



WAR AND RESILIENCE

The Multifaceted Impacts of Sudan's
Conflict and Pathways to Recovery



EDITED BY

Khalid Siddig, Oliver K. Kirui, and Paul Dorosh

About IFPRI

The International Food Policy Research Institute (IFPRI), a research center of CGIAR, provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition in low- and middle-income countries. IFPRI was established in 1975 to identify and analyze alternative national and international strategies and policies for meeting the food needs of the developing world, with particular emphasis on low-income countries and on the poorer groups in those countries. Partnerships, communications, capacity strengthening, and data and knowledge management are essential components for translating IFPRI's research to action and impact. The Institute's regional and country programs play a critical role in responding to demand for food policy research and in delivering holistic support to country-led development. IFPRI collaborates with partners around the world.

www.ifpri.org

About CGIAR

CGIAR is a global research partnership for a food-secure, sustainable future, dedicated to transforming food, land, and water systems in a climate crisis. CGIAR science aims to reduce poverty, enhance food and nutrition security, and improve natural resources and ecosystem services. As the world's largest agricultural innovation network, its research is delivered by 13 Research Centers and Alliances, working around the world in close collaboration with hundreds of partners, including national and regional research institutes, civil society organizations, academia, development organizations, and the private sector.

www.cgiar.org

War and Resilience

The Multifaceted Impacts of Sudan's
Conflict and Pathways to Recovery

Edited by Khalid Siddig, Oliver K. Kirui, and Paul Dorosh

A Peer-Reviewed Publication

International Food Policy Research Institute
Washington, DC

Copyright © 2026 International Food Policy Research Institute (IFPRI).

This publication is licensed for use under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/). Subject to attribution, you are free to share (copy and redistribute the material in any medium or format), adapt (remix, transform, and build upon the material) for any purpose, even commercially.

ISBN: 978-0-89629-475-2

Handle: <https://hdl.handle.net/10568/179201>

Library of Congress Control Number: 2026938763

Recommended citation: Siddig, Khalid; Kirui, Oliver K.; and Dorosh, Paul. 2026. *War and Resilience: The Multifaceted Impacts of Sudan's Conflict and Pathways to Recovery*. Washington, DC: International Food Policy Research Institute.

This is a peer-reviewed publication. Any opinions expressed herein are those of the authors and are not necessarily representative of or endorsed by the International Food Policy Research Institute (IFPRI) or CGIAR.

Third-party content: The International Food Policy Research Institute does not necessarily own each component of the content contained within the work. The International Food Policy Research Institute therefore does not warrant that the use of any third-party-owned individual component or part contained in the work will not infringe on the rights of those third parties. The risk of claims resulting from such infringement rests solely with you. If you wish to re-use a component of the work, it is your responsibility to determine whether permission is needed for that re-use and to obtain permission from the copyright owner. Examples of components can include, but are not limited to, tables, figures, or images.

Disclaimer: The boundaries and names shown and the designations used on maps in this book do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI). Final boundary between the Republic of Sudan and Republic of South Sudan has not yet been determined.

International Food Policy Research Institute
1201 Eye Street, NW, 12th floor
Washington, DC 20005 USA
Telephone: +1-202-862-5600
www.ifpri.org

Cover photo and art credits: Ivor Prickett/Panos Pictures; Pascal Maitre/Panos Pictures.

Cover Design and Book Layout: Jason Chow

Project Manager: Claire Davis

Contents

Tables and Figures	vii	
Acronyms and Abbreviations	xv	
Foreword	xix	
Acknowledgments	xxi	
Author Affiliations	xxiii	
<hr/>		
Section I	Origins and Dynamics of the Conflict	1
Chapter 1	Introduction	3
	Khalid Siddig, Oliver K. Kirui, and Paul Dorosh	
Chapter 2	Origins and Causes of Sudan’s Conflict: Domestic and International Perspectives	19
	Suliman Baldo	
Chapter 3	State Failure and Elite Capture of Sudan’s Agrifood System	37
	Danielle Resnick, Hala Abushama, Oliver K. Kirui, Khalid Siddig, and Mosab Ahmed	
<hr/>		
Section II	Economic, Social, and Humanitarian Impacts	65
Chapter 4	Monitoring Economic Activities: Leveraging Satellite and Remote-Sensing Technologies	67
	Zhe Guo, Hala Abushama, Khalid Siddig, Oliver K. Kirui, Anne Timu, Shuang Zhou, Kibrom Abay, and Liangzhi You	
Chapter 5	Cereal Production, Markets, and Policy in Sudan	89
	Paul Dorosh, Oliver K. Kirui, and Khalid Siddig	

Chapter 6	Conflict-Induced Trade Dynamics: A Gravity Framework Analysis of Sudan's Agricultural Exports	117
	Enock Kojo Ayesu, Lukas Kornher, Daniel Sakyi, and Hala Abushama	
Chapter 7	Economywide Impact of Sudan's Conflict and Pathways to Recovery	147
	Khalid Siddig, Zuhail Elnour, and James Thurlow	
Chapter 8	Food Consumption Patterns and Dietary Diversity amid Conflict	169
	Fredrik Svensson and Oliver K. Kirui	
Chapter 9	Worsening Food Security in Sudan amid Conflict	191
	Oliver K. Kirui, Khalid Siddig, Alemayehu S. Taffesse, and Hala Abushama	
Chapter 10	Human Capital at Risk: The Impact of Conflict on Health and Education in Sudan	219
	Ebaidalla M. Ebaidalla, Mohammed Gebrail, Gotada Suliman, Oliver K. Kirui, Tarig Alhaj Rakhy, and Halefom Yigzaw Nigus	
<hr/>		
Section III	Resilience and Recovery Strategies	243
Chapter 11	Shocks, Coping, and Household Livelihood Strategies in Wartime	245
	Oliver K. Kirui and Tarig Alhaj Rakhy	
Chapter 12	Delivering Aid amid Active Conflict and Insecurity: Digital Transfers for Delivering Social and Humanitarian Assistance in Sudan	257
	Kibrom A. Abay, Hala Abushama, Shima Mohamed, and Khalid Siddig	
Chapter 13	Drivers of Vulnerability and Low Resilience in Sudan	287
	Youssef Chaitani and Hong Pum Chung	
Chapter 14	A Sudanese Strategy for Postconflict, Agriculture-led Transformative Growth	309
	Ibrahim Elbadawi	
<hr/>		
Section IV	The Way Forward	345
Chapter 15	Toward a Prosperous and Secure Sudan: A Way Forward	347
	Khalid Siddig, Oliver K. Kirui, and Paul Dorosh	

Tables and Figures

Tables

Table 1.1	Major historical events in Sudan, 1956–2025	7
Table 1.2	Selected economic variables, Sudan, 1991–2023	9
Table 1.3	Selected economic and social indicators, Sudan, 1991–2023	10
Table 1.4	Selected indicators, East African countries, 2023	11
Table 1.5	Summary of micro-level survey data, collected during 2023–2024	11
Table 4.1	NO ₂ concentrations (mol/m ²) and changes in selected cities of Sudan in April 2023	81
Table 5.1	Co-integrated cereal market pairs in Sudan, January 2015–August 2024 data (nominal prices)	99
Table 5.2	Wheat prices in various markets, Sudan, 2023–2024	101
Table 5.3	Sorghum prices in various markets, Sudan, 2023–2024	104
Table 5.4	Sudan model simulation results	107
Table 5.5	Model simulation results for wheat trade liberalization, Sudan	111
Table 6.1	Sudan's major agricultural export products between 2018 and 2022 (HS-6)	128
Table 6.2	Classification of agricultural products into RSF- and SAF-controlled areas	132
Table 6.3	General war effects on Sudan's agricultural exports	132

Table 6.4	War effects on Sudan's agricultural exports disaggregated by RSF- and SAF-controlled products	133
Table 6.5	War effects on Sudan's agricultural exports disaggregated by type of product	134
Table 7.1	Summary of key scenario assumptions	152
Table 7.2	Annual real GDP growth rates (%) and values (US\$ billion), conflict and intervention scenarios, 2025–2030	159
Table 7.3	Average annual growth rates (%) of total and sectoral GDP, conflict and intervention scenarios, 2022–2030	160
Table 7.4	Change in number of poor and undernourished people, conflict and intervention scenarios, 2025–2030	161
Table 8.1	Prevalence of acute malnutrition in children under five years of age, Sudan, based on mid-upper arm circumference	181
Table 8.2	Minimum acceptable diet and subcomponents, disaggregated by age group, Sudan, 2024	184
Table 9.1	Variables used in the analysis: Definitions and a priori expectations	197
Table 9.2	Summary of survey data used in the study	197
Table 9.3	Household food security status based on Food Insecurity Experience Scale raw scores, by state (percentage of households in each category)	201
Table 9.4	Prevalence of household food insecurity in Sudan between 2020 and 2022 using WFP data (percentage)	203
Table 9.5	Rank of states by household prevalence of moderate and severe food insecurity in the preconflict period and during the conflict	203
Table 9.6	Rasch model estimates: Probability of households being food insecure by state (percent of households in each category)	205
Table 9.7	Descriptive statistics of explanatory variables	207
Table 9.8	Semi-nonparametric extended ordered probit for rural households in the preconflict period, 2022	209
Table 9.9	Semi-nonparametric extended ordered probit for urban households in the preconflict period, 2022	210

Table 9.10	Semi-nonparametric extended ordered probit for rural households during the conflict period, 2023/24	211
Table 9.11	Semi-nonparametric extended ordered probit for urban households during the conflict period, 2024	213
Table 10.1	Average life expectancy at birth (in years), 2000, 2010, and 2023	222
Table 10.2	Infant mortality rate (per 1,000 live births), 2000, 2010, and 2023	223
Table 10.3	Under-five mortality rate (per 1,000 live births), 2000, 2010, and 2023	223
Table 11.1	Number of shocks experienced by households	248
Table 13.1	Overall risk, Sudan, 2023	289
Table 13.2	Conflict risk, Sudan	294
Table 13.3	Drivers of vulnerability and resilience for conflict risk, Sudan	295
Table 13.4	Climate risk	299
Table 13.5	Drivers of vulnerability and resilience for natural resources risk, 2013–2023	299
Table 13.6	Drivers of vulnerability and resilience for climate hazards risk, Sudan	300
Table 13.7	Development risk, Sudan	302
Table 13.8	Drivers of vulnerability and resilience for economic risk, Sudan	303
Table 13.9	Drivers of vulnerability and resilience for social risk, Sudan, 2013–2023	305
Table 13.10	Drivers of vulnerability and resilience for institutional risk, Sudan, 2013–2023	305
Table 14.1	Financial requirements to cover basic food commodities deficit in the Arab world	332

Figures

Figure 1.1	Map of Sudan	5
Figure 3.1	Sudan's political settlement, 2011–2019	42
Figure 3.2	Sudan's political settlement, 2019–2021	43
Figure 3.3	Geographical distribution of agribusiness dominance	46
Figure 3.4	Landscape of Sudanese Armed Forces' companies	47
Figure 3.5	Landscape of Rapid Support Forces' companies	49
Figure 4.1	Average of NO ₂ concentration (mol/m ²) in 2022	74
Figure 4.2	NO ₂ levels (mol/m ²) in Sudan before the conflict (April 1–7, 2023)	75
Figure 4.3	NO ₂ levels (mol/m ²) in Sudan during the conflict (April 14–21, 2023)	75
Figure 4.4	NO ₂ levels (mol/m ²) in the Khartoum cities (conflict-affected area)	77
Figure 4.5	NO ₂ levels (mol/m ²) in Ed Damazin, Kadugli, and Kassala (less conflict-affected areas)	78
Figure 4.6	Nightlight intensity (nanowatts per square centimeter per steradian, nW·cm ⁻² ·sr ⁻¹) of March 2022 (upper left), May 2022 (upper right), March 2023 (bottom left), and May 2023 (bottom right)	80
Figure 4.7	Nightlight intensity (nanowatts per square centimeter per steradian, nW·cm ⁻² ·sr ⁻¹) of March 2023 (left) and May 2023 (right).	81
Figure 4.8	Changes in NO ₂ concentrations (mol/m ²) in selected cities for three periods after the conflict began compared to the April 11–15 period	83
Figure 5.1	Production of sorghum, millet, and wheat in Sudan, 2018–2023 (thousand tons)	91
Figure 5.2	Production of sorghum, millet, and wheat in Sudan by state, 2018–2023, thousand tons	93
Figure 5.3	Retail prices of wheat in markets in Sudan, 2019–2024	97
Figure 5.4	Retail prices of sorghum in markets in Sudan, 2019–2024	98

Figure 5.5	Domestic and import parity wheat prices in Sudan (2021 SDG/kg), 2021–2024	102
Figure 5.6	Retail wheat prices in Sudan (SDG/kg), 2023–2024	102
Figure 5.7	Sorghum prices in various markets, Sudan, 2023–2024	104
Figure 5.8	Model simulation results for wheat production and imports, Sudan	108
Figure 5.9	Model simulation results for wheat prices, Sudan	109
Figure 5.10	Model simulation results for wheat consumption by region, Sudan	110
Figure 6.1	Average time and costs to export and import	124
Figure 6.2	Average tariff rate, most favored nation, simple mean, all products (%)	125
Figure 6.3	Per capita sheep ownership in Sudan	131
Figure 6.4	Per capita sesame production in Sudan	131
Figure 7.1	Annual real GDP growth rates and values, preconflict (base) and conflict scenarios, 2023–2030	155
Figure 7.2	Annual GDP growth rates for agriculture, industry, and services, conflict scenario, 2023–2030	156
Figure 7.3	Change in poor and undernourished population, conflict scenario, 2023–2030	157
Figure 7.4	Percent change in per capita consumption relative to baseline, conflict scenario, selected years (2025–2030)	158
Figure 7.5	Change in per capita consumption (%), intervention relative to conflict, 2028	162
Figure 8.1	Food consumption by state, Sudan, 2024	174
Figure 8.2	Prevalence of inadequate food consumption by state, Sudan, 2022, 2023, and 2024	176
Figure 8.3	Prevalence of inadequate food consumption by gender of household head, Sudan, 2024	177
Figure 8.4	Minimum Dietary Diversity for Women by state, Sudan, 2024	178
Figure 8.5	Food Consumption Scores, all Sudan, 2023 and 2024	179

Figure 8.6	Percentage of households that rely on own production for their household cereal consumption by state, Sudan, 2023 and 2024	180
Figure 8.7	Proxy measures of wasting in children under five, by age, Sudan, 2024	182
Figure 8.8	Proxy severe and moderate acute malnutrition levels by state, Sudan, 2023–2024	182
Figure 8.9	Proxy thinness of women, Sudan, 2024	183
Figure 8.10	Proportion of children with potentially fatal malnutrition and fever in the last two weeks, Sudan, 2024	185
Figure 9.1	Household food security status based on Food Insecurity Experience Scale raw scores	200
Figure 9.2	Rasch model estimates: Prevalence of moderate-to-severe and severe food insecurity among rural and urban households before and during the conflict in Sudan	204
Figure 9.3	Households estimated as experiencing moderate or severe food insecurity, before and during current conflict, by gender of household head (percentage)	206
Figure 10.1	Enrollment rate by educational level, average 2000–2022 (percent)	226
Figure 10.2	Literacy rate, adult total (percentage of people ages 15 and above), 2018	227
Figure 10.3	Households' reported ability to obtain health services before and during the conflict	227
Figure 10.4	Urban households reporting no access to health services, by region	228
Figure 10.5	Urban households' own rating of current health status relative to before the conflict	229
Figure 10.6	Urban households' health status by household characteristics	230
Figure 10.7	Distribution of households with school-age members and status of enrollment, by region	231
Figure 10.8	Households with school-age members and status of enrollment, by selected household characteristics	232
Figure 11.1	Types of shocks experienced by rural households	248

Figure 11.2	Use of food-based coping strategies, by region	249
Figure 11.3	Number of livelihood coping strategies used, by region	250
Figure 11.4	Coping strategies by sex of household head, rural households	251
Figure 11.5	Assistance received by source, urban households	253
Figure 11.6	Disruptions in assistance by age, education, and household headship	253
Figure 12.1	Humanitarian access constraint map, January 2025	266
Figure 12.2	Overall preference for transfer modality	268
Figure 12.3	Preference for assistance by preference for transfer modality	271
Figure 12.4	Exposure to digital transfers by preference for transfer modality	272
Figure 12.5	Share of respondents who paid transaction fees, by transfer method and preference for transfer modality	272
Figure 12.6	Priorities (savings and food stocks) by preference for transfer modality	274
Figure 12.7	Access to markets by preference for transfer modality	275
Figure 12.8	Exposure to theft/violence by preference for transfer modality	276
Figure 12.9	General insecurity by preference for transfer modalities	277
Figure 12.10	Trust in banks and NGOs by preference for transfer modalities	278
Figure 13.1	Conceptual framework for the Arab Risk Monitor	288
Figure 13.2	Measurement framework for the Arab Risk Monitor	290
Figure 13.3	Risk vulnerability ranked by domain, Sudan	291
Figure 13.4	Risk resilience ranked by domain, Sudan	291
Figure 13.5	Drivers of vulnerability, Sudan, 2018 and 2023	292
Figure 13.6	Drivers of resilience, Sudan, 2018 and 2023	293
Figure 13.7	Conflict vulnerability and resilience, Sudan, 2023	295
Figure 13.8	Conflict fatalities in Sudan and near Sudan (within 100 km), 2020–2024	296
Figure 13.9	Conflict fatalities and refugees, Sudan, 2018–2024	297

Figure 13.10	People in need and internally displaced people, Sudan, 2018–2023	297
Figure 13.11	Climate vulnerability and resilience in various countries, 2023	298
Figure 13.12	Mean change in temperature by 2025 (2016–2035) compared to the reference period (1981–2000), RCP 8.5, Sudan	301
Figure 13.13	Mean change in precipitation by 2025 (2016–2035) compared to the reference period (1981–2000), RCP 8.5, Sudan	301
Figure 13.14	Development vulnerability and resilience, various countries, 2023	302
Figure 13.15	Acute food insecurity, Sudan, 2020 and 2024	303
Figure 13.16	Real GDP growth and inflation, Sudan, 2013–2025	304
Figure 13.17	Changes in institutional resilience, Sudan, 2013–2023	306
Figure 14.1	Sudan’s domestic capabilities relative to the global average	314
Figure 14.2	Ethiopia’s and Sudan’s divergent growth paths	322
Figure 14.3	Ethiopia’s per capita income is catching up to Sudan’s	322
Figure 14.4	Agricultural labor productivity	330

