietorships suffered the smallest reduction at 16.4% (see Appendix Table 2).

Table 4. Performance indicators of manufacturing firms before and after the war (unit: US$)

Variable	No.	Mean	Std. Dev.	Min	Max
Average annual sales revenue before the war	726	24,985	191,392	84.4	4,622,222
Average sales revenue in 2021	726	87.4916	452.4	0	6,690.89
Average annual profit before the war	726	6,252.19	47,848	0	1,157,778
Average annual profit in 2021	726	23.88	123.51	0	1,826.61
Average loan repayment before the war	726	1,725.60	13,206.12	0	320,000
Average loan repayment in 2021	726	0	0	0	0
Average employment before the war	726	12.18	24.6	1	320
Average employment in 2021	726	1.09	2.2	0	28.8

Note: The average was computed for five years from 2016 to 2020.

Source: Extracted and computed from the TIPS's data set 2021 and 2024.

The rate of decline in profit varied across firm types, ranging from a 99.27% decrease among sole proprietorships to a comparatively smaller decline of 16.4% in private limited companies (PLCs). Cooperative firms experienced a profit loss of 99.3%, while partnership firms faced a 99.7% reduction in profit as a result of the war. This substantial and near-universal drop in average profits highlights the severity of the conflict and its devastating impact on manufacturing firms.

The third performance indicator examined in this study is loan repayment status. It is well-established that a significant number of manufacturing firms—particularly medium and large enterprises, and to a lesser extent small firms—have relied on loans to finance their establishment and operations. Before the war, none of the firms included in the study had defaulted on loan repayments. However, following the outbreak of the conflict, all firms, regardless of size or ownership type, accrued defaulted loans. Although financial institutions had not yet formally classified these loans as non-performing or taken actions regarding accrued interest, they continued to treat the loans as active debts to be repaid under certain conditions.

Before the war, the average annual loan repayment was approximately US$1,725.60, with payments ranging from zero—reflecting firms that had not taken loans or were benefiting from grace periods—to a maximum of US$320,000. During the war, loan repayments dropped to zero across all firms, indicating a complete halt in repayments to lenders. This cessation is likely attributable to the extensive damage inflicted on firms, resulting in sharp declines in revenue and profitability. Additionally, firms' expectations of compensation for war-related damages and the uncertainty caused by ongoing conflict may have further contributed to the breakdown in loan repayment.

The final performance indicator assessed is employment. Prior to the conflict, the average number of employees per firm was 12.18, with a range from one to 320 employees. Collectively, the sampled firms employed a total of 8,840 individuals, including both permanent and temporary staff. After the war, this figure plummeted to an average of 1.09 employees per firm, with a maximum of 28.8 and a minimum of zero—indicating many firms had ceased operations entirely.

These findings demonstrate the profound negative effects of the war on firm performance across multiple dimensions—revenue, profit, loan repayment, and employment—and are consistent with empirical evidence from prior studies by Cerra and Saxena (2008), Petracco and Schweiger (2012), and Klapper et al. (2015).

4.4 Motivations and Threats Faced by Manufacturers

The manufacturing sector in Tigray experienced varying levels of damage, ranging from complete destruction to moderate or minimal impact. Key targets of this damage included machinery and

equipment, assets and spare parts, buildings, transportation and special-purpose vehicles, electrical and electronic systems, civil works, and ICT infrastructure.

The immediate short-term consequences of this damage included: (i) suspension of operations (reported by 55% of firms), (ii) reduction in production capacity (75%), (iii) operational downtime (60%), (iv) pervasive uncertainty regarding the future of firms (100%), and (v) other effects reported by 30% of firms.

The manufacturing sector was severely impacted by the extensive damage and prolonged siege, leading to a state of economic stagnation and social crisis among manufacturers. However, following the Pretoria Peace Agreement, manufacturers have regained confidence to resume operations and actively participate in the post-war reconstruction efforts. Based on insights gathered from focus group discussions and key informant interviews, the levels of motivation and perceived threats among manufacturers were assessed and are summarized as follows:

4.4.1 Motivation to run firms

The manufacturers are highly encouraged by the Pretoria Peace Agreement and are optimistic about returning to normal operations. Many have begun actively seeking and mobilizing financial resources to restart their businesses and improve their current status, particularly those firms that have resumed limited operations. They have started clearing damaged materials from their stores and workshops, repairing basic machinery, restoring electrical connections, and reconnecting with their workforce. Furthermore, manufacturers have re-established communication with suppliers in Addis Ababa and engaged with banks and microfinance institutions to secure seed funding and alternative financing options such as equity investments. The operators are strongly motivated to recover from the damages incurred, compensate for losses accumulated over the past three years, rebuild or replace sold assets, and contribute to the region's post-war recovery.