Acronyms and Abbreviations

ACLED	Armed Conflict Location and Event Data
ADF	Augmented Dickey-Fuller
AIS	Automatic Identification System
ARM	Arab Risk Monitor
CATI	Computer-assisted telephone interview
CBO	Community-based organization
CCP	Chinese Communist Party
CFSAM	Crop and Food Supply Assessment Mission
CFSVA	Comprehensive Food Security and Vulnerability Assessment
CGE	Computable general equilibrium
CHW	Community health worker
CPA	Comprehensive Peace Agreement
EPRDF	Ethiopian Peoples' Revolutionary Democratic Front
ESCWA	United Nations Economic and Social Commission for Western Asia
FAO	Food and Agriculture Organization of the United Nations
FCS	Food Consumption Score
FCS-N	Food Consumption Score-Nutrition
FDI	Foreign direct investment
FFC	Forces of Freedom and Change
FIES	Food Insecurity Experience Scale

GAM	Global acute malnutrition
GCC	Gulf Cooperation Council
GDP	Gross domestic product
GHI	Global Hunger Index
HIPC	Heavily indebted poor countries
ICT	Information and communications technology
IDP	Internally displaced persons
IFI	International financial institution
IGAD	Intergovernmental Authority on Development
IMF	International Monetary Fund
IPC	Integrated Food Security Phase Classification
MAD	Minimum acceptable diet
MDD	Minimum Dietary Diversity
MDD-W	Minimum Dietary Diversity for Women
MIC	Military Industrial Corporation
MOFEP	Ministry of Finance and Economic Planning
MRT	Multilateral resistance terms
MUAC	Mid-upper arm circumference
NCP	National Congress Party
NDVI	Normalized Difference Vegetation Index
NGO	Nongovernmental organization
NISS	National Intelligence and Security Service
NO ₂	Nitrogen dioxide
OLS	Ordinary least squares
PKO	Peacekeeping operation
PPML	Poisson pseudo maximum likelihood
PSA	Power-sharing agreement
RIAPA	Rural Investment and Policy Analysis
RICCAR	Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio Economic Vulnerability in the Arab Region

RSF	Rapid Support Forces
SAF	Sudanese Armed Forces
SDG	Sudanese pound
SDG	Sustainable Development Goal
SHCC	Safeguarding Health in Conflict Coalition
SLMPS	Sudan Labor Market Panel Survey
SNEOP	Semi-nonparametric extended ordered probit
SOE	State-owned enterprise
SPA	Sudanese Professionals Association
SPAM	Spatial Production Allocation Model
SPLM/A	Sudan People's Liberation Movement/Army
SPS	Sanitary and phytosanitary
SRHS	Sudan Rural Household Survey
SUHS	Sudan Urban Household Survey
TARL	Teaching at the Right Level
TROPOMI	Tropospheric Monitoring Instrument
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Programme
VIIRS	Visible Infrared Imaging Radiometer Suite
WFP	World Food Programme
WHO	World Health Organization
WITS	World Integrated Trade Solution

Foreword

Since its inception in April 2023, the ongoing war in Sudan has become far more than a battle for power; for the country's people, it is a shock that has ruptured livelihoods, markets, and the everyday systems that allow families to survive. Since independence in 1956, Sudan has endured repeated cycles of political upheaval and violence that have reinforced deep inequalities between regions, weakened institutions, and sustained mistrust among communities. The current conflict between the Sudanese Armed Forces and the Rapid Support Forces has intensified these long-standing fractures and pushed the country into one of the gravest humanitarian and economic crises in its modern history.

With rigor and clarity, this book documents the impacts of this crisis on people's everyday lives. The war has displaced millions, disrupted core services, and constrained movement and trade. Markets that once connected producers, traders, and consumers have been fragmented; transport routes are insecure or blocked; and food systems have been destabilized. The result is a sharp deterioration in household welfare—lost incomes, higher prices, reduced purchasing power, deepening food insecurity, and limited access to healthy diets—alongside the collapse or severe weakening of health, education, and other essential services. These impacts vary by geography, livelihoods, and exposure to violence, but together they constitute a national emergency with lasting consequences for human capital and social cohesion.

This IFPRI book is the product of the authors' strong commitment to measuring the impact of conflict under extraordinarily difficult conditions. Analyses by IFPRI researchers and colleagues combine primary evidence from household, farmer, and trader surveys with market and price data, remote-sensing indicators, and modeling to discern what is happening across

regions and over time. This approach helps identify the mechanisms by which conflict reshapes incentives, disrupts supply chains, and erodes institutions, and it allows the authors to test recovery options with greater discipline than narrative accounts alone can offer.

Importantly, the book also captures the resilience of Sudan's people. They are not passive victims of conflict: they adapt through social networks, community support, remittances, and the reorganization of household labor, with women often carrying much of the burden of coping and care. This resilience is no substitute for peace, but it points to practical pathways for protecting lives and sustaining dignity, even in the darkest circumstances.

The evidence in these chapters converges on a clear conclusion: Sudan's recovery will require an integrated agenda. Peace and security are indispensable. Reconnecting markets and restoring mobility are essential to revive economic activity and stabilize prices, and restoring basic services is critical to prevent permanent loss of human potential. Social protection must be strengthened to protect consumption and nutrition, while agriculture and enterprise recovery can rebuild incomes and local economies. Finally, sustainable recovery will also require governance reforms that address long-standing inequalities and reduce the dominance of armed actors in economic life. Delayed action will deepen losses; early, coordinated action can limit further damage and help lay the foundation for renewal.

With its unique data and insights into the impact of the conflict in Sudan, this book will be essential reading for any organization working to support recovery efforts, both in Sudan and other conflict-affected countries. Its innovative approach to conducting research during a conflict can provide a model for other researchers, and the analysis on options for moving forward can inform the broad range of policies and investments needed to build a productive, inclusive, and resilient agrifood system for the future. The discussion of delivering assistance amid insecurity is especially timely. This work is a vital contribution to the development of policies and investments that can reduce the damage being inflicted by the conflict and, once peace is achieved, lead to a socioeconomic renewal that will improve the lives of all of Sudan's people.

Dr. Johan Swinnen

Director General, International Food Policy Research Institute

Acknowledgments

We are grateful to the technical editors, chapter authors, and contributing researchers whose scholarship and commitment made this book possible. We also thank the many Sudanese households, farmers, traders, and other respondents who shared their experiences and perspectives—often under conditions of insecurity, displacement, and loss. Their participation is the foundation of the evidence presented here.

This work depended on wide collaboration and dedicated teams. We acknowledge the contributions of colleagues from IFPRI (Kibrom A. Abay, Hala Abushama, Zhe Guo, Shima Mohamed, Tarig Alhaj Rakhy, Danielle Resnick, Gotada Suliman, Alemayehu S. Taffesse, Anne Timu, James Thurlow, Liangzhi You, Halefom Yigzaw Nigus, and Shuang Zhou); World Food Programme, Sudan (Fredrik Svensson); UNICEF, Sudan (Mosab Ahmed); Kwame Nkrumah University of Science and Technology, Ghana (Enock Kojo Ayesu; Daniel Sakyi); Sudan Transparency and Policy Tracker (Suliman Baldo); United Nations Economic and Social Commission for Western Asia (Youssef Chaitani and Hong Pum Chung, as well as Marlene Sara Hess, Ziad Khayat, and Ann Tomaszekiewicz); Qatar University (Ebaidalla M. Ebaidalla); Development Studies & Research Forum (Ibrahim Elbadawi); Humboldt-Universität zu Berlin (Zuhal Elnour); University of Konstanz (Mohammed Gebrail); German Institute of Development and Sustainability (Lukas Kornher); and other partners who supported research design, field implementation, and analytical review.

We extend special appreciation to the field and technical teams—coordinators, supervisors, enumerators, monitors, research assistants, data managers, programmers, and translators—who ensured the research could proceed under exceptional constraints.

We are equally grateful to our support staff, whose behind-the-scenes work sustained the project from start to finish. In particular, we thank Ramela Carrion and Amina Yakubu Bashir for their steadfast administrative and operational support, as well as colleagues who assisted with scheduling, documentation, procurement, and production throughout the process. We also wish to recognize the support of the CPA team, including Claire Davis, Pamela Stedman-Edwards, and Charlotte Hebebrand, along with Jamed Falik, Jason Chow, and Michael Go, for their guidance on coordination, communications, and the practical steps required to bring this book to publication.

This research was supported by the donors who fund CGIAR's Science Programs on Policy Innovations and Food Frontiers and Security through their contributions to the [CGIAR Trust Fund](#). Any remaining errors are the responsibility of the authors and editors.

We hope this book will be useful to Sudanese decision-makers, humanitarian and development practitioners, regional and international partners, and researchers in supporting policies and programs that protect lives now and contribute to a more secure, inclusive, and resilient Sudan.

Author Affiliations

Kibrom A. Abay, Senior Research Fellow, Development Strategies and Governance (DSG) Unit, IFPRI

Hala Abushama, Research Analyst, DSG, IFPRI

Mosab Ahmed, Social Policy Specialist, UNICEF, Sudan (former IFPRI Research Assistant)

Gotada Suliman, Research Analyst, DSG, IFPRI

Enock Kojo Ayesu, Lecturer, Kwame Nkrumah University of Science and Technology (KNUST)

Suliman Baldo, Director, Sudan Transparency and Policy Tracker

Youssef Chaitani, Project Coordinator, United Nations Economic and Social Commission for Western Asia (UNESCWA)

Hong Pum Chung, Statistician, UNESCWA

Paul Dorosh, Emeritus Fellow, IFPRI

Ebaidalla M. Ebaidalla, Assistant Research Professor, Qatar University

Ibrahim Elbadawi, Founder, Managing Director, Development Studies & Research Forum

Zuhail Elnour, Postdoctoral Research Fellow, Humboldt-Universität zu Berlin

Mohammed Gebrail, Postdoctoral Researcher, Department of Politics and Public Administration, University of Konstanz

Zhe Guo, Senior GIS Coordinator, Foresight and Policy Modeling (FPM) Unit, IFPRI

Oliver K. Kirui, Research Fellow, DSG, IFPRI

Lukas Kornher, Senior Researcher, German Institute of Development and Sustainability

Shima Mohamed, Research Analyst, DSG, IFPRI

Tarig Alhaj Rakhy, Research Analyst, DSG, IFPRI

Danielle Resnick, Senior Research Fellow, Markets, Trade, and Institutions Unit, IFPRI

Daniel Sakyi, Professor of Economics and Director of the Centre for Cultural and African Studies, KNUST, Ghana

Khalid Siddig, Sudan Country Program Leader and Senior Research Fellow, DSG, IFPRI; Associate Professor, Khartoum University

Fredrik Svensson, Vulnerability Analysis and Mapping Officer, World Food Programme

Alemayehu S. Taffesse, Senior Research Fellow, DSG, IFPRI

James Thurlow, Director, FPM, IFPRI

Anne Timu, Associate Research Fellow, FPM, IFPRI

Halefom Yigzaw Nigus, IFPRI Research Collaborator (Consultant)

Liangzhi You, Senior Research Fellow, FPM, IFPRI

Shuang Zhou, Research Analyst, FPM, IFPRI

Other Contributors

Johan Swinnen, Director General, IFPRI

SECTION I

Origins and Dynamics of the Conflict

INTRODUCTION

Khalid Siddig, Oliver K. Kirui, and Paul Dorosh

Sudan is experiencing one of the most severe humanitarian and economic crises in its modern history due to the ongoing conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF). The war has devastated livelihoods, displaced millions, and significantly weakened the country's agrifood system and broader economic structure (Ahmed et al. 2026; Siddig et al. 2025). Since the conflict erupted in April 2023, it has escalated into the world's largest displacement crisis, with nearly 12 million people—nearly one-third of Sudan's population—forced to flee their homes, including 4.5 million refugees who have sought safety in neighboring countries, including Egypt, Chad, South Sudan, and Ethiopia (UNHCR 2026).¹

The death toll has been staggering: estimates from the Armed Conflict Location and Event Data (ACLED 2025) suggest that 44,873 people were killed between April 15, 2023, and September 19, 2025, but other estimates vary widely, with some indicating that as many as 150,000 people have been killed by direct violence, starvation, and disease (Sampson 2025). The situation is particularly dire for children, with 16 million in need of humanitarian assistance, and most school-age children—more than 17 million out of 19 million—out of school (UNICEF 2025). The conflict has also led to widespread destruction of infrastructure, including hospitals and schools, further exacerbating the humanitarian crisis.

The current conflict is only the most recent in a long series, however. Sudan's ongoing crisis is deeply rooted in structural political and economic dynamics that have shaped conflict across the region for decades. As Alex de Waal argues, Sudan developed one of the most complex versions of a "political marketplace"—a system in which political authority is transactional, militarized, and sustained through the buying and selling of loyalties rather than through institutionalized governance (de Waal 1989). Oil (and more recently

1 Data as of February 2026.

gold) revenues, commercialized conflict, and elite patronage networks created incentives for armed competition and fragmented authority, leaving the state vulnerable to repeated cycles of violent contestation. This longstanding political economy helps explain the persistence and destructiveness of contemporary conflicts, including those in Darfur, South Sudan, and now between the SAF and RSF. Conflict between northern Sudan (the present country of Sudan) and southern Sudan (now the country of South Sudan), as well as fighting in Darfur in western Sudan, has plagued the greater Sudanese region for decades.² Ending the current civil war is obviously crucial for improving the lives of Sudan's people, as the war is taking an enormous toll in lives lost, injuries, and displacement. If peace can be restored, there is substantial reason to hope for major improvements in people's lives. Other African countries, including Kenya, Mozambique, Rwanda, and Uganda, successfully stabilized after periods of internal conflict. Such an outcome is possible for Sudan as well.

Nonetheless, Sudan faces several major strategic development challenges, in addition to its ethnic and political divides. Perhaps most important for agriculture is the management of water resources, an issue that will likely become increasingly important with climate change. Rebuilding the country's transport and damaged or destroyed infrastructure is necessary to enable rapid economic growth. Major investments are also needed in education to increase the skill levels and productivity of Sudan's labor force. Strategic choices regarding sectors and locations of public investment will be crucial.

This book compiles much of the material presented and discussed at the *Sudan Conflict Conference: Navigating Recovery and Resilience*, held on April 14–15, 2025, in Nairobi, Kenya. Marking two years since the conflict's onset, the event brought together researchers, policymakers, and humanitarian actors to discuss emerging findings and recovery strategies. Much of the analysis draws on recent surveys of households, farmers, enterprises, and workers, with many of these designed by the chapter authors.

This book is not only about research findings, however. It also draws upon other countries' experiences from comparable conflicts to identify applicable recovery models. We discuss possible solutions to enhance resilience and facilitate sustainable recovery efforts.

2 Unless otherwise noted, in this book, "Sudan" is used to refer to the present-day (2026) country of Sudan, that is, it excludes the current country of South Sudan.

FIGURE 1.1 Map of Sudan

Source: HDX (2026).

Note: Dotted lines indicate disputed territories. Boundaries and names shown and designations used on this map do not imply official endorsement or acceptance by the International Food Policy Research Institute (IFPRI).

Key historical and geographic context

Prior to the independence of South Sudan in 2011, Sudan was the largest country in Africa by area, and it remains the third largest in the continent (Figure 1.1). Apart from relatively small mountain zones, the northern half of the country is desert or semi-desert, while the southern half of the country is mainly low rainfall savanna woodlands. Most of Sudan's agriculture is concentrated in the southern part of the country, where the Nile and its tributaries provide water to irrigate about 5 million hectares, approximately one-fourth of the country's total cropped area (Sudan, Ministry of Agriculture and Forestry 2015). The White Nile, which flows north from Uganda through South Sudan and into southern Sudan, and the Blue Nile, which flows northwest

from the highlands of Ethiopia, meet in Khartoum to form the Nile, which flows north to Egypt.³

Sorghum is the main cereal crop of Sudan and is cultivated on irrigated land in a semi-mechanized system that uses tractors for land preparation and on nonirrigated land in a traditional agropastoral rainfed system. Millet is a major crop in the traditional rainfed sector, while all wheat is cultivated on irrigated land. About 40 percent of the population raise livestock, which play a major role in the food system and serve as a store of wealth.

After centuries of shifting rule by outside forces, in 1899, Egypt and Britain established joint rule of northern and southern Sudan—the two regions now known as Sudan and South Sudan. Under this arrangement, the two regions were considered separate provinces and beginning in the 1920s, passports were required for travel between them. When Sudan declared its independence in December 1955, both regions were included under the new central government.

Civilian government lasted only until 1958, however, and military governments ruled Sudan from 1958 to 1964, and then again from 1969 to 1985 under Gaafar Nimeiry (Table 1.1). Another coup d'état in 1989 brought Omar Al-Bashir to power, initially as part of a military junta. Al-Bashir ruled until he was overthrown in April 2019 and eventually replaced by Abadallah Hamdok as prime minister in August of that year.

Hamdok's government successfully negotiated debt relief and the lifting of economic sanctions on Sudan in March 2021, but it was overthrown in a military coup led by General Abdel Fattah Al-Burhan in October 2021. Hamdok was reinstated briefly as prime minister from November 2021 until early January 2022. After January 2022, Sudan effectively had no civilian prime minister, with power consolidated under military leadership until the army chief appointed Kamil Al-Taib Idris as prime minister in May 2025 (Reuters 2025). Civil war broke out in April 2023 between the SAF, led by General Abdel Fattah Al-Burhan, and the RSF, led by Mohamed Hamdan Dagalo (known as "Hemedti").

3 Construction and subsequent filling of the Grand Ethiopian Renaissance Dam on the Blue Nile in northwest Ethiopia led to intense debates between Egypt, Sudan, and Ethiopia regarding water rights in the greater Nile River Basin.

TABLE 1.1 Major historical events in Sudan, 1956–2025

Time frame	Event
1956	Sudan gains independence from the United Kingdom and Egypt
1969–1985	Gaafar Nimeiri leads military governments following a coup in May 1969, ruling until his overthrow in April 1985
1989	Omar Al-Bashir seizes power in a military coup, with support from the National Islamic Front
1997	The United States imposes comprehensive economic sanctions on Sudan, citing support for terrorism and human rights abuses
1999	Sudan begins exporting oil, marking a turning point in its economic trajectory, and reducing dependence on agriculture
2003	Conflict begins in Darfur between Sudanese government forces and rebel groups, leading to humanitarian and political crises
2005	The Comprehensive Peace Agreement is signed between the Sudanese government and Sudan People's Liberation Movement, ending the Second Sudanese Civil War
2011	South Sudan declares independence after a referendum in January, formally becoming a new nation on July 9, 2011. Sudan loses about three-quarters of its oil reserves, triggering a sharp economic and fiscal crisis.
April 2019	Omar Al-Bashir is overthrown by the military following months of mass protests; the Transitional Military Council takes control
August 2019	A transitional government formed; Abdallah Hamdok is appointed prime minister under a power-sharing agreement between civilians and the military
December 2020	The United States officially removes Sudan from its list of State Sponsors of Terrorism
June 2021	Sudan reaches the decision point under the IMF/World Bank Heavily Indebted Poor Countries Initiative, qualifying for debt relief of more than US\$50 billion
October 2021	A military coup led by General Abdel Fattah Al-Burhan dissolves the transitional government
November 2021	Abdallah Hamdok is reinstated under a political agreement with the military, though the move is widely rejected by pro-democracy groups
January 2022	Abdallah Hamdok resigns
2022–2023	The economic reform program stalls following political instability and the October 2021 coup; inflation remains among the highest globally
April 2023	Civil war begins between the SAF, led by army commander Abdel Fattah Al-Burhan, and the RSF, led by Mohamed Hamdan Dagalo (also known as "Hemedti")
April 2025	The SAF regains control over Khartoum State; the RSF declares the formation of an alternative government (the Government of Peace and Unity) to govern areas under its control, including parts of Darfur and Kordofan
May 2025	Sudan's army chief appoints Kamil Al-Taib Idris as prime minister in a move to reestablish a transitional civilian government
September 2025	The Quad (the United States, Saudi Arabia, Egypt, and the United Arab Emirates) launch a new peace initiative, which proposes a phased roadmap for Sudan, starting with a three-month humanitarian ceasefire to enable expanded relief operations and better protection for civilians in conflict areas
October 2025	The RSF reportedly regains control over El-Fashir, the capital city of Northern Darfur State

Economic reforms and outcomes since 1990

Al-Bashir's government implemented a series of economic reforms in the 1990s, reducing subsidies and ending various monopolies held by public parastatals. Despite a series of devaluations, however, controls on foreign exchange remained, contributing to substantial implicit taxation of agriculture for most of this period. Average price distortions in agriculture, as measured by nominal rates of assistance, were consistently negative over the 1955–2004 period, though their magnitude was substantially less in the 1999–2004 period (Faki and Ahmed 2007). Wheat production on irrigated land in the Jazirah irrigation scheme in central Sudan was promoted in an effort to achieve food self-sufficiency, even though cotton cultivation would have been more profitable (Hassan et al. 2000).

The independence of South Sudan in July 2011 compounded these macroeconomic difficulties, as oil revenues had accounted for more than half of the Sudan government's revenue and 95 percent of its exports. Subsequent fiscal deficits led to high inflation, appreciation of the real exchange rate (a measure of the relative price of tradable goods relative to nontradables), and more severe price distortions. Macroeconomic distortions steadily increased over the 2013–2017 period, as domestic inflation exceeded the depreciation rate of the nominal exchange rate (286 percent versus 31 percent). Thus, the real exchange rate appreciated by 45 percent, spurring demand for imports, and ultimately required restrictions on imports in the form of import licenses to limit the balance of payments deficit (Dorosh 2021).

Real per capita growth in gross domestic product (GDP) slowed considerably over this period, from 6.2 percent between 1991 and 2001, to 3.6 percent in the next two decades, and to –3.3 percent from 2011 to 2023 (Table 1.2). Agricultural GDP growth also declined steeply from 6.6 percent to 1.6 percent in the first two periods, and then fell by 1.9 percent in the last period (2011–2023). Agriculture's share in GDP (36.6 percent) was higher in 2023 than in 1991 (32.4 percent), however, because oil revenue and GDP were also lower. Moreover, the shares of gross domestic savings, gross capital formation, and exports and imports in GDP all fell steeply between 2011 and 2023.

Despite the generally negative trends observed in major economic variables, some broad measures of development have improved over the past three decades. Access to electricity rose from 26.9 percent in 1991 to 66 percent in 2023. Over the same period, urbanization increased from 29.8 percent to 36.3 percent, and most importantly, life expectancy at birth rose for both women and men, increasing from 58.3 to 69.6 years for women and from 53 to 63.3 years for men (IMF 2025; World Bank 2025).

TABLE 1.2 Selected economic variables, Sudan, 1991–2023

	1991	2001	2011	2023	Annualized growth rate (%)		
					1991–2001	2001–2011	2011–2023
Population (millions)	22.5	28.5	36.1	50.0	2.4	2.4	2.7
GDP, PPP (constant 2021 international \$)	70.8	128.9	184.4	123.6	6.2	3.6	–3.3
GDP per capita, PPP (constant 2021 international \$)	2,591.9	3,701.5	4,467.6	2,469.2	3.6	1.9	–4.8
GDP constant 2015, billions	22.0	40.1	57.3	38.4	6.2	3.6	–3.3
Agricultural GDP (constant 2015 US\$, billions)	7.6	14.4	16.9	13.4	6.6	1.6	–1.9
Share of agriculture (% of GDP)	32.4	39.9	30.2	36.6	0.7	–1.0	0.6
Share of industry (% of GDP)	7.4	13.1	16.2	16.9	0.6	0.3	0.1
Share of services (% of GDP)	60.2	47.0	53.6	46.5	–1.3	0.7	–0.7
Other (% of GDP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gross domestic savings (% of GDP)	12.9	30.0	33.6	1.9	8.8	1.1	–21.2
Gross capital formation (% of GDP)	10.5	20.5	23.3	2.2	6.9	1.3	–17.9
Exports of goods and services (% of GDP)	3.3	9.6	12.5	1.1	11.1	2.7	–18.3
Imports of goods and services (% of GDP)	11.7	10.7	15.0	1.4	–0.9	3.4	–18.1
Official exchange rate (SDG/US\$)	0.007	2.6	2.7	790 ^a	80.7	0.3	60.7
Consumer price index (2015=100)	0.42	37	118	203 ^b	56.3	12.4	4.6

Source: IMF (2025), World Bank (2025), and authors' calculations.

Note: ^a = end of period; ^b = end of period, using estimated annual percentage changes from 2022 to 2023. SDG = Sudanese pounds. The figures shown for 1991, 2001, and 2011 reflect data for northern Sudan (excluding the economy of the future South Sudan).

Regional comparisons

Sudan shares many characteristics with neighboring countries, but it also differs in various ways (Table 1.3). Sudan's population of 50 million people is similar to that of Kenya (55.3 million), but less than half that of Ethiopia (128.7 million) and Egypt (114.5 million). Its urbanization rate is similar to that of Kenya and Ethiopia, but far less than Egypt's. Sudan's GDP per capita of US\$767 (2015) per person is far lower than that of Egypt (\$4,111) and Kenya (\$1,808), but only slightly less than Ethiopia's (\$875). From 2020 to 2023, Sudan's GDP per capita growth rate was sharply negative (–10.1 percent per year), while the economies of Egypt, Ethiopia, and Kenya all grew by 2.9 to 4 percent per capita per year.

Sudan's economic structure is most similar to that of Chad and Ethiopia: agriculture's share of GDP is 31 to 39 percent for all three countries, but it is only 16.2 and 10.5 percent for Kenya and Egypt, respectively. The agriculture sector is expanding in these other countries, however, while in Sudan, it contracted by an average of 1.3 percent per year from 2010 to 2023. Sudan's

TABLE 1.3 Selected economic and social indicators, Sudan, 1991–2023

Indicator	1991	2001	2011	2023	Annualized growth rate (%)		
					1991–2001	2001–2011	2011–2023
Access to electricity (% of population)	26.9	29.4	38.3	66.0	0.9	2.7	4.6
Urban population (millions)	6.7	9.3	12.0	18.2	3.3	2.6	3.5
Urbanization rate (% of population)	29.8	32.5	33.2	36.3	0.9	0.2	0.8
Life expectancy at birth (years)							
Women	58.3	61.9	65.9	69.6	0.6	0.6	0.5
Men	53.0	56.9	60.7	63.3	0.7	0.7	0.3
Total	55.6	59.3	63.2	66.3	0.6	0.6	0.4
Poverty rate*							
Rural	94.0	85.0	58.0	65.0	–1.0	–3.7	0.9
Urban	80.0	60.0	27.0	35.0	–2.9	–7.1	2.2
Total	87.0	72.5	46.5	52.0	–1.8	–4.4	1.0

Source: FAO (2011); UNDP and OPHI (2023), World Bank (2019; 2025), and authors' calculations.

Note: * Figures for changes in poverty are percentage points per year. The figures shown for 1991, 2001, and 2011 reflect data for northern Sudan (excluding the economy of the future South Sudan).

poverty rate of 57.2 percent is similar to that of South Sudan, Chad, and Kenya, the only neighboring countries with recent data.

Similar patterns are seen in other measures of household and individual welfare, many of which are reflected in the Global Hunger Index (GHI) (Table 1.4). Sudan's GHI score ranks the country as 110th in the world, placing it in the same range as Chad, Kenya, and South Sudan but considerably lower than Egypt. The GHI is an unweighted average of four components measured in 2023: undernourishment, child wasting, child stunting, and child mortality. Stunting (low height for age) is particularly high in Sudan (39.6 percent), comparable to stunting in Ethiopia and Chad (36.8 and 31.9 percent, respectively). Life expectancy at birth in Sudan (66.3 years) is similar to that in Kenya (63.6) and Ethiopia (67.3), which is considerably higher than in Chad (55.1) and South Sudan (57.6), but 5.3 years lower than in Egypt (71.6).

Microlevel primary survey data used in the book

The analyses presented in this volume draw on a combination of primary and secondary data sources collected by IFPRI and its partners between 2023 and 2024 (Table 1.5). The primary data comprise a series of national and sub-national surveys, including rural and urban household panels, and small-holder farmer surveys. Data collection employed computer-assisted telephone

TABLE 1.4 Selected indicators, East African countries, 2023

	Chad	Egypt	Ethiopia	Eritrea	Kenya	South Sudan	Sudan
Population (millions)	19.3	114.5	128.7	3.5	55.3	11.5	50.0
Population growth rate (% , 2023)	4.6	1.7	2.6	1.8	2.0	4.1	1.3
Population in urban agglomerations of more than 1 million	1.6	27.8	5.5	...	6.8	...	6.3
GDP per capita (constant 2015 US\$)	567	4,111	875	...	1,808	...	767
GDP per capita growth rate (constant 2015 US\$, 2020–2023, %)	–1.9	2.9	3.1	...	4.0	...	–10.1
Agriculture, value added (% of GDP)	39.4	10.5	30.6	...	16.2	...	36.6
Agriculture, value added (growth rate 2010–2023, %)	1.0	0.9	1.3	...	0.3	...	–1.3
Poverty headcount ratio at \$3.65 a day (2017 PPP) (% of population)	65.7	66.9	63.5	57.2
Global Hunger Index (score)**	36.4	13.2	26.2	...	25	...	28.8
Global Hunger Index (country rank)**	125	63	102	...	100	...	110
Undernourishment (%)	35.1	8.5	22.2	...	34.5	19.6	11.4
Child wasting (%)	7.8	5.3	6.8	...	4.5	...	17.4
Child stunting (%)	31.9	21.1	36.8	...	17.6	...	39.6
Child mortality (%)	10.3	1.8	4.6	3.7	4.1	9.9	5.2
Life expectancy at birth, total (years)	55.1	71.6	67.3	68.6	63.6	57.6	66.3
Life expectancy at birth, female (years)	57.0	73.8	70.7	70.7	65.9	60.6	69.6
Life expectancy at birth, male (years)	53.2	69.5	64.1	66.5	61.5	54.6	63.3

Source: Welthungerhilfe et al. (2024), World Bank (2025), and authors' calculations.

TABLE 1.5 Summary of micro-level survey data, collected during 2023–2024

Survey title	Data collection method	Sample size	Year/period	Population group	Geographic coverage
Urban Household Survey 2024	CATI	3,000	July 2024	Urban households	18 states
Urban Household Survey 2025	CATI	2,513	Feb. 2025	Urban households	18 states
Rural Households Survey—Wave 2024	CATI	4,504	Jan. 2024	Rural households	18 states
Smallholder Farmers Survey	CATI, IVR, and CAPI	3,284	Summer 2023	Smallholder farmers	15 states

Source: Authors' compilation.

Note: IVR = interactive voice recording; CAPI = computer-assisted personal interviews; CATI = computer-assisted telephone interviews.

interviews and computer-assisted personal interviews to reach households, traders, and key informants across 18 Sudanese states. In total, more than 20,000 respondents were covered across multiple survey waves, capturing detailed information on livelihoods, income, displacement, food consumption, coping strategies, market access, and well-being.

In addition to these primary datasets, the book also utilizes secondary data sources, including administrative and monitoring data from the World Food Programme, the Integrated Food Security Phase Classification, and the UN Food and Agriculture Organization's market and production databases, alongside publicly available geospatial, demographic, and conflict datasets. Together, these data sources provide a robust empirical foundation for assessing the multifaceted impacts of conflict on Sudan's economy, food systems, and social resilience.

Organization of the book

This book includes four sections. The first, "Origins and Dynamics of the Conflict," consists of this introduction and two other chapters.

Chapter 2, "Origins and Causes of Conflict: Domestic and International Perspectives," by Suliman Baldo, covers the historical context of the conflict, including Sudan's civil wars (including the secession of South Sudan in 2011) and the transition from the Al-Bashir regime (1989–2019) to the onset of the current conflict in early 2023. Baldo argues that recent developments in the conflict are destroying commercial and trading activities between the areas controlled by the SAF and RSF. Given the "alarmingly inadequate" response of the international community to the humanitarian crisis in Sudan, the onus is on Sudanese stakeholders to work together to end the war and help restore peace, stability, and a democratic transition.

In Chapter 3, "State Failure and Elite Capture of Sudan's Agrifood System," Danielle Resnick, Hala Abushama, Oliver K. Kirui, and Khalid Siddig argue that the SAF's and RSF's contradicting yet complementary commercial interests are among the key drivers of the conflict in Sudan. Partly based on 50 key informant interviews, the chapter discusses three distinct strategies that the SAF and RSF adopted in their business operations: outright capture of livestock trade, unfair competition in wheat milling, and niche market development in horticulture. They also note the "oddly synergistic relationship" between SAF and RSF actors in the cattle sector, in which the RSF buys cattle in western Sudan and then sells them to SAF-affiliated companies that export herds through Port Sudan.

Section II of this book, “Economic, Social, and Humanitarian Impacts,” includes seven chapters based on analysis using various household and enterprise surveys, economic simulation models, and other sources.

In Chapter 4, “Monitoring Economic Activities: Leveraging Satellite and Remote Sensing Techniques,” Zhe Guo and colleagues use satellite-derived nitrogen dioxide (NO₂) concentration data and nightlight intensity data from March 2023 and May 2023 as proxies for human and economic activity. Comparing 2023 data with 2022 data from before the conflict, they find that the most pronounced declines in NO₂ concentrations and nightlight intensity occurred in Khartoum, Khartoum North, and Omdurman, where the conflict has been most severe. NO₂ emissions increased in some smaller cities, however, as well as in parts of Kassala state (east of Khartoum), which became major destinations for internally displaced persons.

Chapter 5, “Cereal Production, Markets, and Policy in Sudan,” by Paul Dorosh, Oliver K. Kirui, and Khalid Siddig, presents state-level data on the production of major cereals, econometric analysis of market price data for wheat and sorghum, and simulation model analysis of the effects of disruptions to trade and transport between western and eastern Sudan in 2023. The model simulations indicate that in the absence of the disruption of regional wheat markets and higher marketing costs, domestic consumption of wheat in western Sudan could have been 16 percentage points higher, assuming wheat imports were allowed to increase to meet demand at import parity prices.

Chapter 6, “Conflict-Induced Trade Dynamics: A Gravity Framework Analysis of Sudan’s Agricultural Exports,” by Enock Kojo Ayesu, Lukas Kornher, Daniel Sakyi, and Hala Abushama, describes an empirical analysis of the effects of Sudan’s conflict on its trade dynamics and employs an econometric model of exports by country of destination. In addition, using a simpler statistical model, the authors find that exports significantly increased in 2023 for products mainly produced in areas controlled by the SAF (including sesame, groundnuts, cotton, and other oilseeds). However, exports declined for products mainly produced in areas controlled by the RSF, such as live animals, meat, and sorghum. These differing outcomes are likely explained by the SAF’s control of Port Sudan, the country’s major port, and the surrounding areas.

In Chapter 7, “Economywide Impact of Conflict and Pathways to Recovery,” Khalid Siddig, Zuhail Elnour, and James Thurlow apply a dynamic computable general equilibrium model and an integrated 2021 economywide database to quantify the conflict’s economic costs and assess the effectiveness of various

intervention scenarios. Based on the simulation results, the authors recommend that government and donors prioritize integrated recovery packages that bundle investments in agriculture, include policies to promote the revitalization of enterprises, and provide household income support. They emphasize the importance of frontloading cash transfers and provision of working capital to help stabilize consumption and restart private sector activity in the short run, as well as investments in agriculture to build long-term resilience.

Chapter 8, “Food Consumption Patterns and Dietary Diversity amid Conflict,” by Fredrik Svensson and Oliver K. Kirui, presents data from the Comprehensive Food Security and Vulnerability Assessment (WFP 2024) and similar surveys collected both before the war in early 2023 and after it began in early 2024. These surveys were conducted through in-person interviews, except in some states most affected by conflict in 2024. The analysis shows a significant increase in the prevalence of inadequate food consumption in South Kordofan, Sennar, and East Darfur, states which were severely impacted by conflict. Maternal nutrition is especially alarming, with mid-upper arm circumference indicating that more than one in four pregnant or lactating women were acutely malnourished.