One participant from the metal and woodwork subsector shared a personal account reflecting the war's impact on his household and his motivation to rebuild:

> *"Before the war, I leased machinery and supplies for my business. When the conflict erupted, everything came to a halt—I lost all income and struggled to feed my wife and two sons. The machinery was government-owned, so I couldn't sell it, even though I had invested my own money to operate the machines and purchase inputs. We faced severe hardship and could not even afford food as our stocks depleted. I prayed for relief, but the situation only worsened. I considered fleeing to Addis Ababa through Afar, but knowing the risks to Tigrayans, I stayed and chose to sell small equipment such as grinders, welders, plumbing, and cutting tools. As the siege continued, our funds were exhausted, and we were left with nothing. My children didn't fully understand the hardships, although their consumption drastically decreased. Eventually, we sold our refrigerator and sofa set, which was emotionally devastating. I collapsed under the pressure and lost hope. My children kept asking why our belongings were gone, and I struggled to hold back tears, often leaving home to avoid their questions. Recently, I secured a simple job and was able to buy a second-hand sofa and refrigerator to comfort my children. Despite everything, I remain hopeful, buoyed by the Pretoria Agreement, and am ready to restart my business to recover my losses and provide better for my family."*

Similar stories were echoed by many manufacturing operators throughout the sector.

4.4.2 Threats

During discussions, participants expressed several concerns that pose ongoing threats to their recovery efforts. These include perceived delays in the implementation of the peace agreement, insufficient post-agreement support from stakeholders, and exclusion from NGO-led bidding processes due to high capital requirements that small and medium manufacturers cannot meet. Additionally, participants noted inadequate support from the Tigray regional government regarding critical issues within its jurisdiction, such as regional taxation, provision of workspace, infrastructure, and other related challenges.

4.5 Challenges Facing Manufacturers

The manufacturing sector faces numerous challenges that hinder its development. Despite significant growth during the Growth and Transformation Plan (GTP I and GTP II) periods, the sector's overall contribution remains low. These challenges stem from both internal and external factors and have become more frequent, severe, and complex, affecting a broad range of entities and subsectors. Addressing these issues requires swift, coordinated actions and increased attention from the government and other stakeholders. Based on discussions, interviews, and document reviews, the challenges before and after the war are categorized as follows:

Table 5. Challenges in the manufacturing sector: before and after the war

Before the outbreak of the war	After the war (after the Pretoria cessation of hostility agreement)
Shortage of raw materials	Insecure environment
Lack of industrial areas and infrastructure	Unable to start due to the damage
Poor market access or linkage[1]	Hopelessness and skill deterioration, and loss of skilled employees
Lack of access to finance	Lack of finance (recovery, startup)
Weak entrepreneurial ability	Market and lack of customers
Poor business environment and institutional set-up	Unable to pay taxes and loan/ interest
	Lack of foreign exchange
	Lack of Institutional and business environment (infant-coordination with federal)
	Lack of raw materials
	Lack of continued supply of utilities
	Lack of working place and amenities

Source: Developed by the authors from the FGD Discussions.

A major concern raised by discussants was the burden of loan repayment—both principal and interest—accumulated during the period when businesses were non-operational and banks were closed. To support damaged, dormant, and underperforming firms, both the National Bank of Ethiopia (NBE) and private banks are expected to implement recovery measures. The government's role is critical in facilitating the rehabilitation and reconstruction of the manufacturing sector, primarily through financial interventions led by the NBE. In June 2023, the National Bank of Ethiopia introduced a forbearance policy intended for implementation in Tigray.

However, based on consultations with financial sector representatives, manufacturers, expert discussants, and document analysis, the financial measures and NBE's interventions exhibit several shortcomings:

[1] About 38% the firms included in this study had market linkages. 59% of them had horizontal linkages, 25% had linkages with the government offices and 15.6% had linkages with large, medium and small enterprises.

1. The policy did not adequately account for the unique nature and extent of damage in Tigray. While the NBE developed recovery measures after assessing damages in Amhara and Afar regions, it directed their application in Tigray without considering the region's distinct and more severe challenges.