Chapter 9, “Worsening Food Security in Sudan amid Conflict,” by Oliver K. Kirui, Khalid Siddig, Alemayehu S. Taffesse, and Hala Abushama, utilizes nationally representative data from the 2022 Sudan Labor Market Panel Survey, the 2023/24 Sudan Rural Household Survey, and the 2024 Urban Household Survey. Food Insecurity Experience Scale scores indicate a dramatic drop in food security after the conflict began, with the share of food-secure households dropping from about 50 percent before the conflict to between 9 and 20 percent during the conflict. Econometric analysis highlights that socioeconomic factors, such as education, housing adequacy, and access to water, played significant roles in mitigating food insecurity before the conflict began. However, the influence of these factors has been diminished, with conflict-induced shocks, including a decline in household income, now significantly exacerbating food insecurity.

Chapter 10, “Human Capital at Risk: The Impact of Sudan’s 2023 War on Healthcare and Education,” by Ebaidalla M. Ebaidalla, Mohammed Gebrail, Gotada Suliman, Oliver K. Kirui, and Tarig Alhaj, documents how the armed conflict has exacerbated the problems of Sudan’s health and education sectors. According to data from the 2024 IFPRI Urban Household Survey, most urban households (78 percent) reported having full access to health services before the war. By 2024, only 15 percent had maintained full access, and nearly 25 percent reported no access at all; in Darfur, as much as 64 percent

had no access. School dropout rates are also extremely high, ranging from an average of 41 percent in northern Sudan to 75 percent in Darfur. The situation is particularly acute for girls, as the war has dramatically increased girls' vulnerability to withdrawal from school, sexual exploitation, and early marriage. Without urgent interventions, Sudan could face a "lost generation" that is unable to contribute meaningfully to future recovery.

Section III, "Resilience and Recovery Strategies," includes four chapters that assess the conflict's impact on household coping strategies and resilience, including preferences for aid delivery, as well as the key drivers of vulnerability and strategic approaches for postconflict reconstruction in Sudan.

Chapter 11, "Shocks, Coping, and Household Livelihood Strategies in Wartime," by Oliver K. Kirui and Tarig Alhaj Rakhy, examines the multifaceted impact of Sudan's 2023 conflict on household livelihoods, coping mechanisms, and resilience strategies in both rural and urban areas. Using data from the 2023–2024 National Rural and Urban Household Surveys, the analysis highlights how preexisting vulnerabilities have been worsened by conflict-related shocks, especially those related to health and climate in rural areas and crime, insecurity, and displacement in urban areas. In response to shocks, households have adopted diverse coping strategies, including food rationing, asset sales, borrowing, and migration. Remittances, social networks, and informal economic activities are critical survival tools, particularly among women. However, these tools are often unstable and insufficient, and formal assistance is very limited.

In Chapter 12, "Delivering Aid amid Active Conflict and Insecurity: Digital Transfers for Delivering Social and Humanitarian Assistance in Sudan," Kibrom A. Abay, Hala Abushama, Shima Mohamed, and Khalid Siddig investigate how household preferences for digital cash transfers compare to preferences for traditional cash or in-kind assistance. Drawing on a computer-assisted telephone survey of urban respondents across Sudan, the authors find that about two-thirds of respondents favor digital transfers, underscoring a growing acceptance of digital modalities, even in areas with limited digital infrastructure. Preference for digital transfers is significantly higher among those exposed to armed violence, theft, or insecurity, suggesting that perceived safety is a key driver. Moreover, trust in financial institutions and nongovernmental organizations emerges as a critical factor shaping demand for digital modalities.

Chapter 13, "Drivers of Vulnerability and Low Resilience in Sudan," by Youssef Chaitani and Hong Pum Chung, uses the Arab Risk Monitor's Risk Analysis framework to analyze the connections between conflict, economic failure, climate shocks, and governance collapse in Sudan. Key risk

factors include conflict escalation, including the ongoing warfare between the SAF and RSF, increased violence in Darfur, and regional spillovers; climate vulnerability, such as severe flooding, drought, and desertification that are worsening food and water insecurity; economic deterioration, including falling GDP, very high inflation, and widespread unemployment; and weak governance, with a breakdown in law, service delivery, and social protection.

Chapter 14, “The Political Economy of Resilience and Economic Recovery,” by Ibrahim Elbadawi, argues that Sudan’s postconflict national renewal and reconstruction requires a broad-based participatory peace-building process. Given the scale of destruction and collapse of social cohesion, however, a multidimensional, transformative peacekeeping operation is needed to initiate an end to the war and build sustainable peace. Also necessary is transformative economic growth that promotes interethnic cooperation by modernizing the economy, accelerating urbanization, and expanding the middle class. This chapter therefore recommends a strategic approach to postconflict reconstruction that includes ensuring a more equitable political landscape to foster sustainable development and peace, building pro-growth coalitions, and unleashing agriculture-led growth, anchored in stronger linkages with industry and services, through agro-industrial growth corridors.

Section IV, “The Way Forward,” features Chapter 15: “Toward a Prosperous and Secure Sudan: A Way Forward,” by Khalid Siddig, Oliver K. Kirui, and Paul Dorosh, which summarizes government development plans in the years prior to the 2023 conflict. It subsequently describes major obstacles that must be overcome to achieve goals in three broad areas: restoring peace and security, achieving broad-based economic growth, and meeting the food security needs of all households. The book concludes with a call for a blend of investments to meet humanitarian, development, and peacebuilding objectives.

References

- ACLED (Armed Conflict Location & Event Data). 2025. "ACLED Explorer." Accessed September 19, 2025. <https://acleddata.com/platform/explorer>
- Ahmed, M., M. Raouf, and K. Siddig. 2026. "What Are the Economic and Poverty Implications for Sudan If the Conflict Continues through 2025?" *The Journal of Development Studies* 62 (1):106–127. <https://doi.org/10.1080/00220388.2025.2510642>
- de Waal, A. 1989. *The Real Politics of the Horn of Africa: Money, War and the Business of Power*. Polity Press.
- Dorosh, P.A. 2021. "Distributional Consequences of Wheat in Sudan: A Simulation Model Analysis." Sudan SSP Working Paper 2. IFPRI. <https://hdl.handle.net/10568/142129>
- Faki, H.H.M. and A.T. Ahmed. 2007. "Distortions to Agricultural Incentives in Sudan (Vol. 2 of 2): National Spreadsheet (English)." Agricultural Distortions Working Paper No. 44. World Bank. <http://documents.worldbank.org/curated/en/500701468149380536>
- FAO (Food and Agricultural Organization of the United Nations). 2011. *Poverty in the Sudan: Poverty: A Broad and Multi-Dimensional Concept*. Policy Brief. FAO. <https://www.fao.org/agrifood-economics/publications/detail/en/c/122289/>
- Hassan, R.M., H. Faki, and D. Byerlee. 2000. "The Trade-Off between Economic Efficiency and Food Self-Sufficiency in Using Sudan's Irrigated Land Resources." *Food Policy* 25 (1):35–54. [https://doi.org/10.1016/S0306-9192\(99\)00063-9](https://doi.org/10.1016/S0306-9192(99)00063-9)
- HDX (Humanitarian Data Exchange). 2026. "Sudan — Subnational Administrative Boundaries." Accessed March 18, 2026. <https://data.humdata.org/dataset/cod-ab-sdn>
- IMF (International Monetary Fund). 2025. "International Financial Statistics." Accessed August 28, 2025. <https://data.imf.org/regular.aspx?key=61545850>
- Reuters. 2025. "Sudan Army Chief Appoints Former UN Official Idris as Prime Minister." *Reuters*, May 19. <https://www.reuters.com/world/africa/sudan-army-chief-burhan-appoints-former-un-official-kamil-idris-prime-minister-2025-05-19/>
- Sampson, E. 2025. "Disaster by the Numbers: The Crisis in Sudan." *New York Times*, January 7. <https://www.nytimes.com/2025/01/07/world/africa/sudan-genocide-numbers.html>
- Siddig, K., K.A. Abay, O.K. Kirui, H. Abushama, S. Mohamed, and T. Rakhy. 2025. *IFPRI-Sudan: Generating Evidence-Based Solutions for Strengthening Humanitarian Response and Economic Resilience*. Sudan SSP Brief April 2025. IFPRI. <https://hdl.handle.net/10568/174025>.
- Sudan, Ministry of Agriculture and Forestry. 2015. *The State of Sudan's Biodiversity for Food and Agriculture*. Ministry of Agriculture and Forestry. <https://openknowledge.fao.org/server/api/core/bitstreams/4d154bff-c7e3-4113-a12c-51992b1825c5/content>

- UNDP (United Nations Development Programme) and OPHI (Oxford Poverty and Human Development Initiative). 2023. *Global Multidimensional Poverty Index 2023: Unstacking Global Poverty: Data for High Impact Action*. UNDP and OPHI. <https://hdr.undp.org/system/files/documents/hdp-document/2023mpireporten.pdf>
- UNHCR (United Nations High Commissioner on Refugees). 2026. *Sudan Situation Map Weekly Regional Update - 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNICEF. 2025. "Every Day Matters: UNICEF Is Responding to the Urgent Needs of Children and Families during the Ongoing Conflict." *UNICEF Stories*, blog, March 24. <https://www.unicef.org/sudan/stories/every-day-matters>
- Welthungerhilfe, Concern Worldwide, and IFHV (Institute for International Law of Peace and Armed Conflict). 2024. *Global Hunger Index: How Gender Justice Can Advance Climate Resilience and Zero Hunger*. Welthungerhilfe, Concern Worldwide, and IFHV. <https://www.globalhungerindex.org/pdf/en/2024.pdf>
- WFP (World Food Programme). 2024. *Comprehensive Food Security and Vulnerability Assessment (CFSVA), Q1 2024*. Internal Dataset (Unpublished).
- World Bank. 2019. *Sudan Programmatic Poverty Assessment: Poverty and Inequality in Sudan, 2009-2014*. World Bank. <https://doi.org/10.1596/34059>
- World Bank. 2025. "World Development Indicators." Accessed February 1, 2025. <https://databank.worldbank.org/source/world-development-indicators>

ORIGINS AND CAUSES OF SUDAN'S CONFLICT: DOMESTIC AND INTERNATIONAL PERSPECTIVES

Suliman Baldo

The war between the Sudanese Armed Forces (SAF) and its subsidiary paramilitary Rapid Support Forces (RSF) that began in April 2023 follows a succession of civil wars that devastated the economically marginalized, socially ostracized, and politically disenfranchised southern and western regions of Sudan, but it has now brought the conflict to the country's geographic and economic power center. Unlike the decades-long North–South civil wars or the ongoing deadly conflict in Darfur, today's conflict began in Khartoum and the agriculturally rich heartland of Central Sudan, bringing death and destruction to the central Aj Jazirah and Sennar states, before moving south and west to Darfur and Kordofan. The same historical, economic, political, and ethnic factors that fueled those previous conflicts are at play now, as the belligerent factions seek to control the country's resources. This time, however, after working together to halt efforts to democratize Sudan, the SAF and RSF turned on each other, each seeking to dominate the kleptocratic state system.

The tripartite capital of Khartoum, Khartoum North, and Omdurman, which is now largely decimated, expanded over decades of rural–urban migration waves spurred by ill-advised development policies and the wars in the peripheral states. By the 2020s, this metropolis was home to an estimated 7 million people. The SAF and RSF have waged their fiercest battles in these densely populated cities, engaging in street fights and artillery duels and using the Air Force and armed drones. This urban warfare has destroyed decades of investment in commercial and industrial assets and the supporting energy and telecommunications networks.

Sudan's protracted conflicts are rooted in mismanagement of ethnic and regional divisions (see Thomas 2009), competition over resources, and the insatiable appetite of ruling elites for control of natural resources in the country's marginalized peripheries. In this chapter, we summarize the long history of these conflicts and the entrenchment of the kleptocratic system, and then look in more depth at the impact of the current war. These sections examine its impact on the economy and community survival mechanisms, divisions

within Sudan, and the response and objectives of neighboring countries and major powers. The chapter concludes with some thoughts on escaping the cycle of crisis and conflict and moving forward in Sudan.

Political regimes, war economies, and food crises in Sudan: 1956–2025

Structural inequities in the distribution of power and wealth between Sudan's dominant elites (primarily drawn from the central and northern riverain regions) and the population in peripheral areas are at the core of the country's chronic instability and repeated violent conflicts. These inequities are compounded by bitter identity disputes, rooted in the failure of successive post-independence governments to effectively manage Sudan's rich ethnic, linguistic, cultural, and religious diversity. Instead of fostering inclusion, successive ruling elites have imposed Arabic language and culture, as well as a specific interpretation of Islam, as the country's official identity, while also fomenting conflict among groups at the local level (Mohammed 2000).

Initially, the modernizing influences of education, mass media, and state administration supported the gradual "Sudanization" of the population, defined as the consolidation of varied traditions into a unified and distinctive national identity (Iyob and Khadiagala 2006). However, the more radical and coercive policies of Islamization and Arabization implemented by the regime of Omar Al-Bashir (1989–2019) exacerbated divisions through the educational curriculum, state-controlled mass media, and, in areas of resistance, aggressive military force. These policies led to the 2011 secession of South Sudan, a region that had been home to a third of the country's population. This long history of marginalization, identity-based conflict, and disregard for human rights continues to frustrate Sudan's struggle for peace and stability.

A brief timeline of events since Sudan's independence in 1956 illustrates the country's chronic instability. These decades have been marked by a recurring cycle of short periods of civilian rule interrupted by military coups, then followed by popular uprisings that restore democratic governments—only for the military to seize power again. Throughout this turbulent period, state policies have generally favored those with political connections and geographic advantages. Power remained concentrated in the hands of elites from northern and central Sudan, who benefited from state-led agricultural schemes, infrastructure (such as the large-scale irrigation projects), and access to markets, while small farmers, tenants, and laborers remained marginalized (Berridge et al. 2022).

1956–1969: Fragile civilian rule and early military centralization

Sudan's first experiment with parliamentary democracy (1956–1958) unfolded with its independence under Prime Ministers Ismail al-Azhari and Abdallah Khalil. The new state inherited a mixed economy built around the colonial era's Jazirah irrigation scheme in central Sudan and cotton exports, but structural inequities and southern marginalization quickly generated rebellion. The First Civil War (1955–1972), which began even before independence, drained resources and disrupted agricultural production in the South.

A military coup in 1958 brought General Ibrahim Abboud to power. Abboud inaugurated a centralized, state-led development policy and early industrialization projects. However, assimilationist policies toward the South and the neglect of peripheral economies fueled hardship and insurgency. The October Revolution of 1964, consisting of a civil disobedience campaign spearheaded by opposition groups including trade and student unions, forced Abboud to hand over power to their representatives. This initiated a one-year civilian transition and led to an elected government months later, but the transitional rule was marked by political fragmentation, weak fiscal management, and continued conflict.

In terms of agriculture, the 1956–1969 period saw the expansion of government irrigation projects, such the Managel Extension of the Jazirah Scheme and Khasm Al-Girba project, while private owners consolidated their holdings in the rainfed mechanized farming areas, particularly in Gedaref state (Ali 1989).

1969–1985: Nimeiri's shifting economic models and renewed war

The May Revolution of 1969 ushered in the long rule of Colonel Jaafar Nimeiri, whose policies oscillated between socialism and neoliberal reform. Initially, his regime pursued nationalization and state control over key industries (1969–1977), which disrupted private agricultural enterprise and centralized food supply chains. Following IMF-led reforms in 1978, economic liberalization policies prioritized export crops and austerity, which undermined rural livelihoods and food affordability. Foreign investments, mainly from Arab sovereign funds and private businesses, and joint ventures in the agricultural sector increased considerably, favoring the expansion of large-scale rainfed and irrigated mechanized farming (Ali 1989). This expansion came at a cost for small-scale subsistence farmers. Not only did these farmers receive little or no state support for productivity improvements, but also the expansion of mechanized farming often displaced them from their lands, thus reducing their food security and forcing them to join the growing population of rural–urban migrants.

In 1972, the Addis Ababa Agreement ended the First Civil War and brought a decade of relative stability and agricultural recovery to the South. However, Nimeiri's 1983 unilateral abrogation of southern autonomy and imposition of Sharia laws in the entire country reignited the conflict, triggering the Second Civil War (1983–2005). The Sudan People's Liberation Movement/Army (SPLM/A) emerged in 1983 under southern commanders frustrated by the central government's betrayal of the Addis Ababa Agreement. Key among their motivations was the protection of the South Sudanese right to benefit from resources in their region, namely the newly discovered oil and water.

The renewed fighting devastated farming regions, leading to prolonged food crises, and redirected state resources toward war, laying the foundations of a militarized and extractive economy. Mounting hardship led to Nimeiri's ouster after a countrywide civil disobedience campaign led by students' and workers' unions in April 1985.

1985–1989: Fragile civilian transition and economic crisis

The transitional government under General Abdel Rahman Swar al-Dahab, as head of a sovereignty council overseeing a technocratic government appointed by trade unions and opposition parties, and the elected government of Prime Minister Sadiq al-Mahdi that followed faced a collapsing economy burdened by external debt and austerity measures. Market liberalization without institutional reform deepened inequalities, while the continuing war against the SPLM/A consumed scarce resources. Food insecurity intensified amid drought and displacement, culminating in the famines of the 1980s, the worst in a generation.

At the peak of the second North–South civil war, in 1988, Northern Bahr al-Ghazal state (now in South Sudan) suffered a famine that ranks as one of Sudan's worst manmade humanitarian disasters. Tens of thousands died and hundreds of thousands more were displaced. Relentless government bombardments destroyed the subsistence farming and livestock livelihoods of the predominantly Dinka local communities and caused the collapse of their markets, leaving them vulnerable to famine even as food aid was blockaded. The government's weaponization of hunger and the involvement of some SPLM commanders and traders in diverting food and manipulating exchange rates for their own benefit resulted in devastation that prompted the international community to launch Operation Lifeline Sudan in 1989 (Keen 1994).

Political paralysis in the central government paved the way for the Islamist-backed coup of June 1989.

1989–2019: The Bashir era – Islamization, oil economy, and structural famine

The Inqaz (Salvation) Regime of Omar Al-Bashir, backed by the National Islamic Front, transformed Sudan's political economy into a fusion of military control, ideological Islamization, and economic patronage.

In the early 1990s, international isolation and blanket economic and trade sanctions imposed by the United States (following its designation of Sudan as a supporter of international terrorism) forced a cycle of extreme austerity and a turn toward self-sufficiency and state monopolies, while war expanded into Sudan's resource-rich peripheral areas. The sanctions generally increased food insecurity by blocking agricultural inputs and discouraging export markets. However, large exports of oil beginning in 1999 shifted the economy toward petroleum, spurring growth and urban consumption but deepening regional disparities.

Under Bashir's regime, an elaborate kleptocratic system of governance developed, using violence to maintain control of national wealth, and dispensing its proceeds to those in the inner circles of power at the cost of rural populations (Lanfranchi and Hoffman 2023). This kleptocratic system is a primary driving force in all Sudan's civil wars, and conflict has remained endemic as a result. The regime represented a sophisticated iteration of what Alex de Waal refers to as the "military-commercial complex" that dominated Sudan during the colonial as well as the postcolonial periods (De Waal 2023). The kleptocracy—deeply embedded in state institutions, the security establishment, and further entrenched through aggressive ideological propagation—survived the fall of Bashir and his ruling National Congress Party in April 2019, following months of pro-democracy protests, and its influence within state institutions remains pervasive today.

Bashir's era was one of never-ending wars, and periodic droughts and displacement compounded food insecurity across the peripheral states. In 1991, a major setback was dealt to southern unity when a leadership split within the SPLM/A divided the movement along Dinka, Nuer, and Shilluk lines, triggering interethnic factional fighting whose legacy still shapes tensions in South Sudan. During the 1990s, as intra-South wars intensified, the New Sudan Council of Churches, supported by the Sudan Council of Churches and tribal elders, launched people-to-people peace processes that helped restore relations among warring factions and communities (Bradbury et al. 2006). "Peace markets" later emerged across frontlines, sustaining trade and livelihoods despite government attempts to suppress them (Rolandsen 2019).

In the “Three Areas” of Abyei, the Nuba Mountains, and Southern Blue Nile—geographically northern but culturally and politically allied with the South—rebellion that lasted from the mid-1980s to 2011 reflected shared marginalization and grievances.

In the late 1990s, eastern Sudan, the Beja Congress, and the Free Lions of the Rashaida tribe joined forces under the Eastern Front, aligning with the Eritrea-based National Democratic Alliance to challenge the Bashir regime. Fighting involved sabotage, raids, and landmines, causing severe civilian suffering. Although a series of agreements have incorporated provisions for the East, many of eastern Sudan’s deep-rooted grievances over exclusion and underdevelopment remain unresolved.

As prospects for peace in the South improved after 2002, Darfur, another marginalized region, rose up to demand inclusion. In Darfur, insurgents protested exclusion, inequitable development, and the manipulation of land and tribal systems, leading to a devastating conflict that killed about 300,000 and displaced more than 2.5 million between 2003 and 2007. While violence ebbed after 2008, a series of peace accords—including the 2020 Juba Agreement—were poorly implemented, though local “tribal peace conferences” achieved limited reconciliation. However, following South Sudan’s secession in 2011, unresolved questions about forces that fought as part of the SPLM/A (known as the SPLM-North) reignited conflict in the new southern regions of the Nuba Mountains and Blue Nile, marked by aerial bombardments, displacement, and the use of ethnic militias.

These various conflicts served as sustained militarized extraction systems that enriched elites while impoverishing agrarian communities. During the Bashir regime, state development policies were largely designed to preserve the ruling coalition of Islamist businessmen and security elites rather than to promote equitable growth. Resource extraction from Sudan’s peripheries financed projects that reinforced this alliance.

The 2005 Comprehensive Peace Agreement (CPA) formally ended the 22-year civil war in South Sudan, one of the longest and deadliest in the continent. Built around North-South power- and wealth-sharing arrangements, the CPA granted South Sudan regional autonomy during a six-year period. Southerners voted for independence in the 2011 referendum, leading to the secession of South Sudan and Sudan’s loss of 75 percent of the oil reserves and revenue.

Anticipating the economic shocks that would result from the secession of South Sudan, Bashir’s Finance Minister Abdelrahim Hamdi warned that elections and possible secession threatened the regime’s hold on power. He

proposed rapid, large-scale investment in the sparsely populated “geographical North,” arguing that improvements in infrastructure and employment there would consolidate the ruling National Congress Party’s electoral base. Hamdi’s proposal evolved into state policy, channeling major infrastructure, agricultural, and hydroelectric investments—largely financed by Chinese loans—into the North, East, and Center, an area critics dubbed the “Hamdi Triangle.” Research by the AidData Lab shows that the bulk of Chinese development finance between 2000 and 2011, Sudan’s revenue taken from the South during the “Oil Decade,” was directed to these regions (Roessler 2013; Verhoeven 2015). This spatial concentration reflected a deliberate political calculus to reward loyal constituencies and strengthen regime control over core territories.

After South Sudan’s secession in 2011, the loss of oil income triggered economic collapse, currency crises, and recurrent food price shocks. The secession stripped Sudan of more than half its fiscal revenue and 95 percent of its exports. This loss undermined the regime’s patronage system, weakened its grip on security institutions, and led to the adoption of extreme austerity measures. As economic conditions deteriorated, grassroots networks of youth and women—the Resistance Committees—emerged to provide community support and mutual aid, operating quietly but effectively under severe economic and political repression.

These committees evolved into resilient, horizontally organized structures that could survive government crackdowns. Through widespread training, debate, and coordination, they built a movement grounded in transparency and equality. When professional associations and opposition parties joined forces with them in the last quarter of 2018, the resulting alliance—the Forces of Freedom and Change (FFC)—led mass demonstrations, strikes, and sit-ins that culminated in the December Revolution and signaled the regime’s loss of legitimacy. Bashir’s 30-year regime was overthrown in April 2019.

2019–2023: Transitional hopes and renewed breakdown

The Transitional Government (2019–2021), comprised of both civilian and military leaders under Abdalla Hamdok and SAF commander Abdel Fattah al-Burhan, sought economic stabilization through subsidy reforms and reengagement with international institutions. Their democratic shift and reform measures paved the way for Sudan’s removal from the US list of state sponsors of terrorism and the lifting of remaining economic sanctions. The short-lived 2020 Juba Peace Agreement, which the transitional government signed with remnants of Darfur armed movements, promised regional integration but proved difficult to implement.

In October 2021, a coup staged jointly by the SAF and the RSF ended civilian participation, returning Sudan to military rule under Burhan and the RSF commander, Mohamed Hamdan Dagalo Hemedti. The joint SAF/RSF coup was aimed at ending far-reaching macroeconomic reforms initiated by the transitional cabinet, which threatened the military's control of multiple sectors of the economy.

FFC dissident factions, eager to have a place in the coup government, paved the way for the coup by calling on the army to take power. Sudan's Islamist Movement's hardliners, other stalwarts of Bashir's ruling party, and business barons also mobilized their constituencies in favor of the coup. The new regime relied increasingly on gold exports, smuggling, and rent-seeking, intensifying informal war economies that inflated food prices through illicit taxation and restricted access to basic goods.

Relations between the SAF and RSF, however, were not as close as their joint interventions to derail Sudan's transition to democracy suggested. Despite the SAF's role in establishing the RSF in 2013 as a proxy counterinsurgency force and building it into a *de facto* parallel army by training, arming, and equipping its fighters, signs of latent tensions between the two forces built up for years. A key factor was the fierce rivalry between the SAF's enterprises and the private family businesses of the RSF commanders for control of ever-expanding shares in key sectors of the economy, including the mining, agricultural, livestock, construction, and banking sectors (Cartier et al. 2022). Further, Hemedti's personal political ambitions had grown as the RSF gained prominence as Bashir's favored force. Hemedti was particularly concerned about the return of the Islamists, who blamed him for Bashir's ouster in 2019, to influential positions in the state apparatus, which he denounced in several public speeches.

With signs in 2022 that the coup partners were rapidly hurtling toward a head-on collision, civilian FFC leaders and former transition partners of the military stepped in, joining mediation efforts led by the Sudan missions of the United States, the United Kingdom, Saudi Arabia, and the UAE to reduce the tensions and prevent an imminent conflict. These efforts were coordinated with those of the UN Integrated Transition Assistance Mission in the Sudan, the African Union, and the subregional Intergovernmental Authority on Development.

A Framework Political Agreement reached in these negotiations and signed in December 2022 stipulated the establishment of a civilian-led government during a two-year transition period and the military's exit from politics. Coming shortly after a process that civilians initiated to ease the exit of the military from political control neared its conclusion, the Framework

Political Agreement contained the seeds of its own failure as it required the integration of the RSF into the SAF but left responsibility for this to the military. Tensions between the SAF and RSF escalated during the first quarter of 2023 over disagreements about the timeline for integrating the RSF into the national army and the place of the top RSF commanders in the chain of command after the integration. The RSF commanders feared the loss of their political influence and the financial autonomy that came with it. Ultimately, these tensions erupted into yet another civil war.

2023–2025: The SAF–RSF war and the collapse of national markets

The outbreak of full-scale war between the SAF and RSF in April 2023 marked the fragmentation of the state and the near-total collapse of formal economic governance. As the conflict spread from Khartoum and the central states to Kordofan and Darfur, food systems disintegrated: transport routes were cut, irrigation schemes abandoned, and grain markets captured by armed actors.

By mid-2025, SAF offensives had reestablished control over Khartoum, Jazirah, and Sennar, while the RSF entrenched itself in Darfur and parts of Kordofan. These territorial divisions, coupled with ad hoc taxation and looting, entrenched a de facto partition of Sudan into competing war economies, each sustaining its forces through coercive resource extraction. The result has been one of the world's most acute and widespread food crises—rooted not in drought or global shocks, but in Sudan's recurrent wars.

The war economy and its impact on community survival mechanisms

The ongoing war has bred a destructive economy, where warring factions and their allied forces exploit the population and natural resources to finance their military campaigns. Their predatory practices include various forms of violence against civilians, which are systematically destroying traditional survival strategies and conflict resolution mechanisms that communities have relied on for generations to navigate natural and manmade crises.

Compounding this devastation are growing polarization and societal divisions, fueled by the spread of propaganda and hate speech on social media, which are eroding the country's social fabric. This loss of societal cohesion not only deepens the immediate humanitarian crisis but also poses a long-term threat to the prospects for reconciliation and recovery.

Pressures created by the warring parties, including prevailing insecurity, diversion of food aid, and several forms of large-scale corruption that directly impact food production, have led nearly 12 million people to flee their homes (UNHCR 2026). A majority of these internally displaced people are food producers and service providers who have abandoned their subsistence agriculture and trade in surplus products and are now dependent on the generosity of host communities and international humanitarian relief, when the warring parties allow humanitarian supplies to reach them.

Rampant misappropriation of humanitarian supplies intended for the people displaced by the warring parties and other armed actors has aggravated the famine conditions and serious food insecurity now prevailing in large regions of Sudan. Attacks on humanitarian convoys and workers by the belligerents have multiplied, and volunteers staffing community kitchens are often targets of harassment, arbitrary detention, and killings (STPT 2024).

Perhaps the most egregious and crude means of financing Sudan's war is the massive and systematic looting by RSF fighters of valuables, including four-wheel vehicles and gold jewelry that Sudanese families use as savings. As occurred in the Central African Republic during the 2013 military campaign that helped place the rebel Seleka movement in power, the RSF offensive to conquer Khartoum and other areas has turned into a massive campaign of plunder. According to media reports, stolen vehicles have found their way to South Sudan, Chad, and other countries of the Sahel, creating an illicit market sustained by the decimation of the savings of Sudan's middle class. In Khartoum, there have been successive waves of looting of factories, businesses, and empty private residences.

War booty motivates RSF fighters to seek new targets and discourages them from establishing any form of governance or service provision in the areas they occupy. For example, in the relatively rich farming communities in Aj Jazirah state, RSF fighters established protection rackets, requiring farmers to provide the fighters with food supplies to avoid violent repression.

Another key source of revenue, particularly for the RSF, has been extortion of payments at checkpoints and other forms of illegal taxation in the areas under its control. For example, businessmen who moved goods and machinery from Khartoum to Aj Jazirah and other stable states at the beginning of the current war were able to do so only after making large payments to the RSF commanders for safe passage of the cargo and personnel.

Pragmatic exchanges between SAF- and the RSF-controlled areas have occurred throughout the war. For instance, shortly after the conflict's outbreak, the RSF laid siege to El-Obeid, the capital of North Kordofan and

home to Sudan's largest exchange for agricultural products, and engaged the SAF garrison there in frequent skirmishes. However, fuel, consumer goods, and medicine continued to flow to El-Obeid from both SAF and RSF areas, while dozens of trucks loaded with agricultural products and livestock left the city daily for sale in markets in the SAF-controlled areas and for export to international trade partners. In addition, petroleum products smuggled from Libya reached El-Obeid.¹ However, the RSF set up tollgates to demand payments from commercial and passenger vehicles traveling to and from the city.

Like El-Obeid, the town of El-Dabba in Northern state has become a crucial hub for commercial exchanges between the SAF-controlled northern and eastern states and the RSF-controlled western states. Its strategic and relatively secure location led to a surge in commercial activities following the outbreak of the war. Relief agencies moved their warehouses to the city, using it as a base for distributing food supplies to conflict-affected areas. This shift created new employment opportunities. Meanwhile, the El-Dabba Chamber of Commerce, under the guise of collecting fees in cash and in kind for supporting the war effort, assumed tax collection powers typically held by state and municipal authorities, despite being managed by volunteer supporters of the SAF. The added financial burden forced an unknown number of traders and transporters to seek ways to evade the payments or to abandon their work.

Since the start of the war, the livestock sector has been damaged by looting, the lack of inputs including feed and vaccines, displacement from grazing areas, and disruptions in the supply chain. Most of the key production areas are now in RSF-controlled areas, but final export markets are largely in SAF-controlled areas. SAF companies have maintained significant livestock exports, but in many cases, they are selling animals raised in RSF-controlled areas and the RSF has been able to extract considerable illicit revenues for their transport.

As a result of these wartime exchanges, livestock exports—mainly to Saudi Arabia and Egypt—were thriving, earning a record US\$879 million by July 2024, during the 15 prior months, despite the destruction of Sudan's largest industrial, commercial, and infrastructure enterprises (Nougud 2024). However, many exporters failed to repatriate and deposit the mandatory percentage of their overseas sales back into Sudan, prompting the Central Bank

1 Information drawn from frequent author phone interviews with El-Obeid residents, May 2023–October 2024.

of Sudan to issue an ultimatum to approximately 250 companies. These firms were instructed to comply with export regulations or risk being removed from the registry of exporters. The ultimatum's effectiveness may be limited, however, given that the largest exporters of livestock and processed meat were companies controlled by the SAF and influential traders closely aligned with the military (Al-Rakoba Editors 2024).

Economic partition in the making

As this chapter went to press, a de facto territorial divide was consolidating in Sudan, with both the SAF and the RSF establishing civilian governments in their respective areas of control. Battlefield developments in the second half of 2024 rapidly shattered the commercial and trading activities between the SAF- and RSF-controlled areas. The disruption of these exchanges poses a direct threat to the national economy and humanitarian interventions, adding to the survival challenges facing the millions of people displaced by the war.

SAF's air force repeatedly bombed large markets in the towns of El-Daein, Nyala, Mellit, Kebkabia, and al-Kuma in a campaign apparently meant to disrupt commercial activities in RSF areas, among other objectives. The airstrikes have killed and injured hundreds of civilians, and destroyed commercial assets in the targeted towns. The RSF alleged that Egypt was providing air support to the SAF and retaliated in October 2024 by imposing an embargo on export to Egypt of 12 commodities produced in western Sudan, including sesame, groundnuts, gum arabic, sorghum, millet, livestock, and gold (Sudan War Monitor 2024).

As prices of the banned commodities fell rapidly in RSF-held areas in Darfur and Kordofan, farmers, traders, transporters, and workers in these value chains suffered great losses. The impact of the export ban in El-Dabba was equally devastating. The number of trucks leaving El-Dabba to Darfur averaged 30 to 40 trucks per day but fell to an average of 12 to 16 per day after the ban. Most of these trucks traveled to East Darfur and West Kordofan states, and a few went to the once-busy trading hub of Mellit in North Darfur. Insecurity on the road to Mellit and repeated SAF airstrikes on the town and its market forced most traders and inhabitants to abandon the town.²

In May 2025, the RSF looted gum arabic valued at approximately US\$75 million from the El-Nuhud market and other production hubs.

2 Information drawn from author messaging with a key informant in El-Dabba.

The cumulative value of stolen gum arabic alone is estimated at around \$150 million, demonstrating the RSF's capacity to sustain its war effort through large-scale plunder and illicit trade. The RSF has also financed itself through the systematic theft of other valuable commodities, notably agricultural produce and copper stripped from electric cables and transformers (Craze and Makawi 2025).

The gum arabic seizure illustrates how the war is disrupting supply chains and pushing foreign buyers to seek new sources; long-time suppliers in Sudan now face competition from exporters in Chad, Kenya, and South Sudan. However, through such operations, the RSF has consolidated control over trade routes and revenue streams, reinforcing its influence in contested territories (Craze and Makawi 2025).

In addition, in late 2024 and early 2025, the RSF acquired more sophisticated militarized drones that it used to destroy large electric power transformers in the SAF-held northern and eastern states, including in Merowe and Dungla in the Northern State and other cities across SAF-held areas, including Khartoum, triggering outages in several states.

The Central Bank of Sudan's introduction of new banknotes in denominations of 500 and 1,000 pounds in November 2024 can be seen as part of the SAF's economic warfare against the RSF. The Central Bank justified the measure as a means to counter widespread forging of older notes as well as the looting of large amounts of cash from banks and freshly printed bills from the Currency Printing House when it was occupied by the RSF at the beginning of the war (Sudan, CBoS 2024). The Central Bank also required the public to deposit their holdings of old bills in existing or new bank accounts in a step to encourage the use of digital money. Since there have been no operating banks in RSF-held areas since the beginning of the war, the RSF rejected the Central Bank's policy categorically and instructed populations in areas under its control to continue using the old banknotes while it prepared to introduce a basket of currencies, including the dollar, for financial transactions (Ismail 2024).