2. The forbearance policy failed to address the concerns of consumers whose assets were damaged during the conflict.

3. Requiring payment of interest for the period when businesses were inactive and customers' accounts were frozen by banks is illogical and unfair.

4. Access to foreign currency remains a critical challenge nationwide, but the situation is significantly worse in Tigray. The problem extends beyond the amount available to include excessive delays; for example, it took over four months to process currency requests from Tigray.

5. Banks operating in Tigray have yet to provide substantive support to manufacturers, primarily because they await national-level decisions. These banks function mainly as intermediaries without autonomous authority.

6. No specific recovery initiatives or tailored financial packages have been introduced by banks to assist damaged firms in Tigray.

7. The volume of loans disbursed to firms in Tigray is disproportionately low relative to regional savings. Despite deposits exceeding US$1.4 billion across government and private banks, loan disbursements amounted to less than US$0.6 billion. This discrepancy indicates that businesses in Tigray have been unable to leverage credit to expand operations, establish new enterprises, or modernize their technologies.

4.6 Postwar Recovery Compensation Mechanisms

As previously noted, manufacturing firms sustained damages exceeding US$1.4 billion, with estimated recovery costs surpassing US$1.7 billion. To facilitate effective recovery and enable these firms to resume normal operations, it is essential to provide compensation to owners through various modalities.

According to the descriptive assessment, 153 firms (21%) did not experience direct physical damage to assets, buildings, machinery, or equipment. Nonetheless, these firms faced significant indirect challenges, including loss of market share, increased input costs, shortages of skilled labor, disruptions in communication and utilities, and financial constraints.

Among the firms that were directly affected, 321 manufacturing enterprises (55.5%) require cash compensation to repair damages and reintegrate into the market. Additionally, 41.3% of firms expressed the need for in-kind compensation in various forms.

Within the in-kind compensation category, the primary mechanisms identified include: (i) duty-free importation of machinery, materials, and equipment (72.4%), (ii) tax relief coupled with adequate provision of foreign currency to facilitate the procurement of replacement equipment (14.6%), and (iii) access to working capital, waiver of loan interest rates, and grace periods for both existing and new loans (13%).

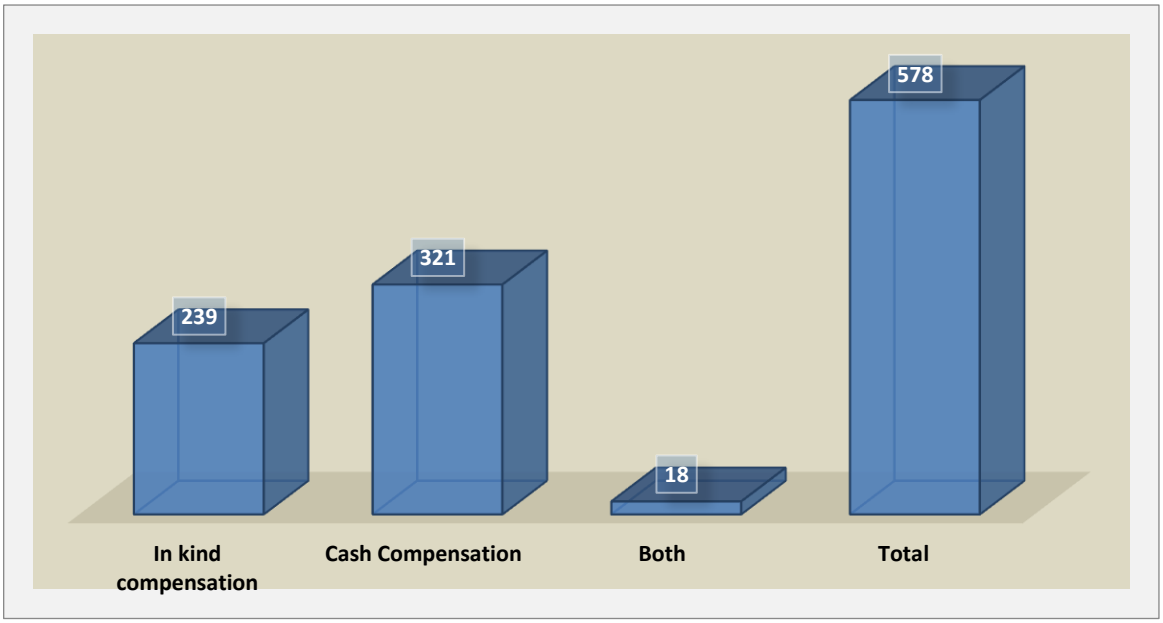

Figure 4. Compensation needs

Source: Extracted and computed from the TIPS's data set 2020 and 2024.