Millions of people are facing severe survival challenges due to the widespread insecurity and turmoil in Sudan described above. However, there are also signs of resilience. Building on the networks developed in the resistance to Bashir, thousands of Sudanese youth and women have come together to create emergency response rooms to meet the needs of their neighbors. With support from Sudanese communities abroad, and increasingly from private and international donors, they provide food, medical care, and other much needed services.

Broader implications and international perspectives

The conflict has exacerbated Sudan's humanitarian crisis, forced millions to flee their homes, and created instability across the region. Neighboring nations such as Chad, South Sudan, Eritrea, Ethiopia, and Egypt are struggling to manage the spillover impacts, including the influx of refugees and rising cross-border tensions.

Thus, the war in Sudan has transformed the country into a stage for competing regional and international powers, all seeking to assert their influence in the East Africa and Greater Horn of Africa regions as well as across the Sahel. Fighters from Chad and the Sahel have joined the RSF, while Ethiopian Tigrayan refugees were reportedly recruited by the SAF. As the conflict drags on, external powers have increased their involvement. The UAE has provided substantial military and logistical support to the RSF, while countries including Iran, Turkey, Egypt, and Saudi Arabia—each pursuing their own strategic goals in Sudan, the Horn of Africa, and the Red Sea—have backed the SAF and the Port Sudan government that is under SAF's control. These nations are also motivated by their reliance on Sudan for resources critical to their economies.

Sudan's strategic importance is further underscored by its 853 km coastline along the Red Sea, a vital international trade route. Russia has provided economic, military, and diplomatic support to the Port Sudan government, anticipating that Sudan will honor a 2017 agreement to grant it a naval base on the Red Sea, signed during former President Bashir's state visit to Moscow. Similarly, Iran is seeking to establish a foothold on the Red Sea, consolidating its influence in the region. Its existing support for the Yemeni Houthi rebels already gives it a disruptive presence in this vital waterway. Meanwhile, the United States and its allies are likely to focus on countering Russian and Iranian ambitions, viewing Sudan as a weak link that could enable these adversaries to expand their reach.

In September 2025, the Quad platform—comprising the United States, Saudi Arabia, Egypt, and the UAE—launched a new peace initiative, proposing a roadmap to address Sudan's escalating crisis. The plan envisioned a phased approach, beginning with a three-month ceasefire designed to facilitate a large-scale surge in humanitarian relief operations and to ensure greater protection for civilians trapped in conflict zones. Given the influence these regional and international actors wield over the warring parties, there was cautious optimism that their combined diplomatic pressure might secure a temporary cessation of hostilities (Baldo 2025).

However, the prospects for translating such a humanitarian truce into a sustained political process appear far more uncertain. The initiative's next phase—anchored in a Sudanese-led dialogue among civilian and local stakeholders to shape a postwar political order—faces formidable challenges. Years of war, entrenched militarization, and deep political fragmentation have eroded the foundations for consensus. Achieving an inclusive settlement that dismantles the military and security establishment's grip over Sudan's political and economic spheres will thus require not only external mediation but a coherent, unified civilian front capable of articulating a shared national vision for the country's future.

Concluding remarks

Sudan's recurring descent into conflict reflects deep structural patterns in its political economy, where exclusionary governance, militarized resource extraction, and institutionalized inequality have repeatedly undermined peace and stability. From independence to the present war, successive regimes have benefited small elite coalitions while marginalizing the rural and peripheral majority. This entrenched structure has produced cycles of rebellion, repression, and humanitarian crisis, perpetuating both political instability and chronic food insecurity. The current war between the SAF and RSF represents the latest—and most destructive—manifestation of this legacy, as rival militarized elites turn the instruments of state violence and economic predation inward to sustain their competing war economies.

The devastating humanitarian toll, with millions displaced and widespread famine looming, underscores that hunger in Sudan is not merely the product of environmental or logistical failure but the predictable outcome of deliberate sociopolitical choices. The destruction of markets, looting of resources, and manipulation of aid flows characterize a war economy sustained by exploitation rather than governance. Yet, amid this devastation, local networks of youth, women, and diaspora groups continue to demonstrate resilience and solidarity, offering a fragile foundation for any future reconstruction.

The inadequacy of international responses—marked by slow diplomacy, fragmented mediation, and muted media attention—has further entrenched the crisis. Regional powers and global actors have pursued competing strategic interests rather than a coherent peace agenda, contributing to Sudan's *de facto* partition and prolonging civilian suffering. Ultimately, sustainable peace will require a complete reconfiguration of Sudan's political economy: dismantling

the military-commercial complex, redistributing power and resources, and rebuilding governance from the community level upward.

Only by addressing these structural inequities and confronting the war economy that has defined its modern history can Sudan move beyond its cycles of collapse and recovery toward a durable, inclusive peace. In this effort, food systems must be rebuilt by dedicating more state resources and investments to traditional subsistence farming, environmental protection, and the improvement of access to markets.

References

- Al-Rakoba Editors. 2024. "Experts Question the Commitment of 250 Companies to Remit Export Proceeds." *Al-Rakoba Newspaper*, May 13, 2024. <https://tinyurl.com/yc6hfpad>
- Ali, T.A.M. 1989. *The Cultivation of Hunger: State and Agriculture in Sudan*. Khartoum Univerisy Press.
- Baldo, S. 2025. "Quad Diplomacy and Sanctions: Washington's Strategic Play in Sudan." *Sudan Transparency and Policy Tracker* (blog), September 15. <https://sudantransparency.org/quad-diplomacy-and-sanctions-washingtons-strategic-play-in-sudan/>
- Berridge, W., J. Lynch, R. Makawi, and A. de Waal. 2022. *Sudan's Unfinished Democracy: The Promise and Betrayal of a People's Revolution*. Hurst.
- Bradbury, M., J. Ryle, M. Medley, and K. Sansculotte-Greenidge. 2006. *Local Peace Processes in Sudan: A Baseline Study*. The Rift Valley Institute. <https://riftvalley.net/publication/local-peace-processes-sudan/>
- Cartier, C., E. Kahan, and I. Zukin. 2022. *Breaking the Bank: How Military Control of the Economy Obstructs Democracy in Sudan*. C4ADS (Center for Advanced Defense Studies). <https://c4ads.org/reports/breaking-the-bank/>
- Sudan, CBoS (Central Bank of Sudan). 2024. "A New 1000 Egyptian Pound Banknote Will Be Issued in June 2024." *Central Bank of Sudan News* (blog), August 24. <https://tinyurl.com/bdh6uwbd>
- Craze, J., and R. Makawi. 2025. *The Republic of Kadamol: A Portrait of the Rapid Support Forces at War*. Small Arms Survey Briefing Paper. Small Arms Survey. <https://www.smallarmssurvey.org/resource/republic-kadamol-portrait-rapid-support-forces-war>
- de Waal, A. 2023. "Sudan's Future Is Being Shaped by Guns and Money – Like Its Past." *The Conversation* (blog), August 24. <https://theconversation.com/sudans-future-is-being-shaped-by-guns-and-money-like-its-past-211948>

- Ismail, A. 2024. "The Rapid Support Forces Reject the New Banknote, the Dollar Is an Alternative." *El-Arabi Al-Jadid*, November 13. <https://tinyurl.com/2usmdj3p>
- Iyob, R., and G.M. Khadiagala. 2006. *Sudan: The Elusive Quest for Peace*. Lynn Rienner Publishers. https://www.rienner.com/title/Sudan_The_Elusive_Quest_for_Peace
- Keen, D. 1994. *The Benefits of Famine: A Political Economy of Famine and Relief in Southwestern Sudan, 1983-1989*. Princeton University Press.
- Lanfranchi, G., and A. Hoffman. 2023. *Kleptocracy Versus Democracy: How Security-Business Networks Hold Hostage Sudan's Private Sector and the Democratic Transition*. Clingendael Institute. <https://www.clingendael.org/publication/kleptocracy-versus-democracy>
- Mohammed, M.S. 2000. *The Sudan: Wars of Resources and Identity*. Cambridge Publishing House.
- Nougud, S. 2024. "Sudan's Livestock: \$879m Exports Resilience during War." *Atar*, July 8. <https://atarnetwork.com/wp-content/uploads/2024/07/ATAR-English-Issue-8-Sudan-livestock-879m-exports-resilience-during-war.pdf>
- Roessler, P. 2013. "Chinese Development Finance and Strategies of Political (and Territorial) Survival in Sudan." *AidData Blog* (blog), May 8. <https://www.aiddata.org/blog/chinese-development-finance-and-strategies-of-political-and-territorial-survival-in-sudan>
- Rolandsen, Ø.H. 2019. "Trade, Peace-Building and Hybrid Governance in the Sudan-South Sudan Borderlands." *Conflict, Security & Development* 19 (1):79–97. <https://doi.org/10.1080/14678802.2019.1561628>
- STPT (Sudan Transparency and Policy Tracker). 2024. *Humanitarianism under Siege: Millions at Risk as Belligerents Abuse Humanitarian Aid*. STPT. <https://sudantransparency.org/humanitarianism-under-siege/>
- Sudan War Monitor. 2024. "RSF Impose Trade Embargo on Egypt. Decision Threatens Sudan's Own Economy and Humanitarian Efforts." *Sudan War Monitor* (blog), November 1. <https://sudanwarmonitor.com/p/rsf-impose-trade-embargo-on-egypt>
- Thomas, E. 2009. *Against the Gathering Storm: Securing Sudan's Comprehensive Peace Agreement*. Chatham House. https://ciaotest.cc.columbia.edu/wps/riia/0015853/f_0015853_13800.pdf
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- Verhoeven, Harry. 2015. *Water, Civilization, and Power in Sudan: The Political Economy of Militar-Islamist State Building*. Cambridge University Press.

STATE FAILURE AND ELITE CAPTURE OF SUDAN'S AGRIFOOD SYSTEM

Danielle Resnick, Hala Abushama, Oliver K. Kirui,
Khalid Siddig, and Mosab Ahmed

Since the outbreak of Sudan's civil war in April 2023, nearly 12 million people have been displaced, and an estimated 44,000 have been directly killed by the violence (UNHCR 2026; ACLED 2025).¹ Many more are estimated to have suffered from war-related disease and malnutrition (Roberts 2025). The decimation of the capital city of Khartoum—the epicenter of the jubilant civilian uprisings in 2019—epitomizes the country's short journey from a promising democratic opening to a failed state.

Failed states often emerge after the breakdown of the political settlement, which refers to the underlying distribution of power in a society, often based on an informal bargain among ruling elites or formal codification in governance structures (Di John and Putzel 2009; Khan 2011; North et al. 2012). A breakdown is more likely when there are shifts in elite coalitions facilitated by exogenous shocks, a failure to institutionalize power-sharing arrangements, or unequal access by elites to external financing. As shown by Reno (1998), if elites cannot cooperate to maintain stability, the state can collapse into competing patronage networks that facilitate warlordism or regional secession.

In Sudan, the breakdown in the political settlement between the army, the Sudanese Armed Forces (SAF), and the Rapid Support Forces (RSF), a paramilitary movement, is the primary cause of the country's contemporary civil war. After being thrust into an uneasy coalition with civilian partners in 2020, the SAF and RSF forged an unlikely alliance to oust the transition leader, Abdulla Hamdok, in 2021. Yet, the respective leaders—General Abdel Fattah Al-Burhan of the SAF and Mohamed Hamdan Dagalo (known as “Hemedti”) of the RSF—each viewed the other as a threat to political power and economic clout. Galvanized by external actors, including Egypt, Saudi Arabia, and the United Arab Emirates (UAE), neither party had a clear incentive to negotiate peace under the prior political settlement.

1 Displacement figures are current as of early 2026; death toll figures are as of September 2025.

Several studies and reports have highlighted the SAF's and RSF's involvement in multiple industries and economic sectors, which helped to solidify their power (D'Agostino 2025; Gallopin 2020; Verhoeven 2023). This chapter specifically focuses on their involvement in the agrifood system. To do so, the chapter first situates the SAF and RSF in Sudan's recent history and describes their role in the overarching political settlement. It then discusses how these groups amassed their economic fortunes, including through control of natural resources and the creation of conglomerates with diversified interests. The chapter discusses how the SAF and RSF engaged, up until the 2023 conflict, in specific value chains, including livestock, wheat, and horticulture. The conclusion briefly discusses how the conflict has impacted both belligerents' leverage in the agrifood system and the broader lessons from Sudan about business–state relations in fragile contexts.

Data and methodology

Methodologically, this chapter utilizes a case study approach based on process tracing and supported by both secondary literature as well as semi-structured interviews. The interviews were conducted in person or virtually with 50 key informants between August 2021 and September 2024. Purposive and snowball sampling methods were employed to ensure the validity of responses and reliability in selecting the broadest set of key informants (Marshall 1996; Palinkas et al. 2015).² Purposive sampling is a nonrandomized sampling technique that is well-recognized as an appropriate qualitative methodology for gaining in-depth information from the most knowledgeable individuals for the research topic under consideration (Creswell and Plano Clark 2018). While the disadvantage of purposive sampling is that the findings are not generalizable to a larger population and researcher bias may influence participant selection (McNabb 2015), it is a more appropriate method than randomized sampling when details about policy decisions and political economy networks are not well known in the general population (Palinkas et al. 2015; Palys 2008). Indeed, uncovering the role of the SAF and RSF in the agrifood system requires expert knowledge or close familiarity with these actors.

Consequently, the interviewees included agrifood experts with knowledge of the production and marketing structures of the agrifood value chains of

2 Purposive sampling involves choosing informants who are known to be experts on a particular topic. Snowball sampling occurs when each respondent suggests additional interviewees to contact, helping to build momentum until a saturation point is reached, whereby no new information is obtained, or all major stakeholder groups have been included.

interest and political economy experts with insights into the SAF's and RSF's roles in the economy. These criteria allowed us to capture a broad spectrum of information on state–business relations in Sudan's agrifood system. The distribution of key informants is described in Appendix 1. For reasons of confidentiality, respondents' exact identities are not provided, but their expertise and sectoral background are indicated as footnotes when they were the source of key information.

Historical antecedents of elite capture and contestation in Sudan

A vast system of patronage was entrenched during the tenure of Sudan's former president, Omar Al-Bashir, who came to power through a military coup in 1989, reversing a short period of democratic rule under Prime Minister Sadiq al-Mahdi (1986–1989). Al-Bashir concentrated power within his National Congress Party (NCP) and led a personalist autocratic regime whereby he weakened challenges to his rule by fragmenting the security forces, creating overlapping responsibilities among them, and undermining their lines of communication to forestall their ability to engage in a coup against him (Hassan and Kodouda 2019).

Centralization of power around Al-Bashir

Al-Bashir empowered the SAF, the secret police known as the National Intelligence and Security Service (NISS), and a variety of regional militias, including the Janjaweed in Darfur, to deal with localized grievances against his regime.³ By 2008, he had also regularized the NISS' role as a paramilitary fighting force (Hassan and Kodouda 2019). Before the secession of South Sudan, the NISS had benefited greatly from Sudan's petrodollars, which it invested in its fighting and cyber surveillance capabilities as well as in assets in the agriculture sector (Verhoeven 2023), including the Seen flour milling company (El Gizouli 2020; Thomas and El Gizouli 2020).

In 2013, Al-Bashir transformed factions of the Janjaweed into the RSF in response to growing ethnic conflicts that raised questions about whether the SAF would continue to support his rule, especially since the SAF's members were from historically marginalized regions. The RSF initially was placed under the control of the NISS (Kurtz 2024). Similarly, when Al-Bashir

3 The NISS became the General Intelligence Service and was placed within the Ministry of the Interior.

reshuffled his military in 2015, many of those in the NISS were given positions within the SAF command, further blurring the lines between the two entities (ISS 2015).

To retain the loyalty of these different factions, including the NISS, SAF, and RSF, Al-Bashir provided them with significant patronage, directing much of the budget toward the security apparatus (Hassan and Kodouda 2019). He provided these actors with access to lucrative economic resources, such as the export of gold, gum arabic, sesame, and weapons, as well as the import of fuel, wheat, vehicles, real estate, aviation equipment, and construction materials (Gallopín 2020). From 2000 onward, significant control of state-owned enterprises (SOEs) was camouflaged behind companies within the SAF's Military Industrial Corporation (MIC). Coupled with special tax rewards and exemptions for highly ranked SAF officers' businesses during Al-Bashir's regime, the SAF developed deeply rooted economic and financial power (El-Battahani 2016). International sanctions against Al-Bashir's government also motivated the military to develop its own economic resources.⁴

The RSF was also hired by Saudi Arabia and the UAE to fight the Houthi rebels in Yemen (Hassan and Kodouda 2019). In the wake of South Sudan's secession in 2011 and Sudan's loss of the oil reserves there, access to foreign exchange through these activities became especially critical to the survival of the political settlement. Both the SAF and RSF benefited immensely under Al-Bashir's regime and gradually transformed their political influence into business empires through their privileged access to financial resources from commercial banks, tax exemptions, special rules and regulations, foreign exchange, and access to land.⁵

At the same time, insurgent movements against the regime were violently repressed in peripheral regions, such as Darfur, South Kordofan, and Blue Nile. Urbanites, who were becoming increasingly numerous, were co-opted through a series of subsidies, including for flour, bread, and fuel. Civil society organizations, including a variety of unions that coalesced into the Sudanese Professionals Association (SPA) and resistance committees, were often repressed or placed under surveillance. These committees, consisting of university students and unemployed youth affiliated with the Communist and other opposition parties, were originally formed in September 2013 during another set of protests initiated by the reduction of wheat and fuel subsidies. They posed a threat to the neighborhood "popular committees" of the regime,

4 Interview with member of Sudan's transitional government, virtual, January 30, 2024.

5 Interview with former central bank official, virtual, February 13, 2024.

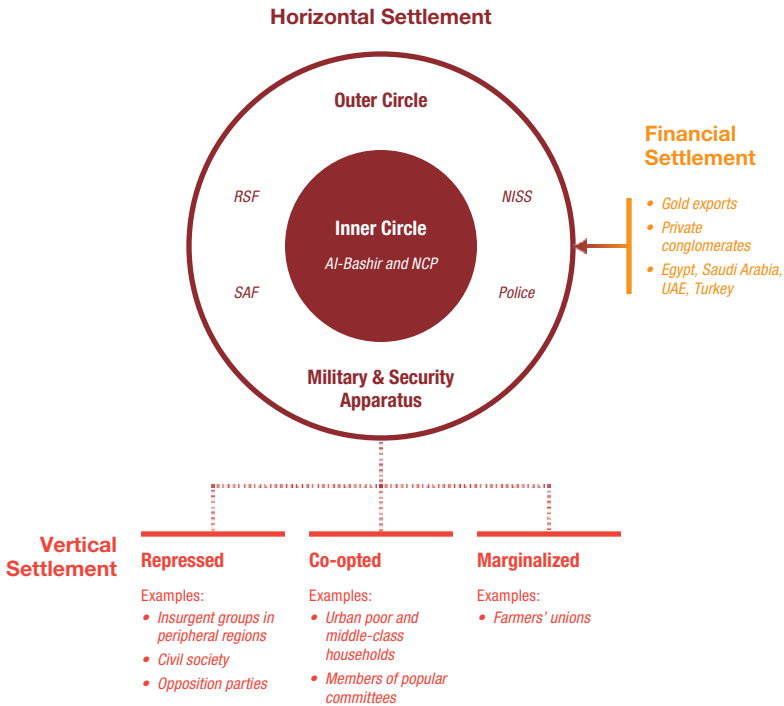
which typically included retired army officers, the mosque imam, and security forces (El Gizouli 2020).

Figure 3.1 presents a schematic of Sudan's political settlement from 2011—when South Sudan seceded—to 2019 and divides the settlement into its horizontal, vertical, and financial dimensions. The distribution of power across different elite actors who comprise the governing coalition constitutes the horizontal dimension. These elites may include political parties and politicians, the bureaucracy, the military, and traditional leaders. Some of these factions are included in power structures and united by either political ideals or materialist interests, while others are excluded. Kelsall (2018) refers to this as the power foundation of the settlement and notes that configurations can be concentrated and/or dispersed. In the former, power is highly centralized within the top leadership, and excluded factions are relatively weak. In the latter, excluded factions are stronger, and the top leadership may depend on an array of short-term bargains and deal-making to achieve its aims.

The vertical dimension, or societal foundation, of a settlement refers to the way in which elites incorporate and manage different societal groups, ranging from trade unions, the media, and business groups to farmers' associations and ethnic networks, among others. These groups may have different types of resources—including economic power, voting weight, and ideational influence—to disrupt extant political institutions. If the group has broad disruptive potential and is united, then the government is likely to co-opt it through mass benefits (such as public housing or state welfare programs); if the group is more divided, then it is likely to be targeted with patronage benefits in return for supporting the government. Narrower groups may either be repressed if they have disruptive resources or marginalized if they do not (Kelsall 2018).

The third dimension addresses how the political settlement is financed (Buur and Salimo 2018; Khan 2011). This might include donor partners, domestic capitalists, foreign investors, and global markets (Usman 2020). Identifying this dimension requires analyzing the ownership structure within specific sectors and understanding the historical relationship between economic actors and the governing coalition (Behuria et al. 2017). Depending on the main sources of financing, negative shifts in the external environment can threaten the extant political settlement, while new windfalls of resources may reinforce it (Usman 2020). Between 2011 and 2018, power was centralized around Al-Bashir and the NCP, bolstered by the military and security apparatus, and largely funded through gold exports and finance from Egypt and the Gulf states. Many groups were repressed during this period, contributing to several civil conflicts across the country (see Chapter 2 in this volume).

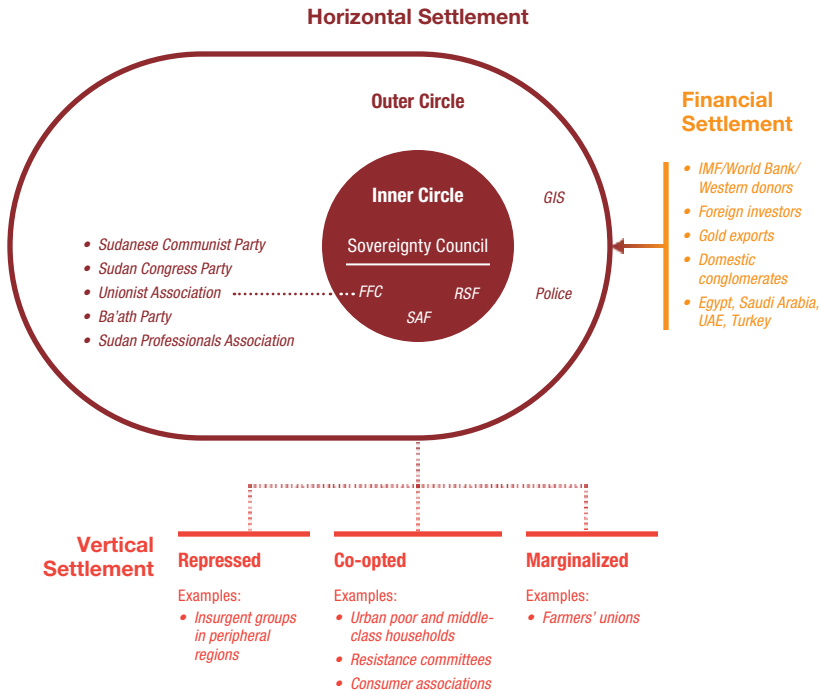
FIGURE 3.1 Sudan’s political settlement, 2011–2019



Source: Partially adapted from Gallopin (2020).

Note: NCP = National Congress Party; NISS = National Intelligence and Security Service; RSF = Rapid Support Forces; SAF = Sudanese Armed Forces; UAE = United Arab Emirates.

This settlement shifted in late 2018 when the escalating price of bread and wheat flour compelled widespread public protests, initially about the rising cost of living but ultimately morphing into a broader set of grievances about government corruption and autocracy (Hassan and Kodouda 2019). Al-Bashir responded by issuing four emergency decrees that banned any gatherings, assemblies, marches, or strikes. However, as protests grew, the SPA took control of the demonstrations and ultimately, with the support of civil society groups and opposition parties, formed the Forces of Freedom and Change (FFC) coalition. When the FFC staged a sit-in at the military headquarters in Khartoum in April 2019, junior officers decided to protect the protesters, and the various elements of Al-Bashir’s outer circle—the military, RSF, and NISS—overthrew the president (Gallopin 2020).

FIGURE 3.2 Sudan's political settlement, 2019–2021

Source: Partially adapted from Gallopin (2020).

Note: FFC = Forces of Freedom and Change; GIS = General Intelligence and Security Services; RSF = Rapid Support Forces; SAF = Sudanese Armed Forces; UAE = United Arab Emirates.

Transitional government

After a tumultuous period in which security forces killed more than 100 pro-democracy protesters in June 2019 outside military headquarters (known as the Khartoum Massacre), a Constitutional Declaration was signed in August 2019 that stipulated the creation of a 36-month post-transition government. This shifted the country's political settlement, creating a more dispersed horizontal power configuration, as shown in Figure 3.2. Specifically, the government was ruled by the Sovereignty Council, which consisted of a coalition between the SAF, RSF, and civilian technocrats led by the prime minister, Abdalla Hamdok, and backed by the FFC. The police and security forces—transformed from the NISS to the General Intelligence and Security Services—also retained significant power.

Because of this fragile alliance, the budget remained skewed toward the military. In addition, the military and security departments continued to control more than 200 state-owned firms, valued at around US\$3 billion and spanning multiple products and sectors, including gold, marble, gum arabic, livestock, telecommunications, banking, pharmaceuticals, and water distribution (Africa Confidential 2021; Sayigh 2023). Under pressure from the International Monetary Fund (IMF), the interim government agreed in March 2021 to begin the process of divesting the military from commercial companies and transferring them to civilian-headed government ministries. This was an essential move, as Hamdok claimed that due to the influence of the security and defense forces on the economy, his government effectively controlled only about 18 percent of the country's public funds (Baldo 2021).

At the same time, the FFC included a broad alliance of actors whose diverse interests hindered consensus on needed economic and political reforms. This was compounded by the variety of external actors who held a stake in the direction of Sudan's post-revolution political settlement. For instance, Turkey had been promised approximately 100,000 hectares of agricultural land to cultivate, with another potential 700,000 hectares under negotiation (Daily Sabah 2021). Even before the revolution, Saudi Arabia and the UAE had negotiated the purchase of some of Sudan's best irrigated land to produce food to feed their own domestic populations (Radio Dabanga 2016). After the ouster of Al-Bashir, both Gulf state governments provided an aid package of approximately US\$3 billion that gave them significant leverage with the transitional military council (The Arab Weekly 2021).

Coup and conflict escalation

The IMF's efforts to work with Hamdok's administration to audit and divest SOEs from the SAF and RSF were one of several factors that prompted the October 2021 coup to oust Hamdok. Both parties signed a Political Framework Agreement with each other and civilian actors in December 2022, which was supported by the international community (UNITAMS 2022). But the underlying emphasis of the reform was to return Sudan to civilian rule, and it involved merging the SAF and RSF, which was opposed by both parties. The RSF leadership's newly found prominence was resented by high-ranking SAF officers (Gallopín 2020). Each side perceived threats to their status and economic interests, ultimately resulting in the eruption of violence in Khartoum in April 2023 before expanding to nine other states, including North Kordofan, North Darfur,

West Darfur, South Darfur, Central Darfur, East Darfur, South Kordofan, West Kordofan, and Blue Nile, albeit with different levels of intensity and magnitude (Siddig et al. 2023).

The SAF and RSF as business actors

The SAF and RSF have adopted parallel yet distinct approaches to building their business empires (Baldo 2021). Both groups have leveraged their ownership of commercial enterprises through domestic and international connections, driven by shared political and economic interests, to generate significant economic profit (Verhoeven 2023). However, the structure of their business operations varies, with the RSF having a more fragmented business model that is largely controlled by segments of the Dagalo family, while the SAF has a more structured approach. The geographic concentration of their agricultural interests also varies. As seen in Figure 3.3, while the SAF's influence is concentrated in northern Sudan, particularly in the River Nile state where the army controls vast tracts of land and water, the RSF wields significant influence in the Darfur and South Kordofan areas, where the paramilitary's historical and tribal connections run deep.⁶

Figure 3.4 highlights the major agrifood companies under the SAF's control, which include finance, livestock, machinery, irrigation, and inputs. The MIC is considered the crown jewel of the SAF's economic empire. It was originally established as a defense manufacturing, automobile, and small electronics company to protect against potential sanctions and disruptions in imports from Western countries (D'Silva et al. 2023; El-Battahani 2016).⁷ Over the years, the institution has evolved to include many different subsidiaries, including in agriculture, which collectively make it a major revenue-generating arm for the SAF. Before the 2023 war, it operated on a five-year strategy that was updated periodically based on the status of the current business. Each business has its own board consisting of both SAF representatives and civilians with technical expertise.⁸

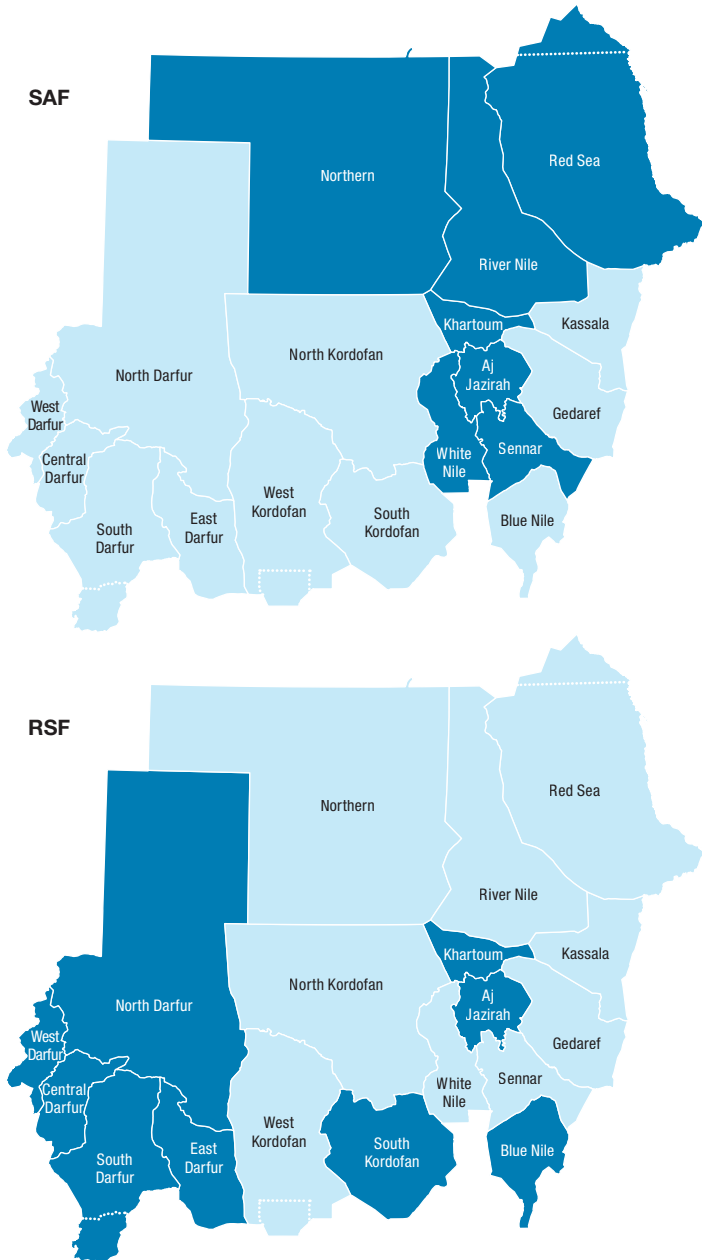
Zadna International Company, an agricultural and construction conglomerate that includes large pivot irrigation schemes in the Northern State, imports chemicals and fertilizers and exports live animals and other crops. It was also previously part of the MIC, but around 2020, it was moved to the Special Fund for the Social Security of the Armed Forces, an ostensible charity investment arm of the SAF, to shield it from civilian oversight (U.S. Department of the

6 Interview with agrifood expert, agribusiness conglomerate, virtual, August 3, 2023.

7 Interview with former SAF industry employee, virtual, September 11, 2024.

8 Ibid.

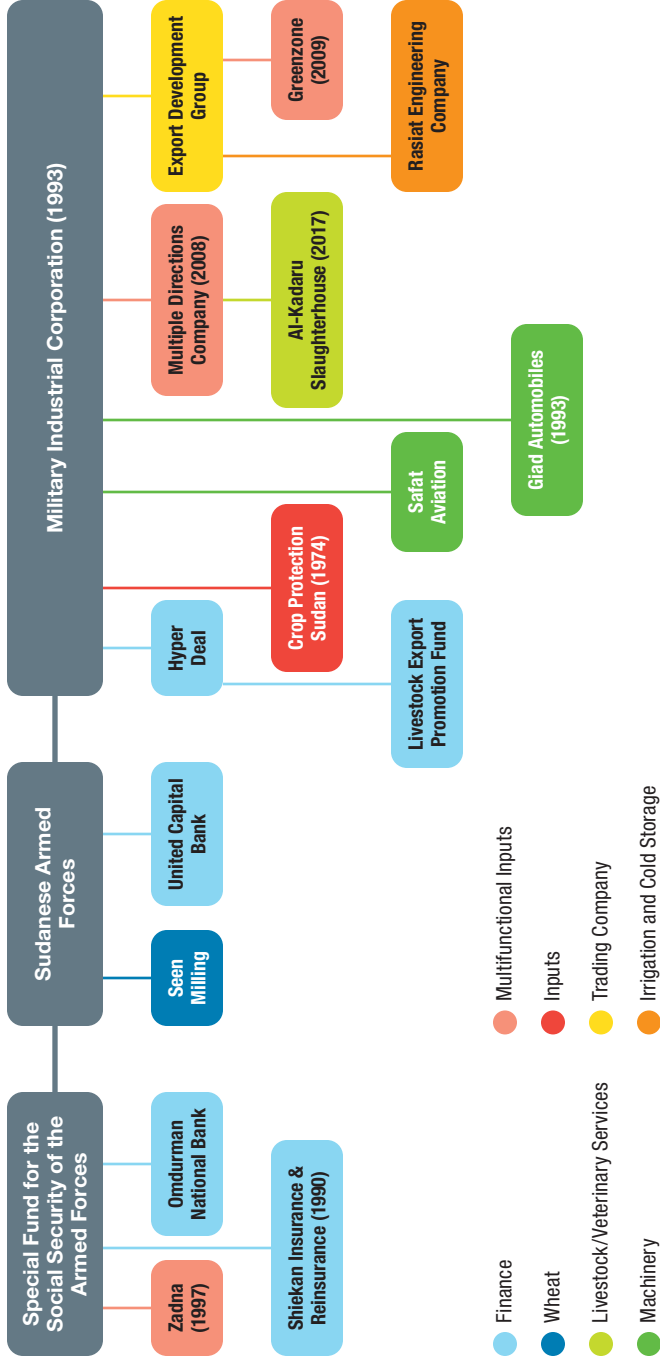
FIGURE 3.3 Geographical distribution of agribusiness dominance



Source: Authors' illustration based on key informant interviews.

Note: Darker blue indicates states of primary activity. RSF = Rapid Support Forces; SAF = Sudanese Armed Forces.

FIGURE 3.4 Landscape of Sudanese Armed Forces' companies



Source: Originally produced in Resnick et al. (2026) based on authors' compilation from interviews, Cartier et al. (2022), and Lanfranchi and Hoffman (2023).

Note: Years in parentheses indicate year of establishment, where available.

Treasury 2024). Interestingly, Zadna is the only institution where representatives of both the SAF and RSF serve on the company's board (Cartier et al. 2022). Beyond Zadna, there are strong clientelist linkages between the agricultural SOEs, the Agricultural Bank, Omdurman National Bank, and the SAF, through SAF institutions and/or members of the NCP that are closely associated with the SAF (Cartier et al. 2022).