Only 18 firms (3.1%) expressed the need for a combination of both in-kind and cash compensation. This dual requirement arises from several interrelated challenges. First, some of the damaged machinery and essential materials are currently difficult to procure within the local market due to limited availability or supply chain disruptions. Second, firms are concerned about the escalating inflation rates and heightened price volatility affecting construction materials and industrial inputs in Ethiopia, which could undermine the effectiveness of cash compensation alone. Third, the persistent shortage of foreign currency within the banking system further restricts the ability of these firms to purchase imported machinery and equipment critical for their recovery. Consequently, a mixed compensation approach—providing both cash to address immediate financial needs and in-kind support to secure scarce or highly specialized inputs—is viewed as the most practical and effective strategy to facilitate their rehabilitation and sustainable reentry into the market.

4.7 Rehabilitation and Reconstruction Process and Priority Identification in Manufacturing Firms

The post-war reconstruction of the manufacturing sector in Tigray, similar to other affected sectors, requires a well-coordinated and comprehensive approach that encompasses detailed planning, securing sustainable funding, and the establishment of clear priorities to guide recovery efforts. Effective rehabilitation must not only restore physical assets but also revitalize the sector's capacity to contribute meaningfully to economic growth, employment, and social stability.

This section outlines critical considerations and strategic steps necessary for developing a robust post-war reconstruction plan tailored specifically to the manufacturing sector. The approach must balance immediate recovery needs with long-term sustainability and resilience against future shocks. The Post-War Reconstruction (PWR) process in the manufacturing sector should incorporate the following key steps:

4.7.1 Targeting

Reconstruction efforts must adopt a targeted strategy, prioritizing firms based on a multidimensional evaluation of their socioeconomic significance and strategic value to the region's broader development objectives. The criteria for targeting should include:

- **Socioeconomic Contribution:** Firms that generate substantial employment opportunities, provide livelihood support to communities, and contribute to social welfare must be given priority. These

firms often serve as economic anchors in their localities and play a critical role in post-conflict social stabilization.

- **Economic, Social, and Environmental Linkages:** The development of a composite index that captures a firm's interconnectedness with the regional economy—through supply chains, technology transfer, and environmental sustainability—should guide prioritization. Firms with stronger linkages create multiplier effects, amplifying the benefits of reconstruction investments.
- **Technological and Export Potential:** Special consideration should be given to firms that facilitate technology transfer, contribute significantly to export earnings, and support import substitution. These firms enhance the region's competitiveness, diversify economic activities, and reduce dependency on external markets.
- **Dependence on Local Resources:** Priority should be given to enterprises that predominantly utilize local raw materials and inputs, as this strengthens local value chains and promotes inclusive growth.
- **Multi-sectoral Impact:** Firms that have linkages across multiple sectors—such as agriculture, services, and trade—should be considered first, as their recovery has a broader positive impact on the regional economy.

The rehabilitation plan should implement a phased approach, initially focusing on firms with the highest composite index scores to maximize the socio-economic returns of limited resources. Subsequent phases should address firms with lower indices, ensuring inclusivity while maintaining efficiency in resource allocation.

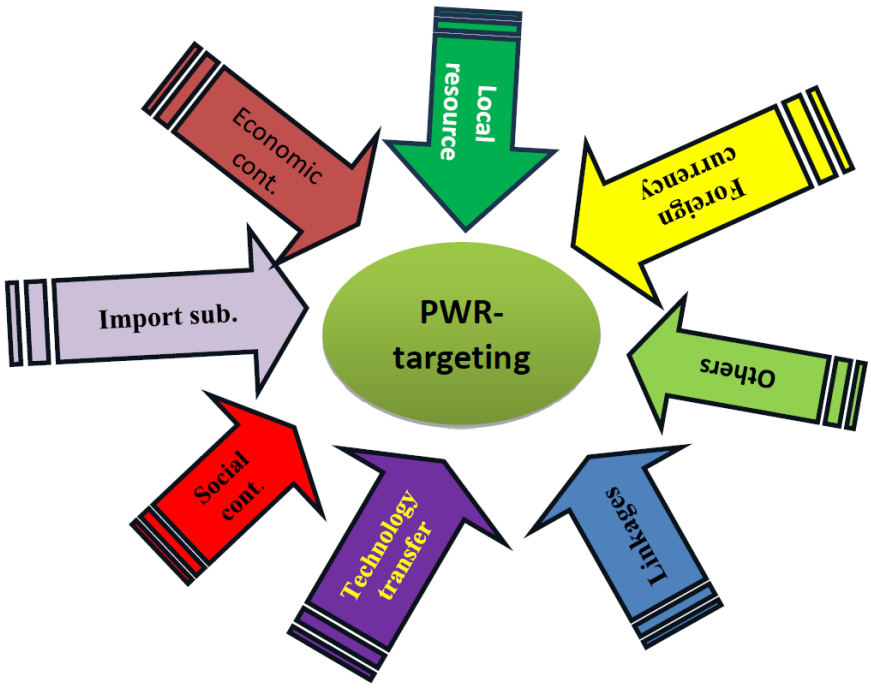

Figure 5. Targeting in PWR

Source: Developed by the authors.

4.7.2 Phasing: phase-based reconstruction intervention

As noted above, addressing the manufacturing sector's recovery based on damage severity cannot be accomplished through a one-time intervention. Instead, a phased reconstruction approach is necessary

to effectively restore production capacity. The proposed process includes the following stages:

(1) Prioritize the recovery and reconstruction of firms with minor damages as well as those that are completely damaged (as identified through damage indexing).

(2) Support the rehabilitation of micro and small enterprises through tailored recovery packages, which may include revolving funds, financial incentives such as interest relief, and other targeted assistance programs.

4.7.3 Recovery packages: industrial recovery and compensation/incentive schemes

Experience from various countries demonstrates that post-war reconstruction (PWR) processes are typically undertaken not only by the affected country itself but also through the active involvement of multinational, international, national, and local organizations. These stakeholders often have diverse motivations for investing in specific sectors of a damaged economy. Therefore, thorough investigations and assessments are essential to identify appropriate intervention areas, understand the interests of different actors, and align their requirements effectively. Based on this understanding, we recommend the following actions:

(1) Develop and introduce industrial recovery package schemes in collaboration with financial institutions, UNIDO, the United Nations, the World Bank, and other relevant stakeholders.

(2) Implement comprehensive compensation and incentive programs at both national and regional government levels, encompassing:

(i) Various forms of compensation, including cash payments, in-kind support, and repair services

(ii) Financial incentives tailored to specific projects, such as interest rate reductions, extensions of loan terms, and provision of additional credit

(iii) Tax relief and duty-free provisions to reduce the cost burden on recovering firms

(iv) Cost-sharing mechanisms to encourage joint investment and risk-sharing

(v) Initiatives aimed at improving market integration to facilitate access to supply chains and export opportunities.

4.7.4 Industry Policy and Strategy: Development of Post-War Reconstruction (PWR) Targeted Policies, Strategies, and Programs

In the aftermath of the conflict, the severity and scope of damage within Tigray's manufacturing sector necessitate the formulation of a dedicated PWR policy and strategy. Such a framework should address critical areas, including land management, investment facilitation, access to finance, and other key government interventions. As part of this recovery policy, the Ethiopian government should implement financial sector forbearance measures that are tailored to reflect the extent of damage, duration of impact, inclusiveness, and the diverse nature of firms within the sector.

4.7.5 Human Resources and Institutional Coordination for PWR

The post-war reconstruction process inherently demands skilled human resources capable of managing and coordinating the substantial financial, human, and material inputs required for relief, recovery, and reconstruction activities. The Tigray regional government should prioritize capacity building among existing personnel, alongside reviewing and updating operational manuals and implementation procedures. Furthermore, based on comprehensive assessments, the regional administration should consider restructuring the civil service bodies directly involved in the PWR and recruiting temporary specialized personnel from international markets to augment local capacities.

4.7.6 Implementation Efficiency: Timeliness and Reliability

Efficient implementation is critical to sustaining ongoing funding from diverse sources. The PWR planning process must be inclusive, holistic, and grounded in active grassroots participation. Engagement of all stakeholders should extend beyond planning to encompass active roles in the implementation and evaluation phases. This participatory approach is essential to ensure accountability,

transparency, and the overall success of reconstruction efforts.

5. Conclusion and Recommendations

5.1 Conclusion

The war inflicted profound and extensive damage on the manufacturing sector in Mekelle, severely impacting the regional economy and social fabric. This study assessed the war's effect on the performance of 726 manufacturing firms across small, medium, and large classifications. Approximately 79% of these firms experienced direct damage, while the remaining 21% were indirectly affected. The total estimated direct damage to the sector exceeds US$1.4 billion, with rehabilitation and reconstruction costs projected to surpass US$1.7 billion.

The conflict significantly disrupted production capacity, manifesting in production suspension (55%), reduction (75%), downtime (60%), and pervasive uncertainty about future operations (100%). Key performance indicators including sales revenue, profit, loan repayment capacity, and employment levels declined drastically. Prior to the conflict, firms generated an average annual sales revenue of US$24,985, which plummeted to US$87.4 in 2021. Profit margins declined by over 99%, varying between 99.2% and 99.9% depending on firm ownership type. Similarly, the average annual loan repayment fell from US$1,725.6 to zero. Employment capacity contracted sharply from an average of 12 employees per firm to just one.

The sector faces numerous compounded challenges that hinder recovery. War-induced disruptions exacerbated pre-existing issues such as raw material shortages, limited access to finance, weak entrepreneurial capacity, and a fragile business environment. New challenges, including damaged infrastructure, insecurity, skill degradation, and loss of experienced personnel, further undermine the sector's revival. To restore normal operations, a combination of in-kind compensation, cash support, or a hybrid of both is essential.

5.2 Recommendations

Based on the findings, the following recommendations are proposed for policymakers and implementers:

- **Collaborative Recovery Efforts:** The manufacturing sector's rehabilitation requires coordinated efforts among firm owners, government bodies, and stakeholders. Comprehensive planning, resource mobilization, implementation, monitoring, and evaluation must incorporate active grassroots participation at all stages.
- **Targeted Post-War Reconstruction Framework:** The reconstruction process must be guided by targeted policies, strategies, and programs that are inclusive and responsive to the extent of damage sustained by firms.
- **Prioritization of Recoverable Firms:** Interventions should prioritize firms that can be rehabilitated efficiently—those that generate significant employment, promote social cohesion, strengthen economic linkages, and rely predominantly on local resources.
- **Strengthening Government Capacity:** Key governmental institutions responsible for implementing recovery programs must enhance their operational capacity to meet the sector's needs effectively.
- **Human Capital Development:** Regional and federal governments, alongside stakeholders and the private sector, should invest in basic skills training, psychosocial support, and motivational programs for employees affected by the conflict.
- **Financial and Material Support:** Damaged firms require targeted financial assistance, including grant support or low-interest startup capital, duty-free importation of essential materials, loan interest waivers, and provision of adequate working spaces. Additionally, the federal government and financial institutions should allocate sufficient foreign currency quotas to enable firms to import necessary inputs for reconstruction.

- **Tailored Financial Sector Interventions:** The National Bank of Ethiopia, as the key financial regulatory institution, should implement firm-specific interventions. This includes revising collateral requirements, improving loan repayment schemes, adjusting foreign currency limits, and other customized measures based on the nature and severity of each firm's damage, rather than applying uniform policies.

References

African Economic Outlook (AEO) (2024). *Driving Africa's Transformation: the Reform of the Global Financial Architecture*. https://www.afdb.org/en/countries/east-africa/ethiopia/ethiopia-economicoutlook#:~:text=Ethiopia%27s%20economy%20grew%207.1%25%20included%20private%20consumption%20and%20investment. Assessed on February 5, 2024

Butler, S. (2014). *Macquarie Complete Dictionary*. iPad App ed. Sydney, NSW, AUST: Macquarie Dictionary Publishers.

Cerra, V., & Saxena, S. C. (2008). Growth dynamics: the myth of economic recovery. *American Economic Review, 98*(1), 439-457.

Chow, H. (2010). Asian Tigers' Choices: An Overview. ADBI Working Paper 238. Tokyo: Asian Development Bank Institute. Available at: http://www.adbi.org/workingpaper/2010/08/09/4029.asian.tiger.economies

Del Prete, Davide, Di Maio, Michele, & Rahman, Aminur. (2021). Firms amid Conflict: Performance, Production Inputs, and Market Competition. Available at SSRN: https://ssrn.com/abstract=3969949 or http://dx.doi.org/10.2139/ssrn.3969949

Devon, Denomme. (2023). What is a manufacturing business? Understand and learn the essential keys for a manufacturing business. https://study.com/academy/lesson/what-is-a-manufacturing-business-definition-examples.html

Elliott, M., & Merrill, F. (1961). *Social disorganization*. New York.

Feierabend, I., & Feierabend, R. (1966). Aggressive behaviors within polities, 1948~1962; a cross-national study. *Journal of Conflict Resolution, 10*(3), 249-71.

Gebreslassie, M. G., Asgedom, H. B., Gebremichael, H. S., Gebremeskel, S. A., Baraki, A., Gebreeyesus, M., & Abrha, H. (2020). The State of Manufacturing Infrastructure and Business Environment in Tigrai: Challenges and Recommended Policies. *Branna Journal of Engineering and Technology, 2*(2), 113-134.

Gomes, C. F., Yasin, M. M., & Lisboa, J. V. (2004). A literature review of manufacturing performance measures and measurement in an organizational context: a framework and direction for future research. *Journal of Manufacturing Technology Management, 15*(6), 511-530.

Hailesilassie, Mehari. (2023). *Wartime innovations in the manufacturing sector in Tigray*. A paper presented at the National Industry Symposium 2023, Mekelle.

International Bank for Reconstruction and Development and World Bank. (2010). Damage, Loss and Needs Assessment. *Guidance Notes*, Volume 3, Washington DC.

International Monetary Fund. (2018). *Employment Trends in the Manufacturing Industry*. Washington, DC.

Jung Mo Kang, & Lee Sung-Kyu. (2024). Policy-augmented Human Capital: A Key Factor to the Rapid Economic Development in Korea. *Review of Institution and Economics, 18*(1), 45-69. https://doi.org/10.30885/RIE.2024.18.1.045

Jwa Sung-Hee, & Lee Sung-Kyu. (2019). Resurrecting the Industrial Policy as Development Policy Based on Korean Experiences. *World Economics, 20*(4).

Kaplan, R. S. & Norton, D. P. (1992). The Balanced Scorecard: Measures that drive performance.

Harvard Business Review, January-February issue, 71-79.

Klapper, Leora, Richmond Christine, & Tran Trang. (2015). Civil Conflict and Firm Performance: Evidence from Cote d'Ivoire. https://cega.berkeley.edu/assets/miscellaneous_files/63-ABCA_-_Civil_Conflict_and_Firm_Performance.pdf

Lynch, R. L. & Cross, K. F. (1991). *Measure Up—Yardsticks for Continuous Improvement*. Business, Oxford.

Markiian, M., & Yevhenia, B. (2022). War Damage to Industry: Rapid Damage Assessment. *Analytics Economics*.

McGaghie, W. C., Bordage, G., & Shea, J. A. (2001). Problem statement, conceptual framework, and research question. *Academic medicine, 76*(9), 923-924.

Ministry of Industry of Ethiopia. (2018). *Performance and Coverage of Manufacturing Firms*. Addis Ababa, Ethiopia.

Oakland, J. (2000). *Total Quality Management Text with Cases*. London, Butterworth Heinemann.

Oliver, K. Kirui, Khalid Siddig, Hala Abushama, & Alemayehu Seyoum Taffesse. (2023). Armed Conflict and Business Operations in Sudan Survey Evidence from Agri-food Processing Firms. *Strategy Support Program*, Working Paper 11, IPFRI. https://doi.org/10.2499/p15738coll2.136835

Paulson Gjerde, K., & Hughes, S. B. (2007). Tracking performance: when less is more. *Management Accounting Quarterly, 9*(1), 1.

Petracco, C., & Schweiger, H. (2012). The Impact of Armed Conflict on Firms' Performance and Perceptions. *European Bank for Reconstruction and Development Working Paper*, 152.

Sorokin, P. (1937). *Social and cultural dynamics, Vol. Iii: Fluctuations of Social Relationships, War and Revolutions*. New York: Amer. Book Co.

Stohl, M. (1971). *The study of conflict behavior within and between nations: some new evidence*. Paper Midwest Political Science Association, Chicago.

Szirmai, A. (2009). *Industrialization as an Engine of Growth in Developing Countries, 1950~2005*. UNU-MERIT, Working Paper, 10.

Tigray Bureau of Industry. (2023). *Consultative Report on the Extent of Damage in the Manufacturing Sector*. Mekelle, Tigray. (unpublished)

Tigray Region Bureau of Trade and Industry. (2019). *Annual Performance Report*. Mekelle.

Tigray Statistics Agency. (2019). *Population Projection Report*. Mekelle. (unpublished)

Tigray Statistics Agency. (2020). *Annual Macroeconomic Report of Tigray Regional State Regional Gross Domestic Product (RGDP) 2008 EFY-2011EFY: Concepts, Data Source and Estimation Techniques*. Mekelle.

United Nations Development Programme (UNDP). (2023). *Can Ethiopia Become a Manufacturing Powerhouse*? Working Paper Series, No. 4.

United Nations. (2008). *International Standard Industrial Classification of All Economic Activities*, Rev. 4, New York. (http://unstats.org/unsd/cr/registry/).

Winter, J. M. (Ed.). (1975). *War and Economic Development: Essays in Memory of David Joslin*. Cambridge: At the University Press.

Winter, S. G. (1975). Optimization and evolution in the theory of the firm. *Adaptive Economic Models*, 73-118.

Yeniyurt, S., & Townsend, J. D. (2003). Does culture explain the acceptance of new products in a country?: An empirical investigation. *International Marketing Review, 20*(4), 377-396.

Appendix

Appendix Table 1. Years of establishment of firms

Year	No.	Percent	Cum.
1975	1	0.14	0.14
1981	1	0.14	0.28
1984	1	0.14	0.41
1985	1	0.14	0.55
1986	3	0.41	0.96
1987	3	0.41	1.38
1988	2	0.28	1.65
1989	2	0.28	1.93
1990	1	0.14	2.07
1991	1	0.14	2.2
1992	3	0.41	2.62
1993	6	0.83	3.44
1994	5	0.69	4.13
1995	9	1.24	5.37
1996	15	2.07	7.44
1997	16	2.2	9.64
1998	17	2.34	11.98
1999	17	2.34	14.33
2000	31	4.27	18.6
2001	17	2.34	20.94
2002	24	3.31	24.24
2003	37	5.1	29.34
2004	30	4.13	33.47
2005	54	7.44	40.91
2006	34	4.68	45.59
2007	54	7.44	53.03
2008	68	9.37	62.4
2009	67	9.23	71.63
2010	80	11.02	82.64
2011	70	9.64	92.29
2012	52	7.16	99.45
2013	4	0.55	100
Total	726	100	-

Source: Computed from the TIPS data set, 2024.

Appendix Table 2. Performance indicators before and after the war by type of firm ownership (Unit: US$)

Ownership	Performance measure	No.	Mean ($)	Std. Dev.	Min. ($)	Max. ($)
Cooperative	Average annual revenue	2	20,000	18,856.18	6,666.67	33,333.33
	Average profit before the war	2	5,000	4,714.04	1,666.67	8,333.33
	Average profit in 2021	2	125	176.7	0	250
	Average loan repayment before the war	2	1,380	1,301.07	460	2,300
	Average loan repayment in 2021	2	0	0	0	0
	Average employment before the war	2	71.5	89.80256	8	135
	Average employment in 2021	2	6.435	8.08223	0.72	12.15
PLC	Average annual revenue	29	293,333	913,333	444.44	4,622,222
	Average profit before the war	29	73,316	228,889	111.11	1,157,778
	Average profit in 2021	29	3	9	0	40.84444
	Average loan repayment before the war	29	20,235	62,973	30.66667	320,000
	Average loan repayment in 2021	29	0	0	0	0
	Average employment before the war	29	54.5	75.77	0	320
	Average employment in 2021	29	4.9	6.82	0	28.8
Partnership	Average annual revenue	100	17,531.61	53,697.38	44.44	444,444.4
	Average profit before the war	100	4,382.90	13,424.34	11.11	111,111.1
	Average profit in 2021	100	27.36	132.02	0	833.33
	Average loan repayment before the war	100	1,209.68	3,705.12	3.06	30,666.67
	Average loan repayment in 2021	100	0	0.00	0	0
	Average employment before the war	100	14.38	24.8	0	170
	Average employment in 2021	100	1.2942	2.2	0	15.3
Sole proprietorship	Average annual revenue	595	13,179.08	36,097.47	0	333,333.3
	Average profit before the war	595	3,301.896	9,028.18	0	83,333.33
	Average profit in 2021	595	23.96538	124.90	0	1,826.614
	Average loan repayment before the war	595	911.3231	2,491.78	0	23,000
	Average loan repayment in 2021	595	0	0.00	0	0
	Average employment before the war	595	9.54	15.78	0	125
	Average employment in 2021	595	0.858857	1.42	0	11.25

Source: Computed from the TIPS data set, 2024.