The origins of the RSF's business empire can be traced to Hemedti's control of the Jebel Amer gold mines in Darfur and his family's ownership of the gold trading company known as Al-Junaid (Global Witness 2019). Al-Junaid has expanded into a larger holding company with subsidiaries spanning multiple sectors, including banking, agriculture, construction, transport, and information technology (Cartier et al. 2022; Sarkar and de Waal 2023). As shown in Figure 3.4, the RSF has established direct ties with the global banking system through ownership of Al-Khaleej Bank, which received US\$50 million from the Bank of Sudan prior to the onset of the 2023 war (U.S. Department of the Treasury 2024) and maintains several bank accounts and companies in the UAE (Cartier et al. 2022). Most of the RSF's agricultural companies concentrate on livestock and oilseeds. For instance, the RSF acquired 60 percent of the Animal Resources Bank to develop the livestock trade.⁹ The RSF also owns United Ebony, which focuses on goat breeding for export.¹⁰ Another firm, Al-Mahabba Oils, is owned by Hemedti's brother, and the Plant Oils Factory is part of Al-Junaid (Figure 3.5).

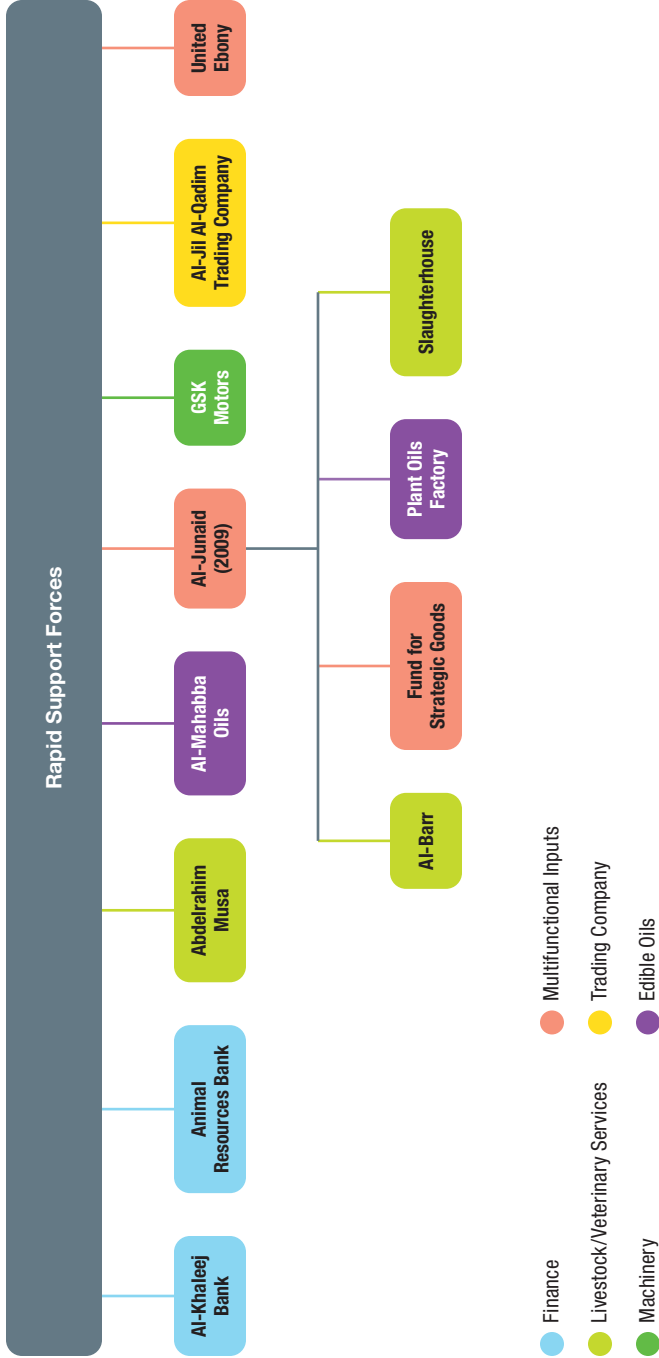
Strategies of engagement in agricultural value chains

Through the companies discussed in the previous section, the SAF and RSF expanded their influence using a distinct set of strategies across diverse value chains. These strategies have varied depending on the technical complexity of value addition and the level of private sector involvement. We discuss here three distinct strategies that the SAF and RSF have used to expand their profit margins and further entrench themselves in Sudan's agrifood economy. These strategies include outright capture in the livestock trade, unfair competition in wheat milling, and the development of niche markets in horticulture.

9 Interviews with agrifood expert from Sudanese conglomerate (August 3, 2023), government transparency expert (July 13, 2023), former Central Bank official (February 13, 2024), and former government advisor (February 14, 2024), all virtual.

10 Interview with former transitional government advisor, virtual, February 14, 2024.

FIGURE 3.5 Landscape of Rapid Support Forces' companies



Source: Originally produced in Resnick et al. (2026) based on authors' compilation from interviews, Cartier et al. (2022), and Lanfranchi and Hoffman (2023).

Note: Years in parentheses indicate year of establishment, where available.

Livestock trade

In Sudan's livestock sector, the SAF and RSF benefit from the opportunity to make high levels of profit with minimal value addition or private sector competition. At least 26 million Sudanese rely on livestock production for their livelihoods, and it is one of Sudan's biggest export earners after gold (World Bank 2020), contributing more than US\$550 million of export revenue in 2022 (Sudan, CBoS 2022). Moreover, it is the largest contributor to agricultural GDP, surpassing both the crop and industrial crop subsectors (Alfadul et al. 2024). About 60 percent of all live animal exports are directed to Saudi Arabia, a third to Egypt, and smaller shares to Qatar, Bahrain, Kuwait, and Lebanon (World Bank 2020). This trade is highly lucrative; exports of live sheep to Saudi Arabia alone have been valued at about US\$400 million annually (Humphrey et al. 2021). The livestock value chain in Sudan is also highly fragmented, involving numerous actors such as input suppliers, small-scale pastoralists, large-scale herders, brokers, transporters, agents, auctioneers, traders, processors, retailers, and exporters (Idris 2007). This fragmentation provides multiple access points for actors to increase rents within the chain.

The SAF primarily focuses on beef cattle, while the RSF trades in sheep, goats, and camels.¹¹ SAF's Multiple Directions Company opened a US\$40 million Al-Kadaru industrial slaughterhouse in 2020, rehabilitated by Egypt, which allows for processed meat exports (Gallopín 2020). A bilateral agreement signed in 2021 allows the SAF to export approximately 2,000 cows per day to Egypt from the slaughterhouse.¹² However, even at the height of its operations, Al-Kadaru has only operated at 55 percent of its maximum capacity.¹³

Due to its deep ties with Darfur and Kordofan—regions known for pastoralism—the RSF has long been involved in the livestock trade. The Dagalo family, historically traders, exported camels to Libya and Egypt two decades ago during Hemedti's leadership of the Janjaweed.¹⁴ Leveraging resources from their participation in the Yemen war, their involvement in the gold trade, and strategic political alliances, the RSF expanded livestock exports to Gulf

11 Interview with livestock expert, international research institute, virtual, February 21, 2024.

12 Interviews with government transparency expert (July 13, 2023), livestock expert (February 21, 2024), and private sector specialist for domestic milling industry (September 12, 2024), virtual.

13 Interview with former SAF industry employee, virtual, September 11, 2024.

14 Interviews with founder of supply chain enterprise (August 3, 2023), agrifood expert from domestic agribusiness conglomerate (August 3, 2023), government transparency expert (July 13, 2023), and gum arabic expert academic (January 31, 2024), virtual.

countries.¹⁵ In 2021–2022, the RSF sought to construct a technologically advanced slaughterhouse north of Khartoum, with US\$36 million in support from the Netherlands (Gallopín 2020).¹⁶ However, due to inadequate business planning, the facility was not equipped with refrigeration, which prevented it from becoming operational by the start of the 2023 conflict.¹⁷

The involvement of both actors in the livestock value chain is largely a modality of rent generation. Through the MDC, the SAF retains the profits from the sales, which are not reported or transferred to the Ministry of Finance and Economic Planning (MoFEP). At the same time, the MDC and SAF have few operational costs, since the MoFEP provides the operation with funding for the trucks, fuel, and drivers to transport the livestock.¹⁸ As one respondent noted, “For Multiple Directions, many people think this is one of the strongest companies of the army because the army needs foreign exchange. They export crops and livestock that generate foreign exchange...There are doubts that the foreign exchange is coming into the Central Bank of Sudan. They [the SAF] can use it instead to import military equipment.”¹⁹ Although livestock is a risky commodity, where exporters can lose about 2 percent of total livestock per shipment, the motivation of rent extraction still makes the value chain very lucrative: “For them [the SAF], it doesn’t matter how much they lose because the goal is to gain revenue, not to build up the value chain or a business enterprise.”²⁰ Due to capacity requirements, much of the meat quality control occurs in Egypt. As one insider notes, “There’s animal quarantine in Abu Simbel in Egypt, and they [live animals] get fattened there. We [Sudan] do not do anything besides export live animals. In livestock, we are not up to the standards.”²¹

It remains questionable whether the involvement of the SAF and RSF in the livestock sector has resulted in significant benefits for pastoralist communities, and there have not been improvements in veterinary health to ensure safer processed meat.²² Sudan often faces import bans and rejections

15 Interview with member of resistance committee, virtual, January 25, 2024.

16 Interviews with agrifood expert from agribusiness conglomerate (August 3, 2023) and private sector specialist with multilateral development organization (August 30, 2023), virtual.

17 Interview with agrifood expert from large-scale sugar company, virtual, July 16, 2023.

18 Interview with government transparency expert, virtual, July 13, 2023.

19 Interview with former member of the transitional government, virtual, January 30, 2024.

20 Interview with agrifood expert from major conglomerate, virtual, April 3, 2024.

21 Interview with private sector specialist for domestic milling conglomerate, virtual, September 12, 2024.

22 Interview with agrifood expert from major conglomerate (July 16, 2023) and private sector specialist for domestic milling conglomerate (September 12, 2024), virtual.

of live animals and processed meat due to noncompliance with sanitary and phytosanitary standards and vaccination protocols (World Bank 2020; Humphrey et al. 2021). Yet, due to the ability to generate high rents, as well as the current high risk for investments in Sudan, there is little incentive for either group to invest in traceability systems, quarantine practices, nutritional feed, cold chain infrastructure, or technical knowledge that could expand Sudan's international markets or meet growing domestic demand (World Bank 2020). As one expert noted, "Nothing has been invested in the livestock sector for decades to improve its value and productivity, even though it's a major export earner for Sudan."²³

The argument that the SAF and RSF focus on the livestock trade because it requires less technical expertise than upgrading the livestock value chain is further reinforced by these groups' absence in the dairy market, where the private sector is much more active. Dairy represents a valuable opportunity for domestic expansion, since most of Sudan's milk remains unprocessed, and dairy imports reached US\$148 million by December 2022.²⁴ However, the dairy industry is technically complex, requiring high standards, costly equipment, and alignment with meteorological conditions.²⁵ As one interviewee noted, "We have observed that both the SAF and RSF are inactive in the dairy value chain. This could be due to the challenge of competing with leading food industries in the field, or perhaps because the dairy value chain system in Sudan is complex and requires specific production technology and standards."²⁶ Although the SAF established the Faapy dairy company in 2013 through the Export Development Group, it went out of business several years later,²⁷ unable to compete with six private sector companies operating milk processing plants in Sudan. The largest, DAL Group, started in the dairy value chain in 1997 and managed a farm of 6,600 dairy cows. The farm featured climate-controlled cattle housing, artificial insemination breeding techniques, and modern milking equipment, positioning it as a leader in the country's dairy sector (World Bank 2020). As an example of functional upgrading, DAL provided numerous dairy products—including pasteurized and long-life milk, yogurts, cheeses, and butters—and managed its own distribution through a fleet of refrigerated trucks.

23 Interview with government transparency expert, virtual, July 13, 2023.

24 Interview with former transitional government advisor, virtual, February 14, 2024.

25 Interview with livestock expert, agribusiness platform, virtual, February 28, 2024.

26 Interview with former transitional government advisor, virtual, February 14, 2024.

27 Interview with former central bank official, virtual, February 13, 2024.

In summary, the livestock sector has proven highly profitable for both the SAF and RSF. Through the MDC, the SAF has a stable export market in Egypt through sales to firms linked to the Egyptian army, allowing it to reinvest profits directly into Sudan's military. The RSF, with its strong ties to trading communities in Darfur and Kordofan and resources from the gold trade, benefits from local trust relationships and favorable pricing with Gulf partners. While upgrading to better quality livestock and higher value-added dairy products could increase market access domestically and internationally, doing so would require significant investments and skill development. With the private sector already more competitive in this area, the SAF and RSF prioritize rent-seeking strategies by focusing on the livestock export trade.

Wheat milling

In addition to livestock, other value chains have appealed to armed actors, particularly commodities for which there is domestic demand, minimal value addition, and therefore little risk. Yet, if the private sector is already involved in such value chains, the predominant strategy of Sudan's armed actors has been competition through a distorted enabling environment.

Due to historical collusive relations between such actors and the state (such as the NCP), armed actors competing with the private sector can benefit from price distortions created by selective import licensing, foreign exchange rationing, and subsidies. For instance, the SAF's exemptions from Sudan's labyrinthine set of levies, including interstate taxes, turnover taxes on production sold by farmers to traders, and the *zakat* (Islamic tax), provide a price advantage to military actors.²⁸ Overall, these mechanisms facilitate a skewed policy landscape, whereby armed actors enhance their competitive advantage through structural power rather than any market-driven efficiencies.²⁹

Wheat milling typifies the competitive strategy used by the SAF. Wheat is a major food commodity in Sudan, especially for urban dwellers who consume substantial amounts of bread. Domestic production in Sudan only covers approximately 15–20 percent of the country's total wheat demand, with the remaining 80–85 percent satisfied through imports (Dorosh et al. 2022; Resnick 2021). In 2022, wheat imports were valued at more than US\$1 billion, which is equivalent to 10 percent of Sudan's total import value (Sudan, CBoS 2022).

Until 1996, when wheat milling was liberalized, the government held a monopoly on wheat imports, which were allocated to 20 small milling

28 Interview with agrifood expert from major conglomerate, virtual, April 3, 2024.

29 Interview with former member of transitional government, virtual, January 30, 2024.

companies through a quota system (FEWS NET 2015). Since then, several private sector companies have dominated the wheat milling sector, including Wheata and Sayga. The latter is part of the large DAL conglomerate, and until the 2023 war, it supplied about 70 percent of wheat flour consumed in Sudan, including both subsidized and commercial flour (Radio Dabanga 2015). The third major player was the Seen Milling Company, which was under the NISS, the armed intelligence services, until the 2019 revolution, after which it fell directly under the SAF's ownership.³⁰ The company is also a shareholder in the SAF's United Capital Bank.³¹ Prior to the war, Seen had a large milling base in Khartoum and two mills in Port Sudan.³²

Seen's goal was to take over the wheat flour business from its private sector competitors, which experienced a market opportunity as Sudan began importing more wheat to satisfy domestic demand. The company benefited from many advantages over its competitors. Most notably, between 2016 and 2021, a preferential exchange rate to import wheat grain served as a wheat subsidy to the milling companies. This required companies to deposit their payments in domestic currency for the required amount of wheat with the Central Bank of Sudan (CBoS), and in turn, the CBoS provided the necessary foreign currency for the imports (Siddig 2016). While all three milling companies were eligible for the subsidy, the CBoS favored Seen when issuing approvals for wheat imports: "CBoS might allow Wheata and Sayga to import one month but then wouldn't approve for the following month. Seen, though, was consistently given approval to import."³³ If there was a shortfall in money to import, Seen received access to dollar financing from the SAF's Omdurman National Bank, which often did not need to be repaid. This subsidy became instrumental to Seen's growth:

Seen benefited greatly from the subsidy era, which allowed the company to establish a strong brand and develop a network of agents and distributors across Sudan. This foundation has been instrumental in helping Seen maintain its position as a top milling company, even after the conflict erupted. In contrast, Wheat and Sayga were significantly affected.³⁴

30 Interview with former Central Bank official (February 13, 2024) and former Ministry of Finance official (April 20, 2024), virtual.

31 Interview with former Central Bank official (February 13, 2024) and former Ministry of Finance official (April 20, 2024), virtual.

32 Interview with agrifood expert from domestic agribusiness conglomerate, virtual, August 3, 2023.

33 Interview with specialist from wheat milling company, virtual, September 12, 2024.

34 Ibid.

By leveraging its access to the media, Seen accused the DAL conglomerate of trying to control Sudan's food staples. At one point, DAL was compelled to shut its Sayga mills for six months and even considered exiting the wheat milling business.³⁵ As noted by one respondent, "DAL had a long battle with the government with wheat...DAL built a milling company and no one realized that the sector was growing so quickly and when the government realized that they missed the boat, they tried to do the 'nasty games'."³⁶

Horticultural development

Both the livestock trade and wheat milling are relatively low-intensity sectors where profits can be gained without sophisticated technical skills or high levels of investment in cutting-edge technology and infrastructure. In contrast, horticulture is both skill- and resource-intensive. Armed actors would only consider investing in such a sector when the potential profit is high and competition from private sector firms is low.

Despite its nutritional and agro-ecological potential, Sudan's horticulture sector has underperformed compared to neighboring countries (World Bank 2020). Among many other factors, Sudan's historical inability to meet the sanitary and phytosanitary requirements of overseas markets has limited growth and investment in the horticulture value chain (World Bank 2020).

The primary company investing in horticulture is Zadna, which was established in 1997 with significant financial backing from the former ruling NCP, the MoFEP, and the Agricultural Bank of Sudan.³⁷ The company is also part of Omdurman National Bank's shareholding network (Cartier et al. 2022). After the October 2021 coup, General El Mirghani Idris Suleiman, a close ally of General Al-Burhan, was appointed as Zadna's chairman to prevent civilian interference (Lanfranchi and Hoffman 2023). Hemedti's brother, Abdulrahim Hamdan Dagalo, also serves on Zadna's board, making it one of the rare instances where both the SAF and RSF have a presence on the same company board (Cartier et al. 2022).

Zadna has diversified its activities over time. It initially focused on agricultural construction, with an emphasis on water irrigation programs in the River Nile State. For example, the company's Zadi 1 project encompasses 1 million acres, which utilize 3,500 pivot irrigation systems to grow fodder, sorghum, and wheat and generate an estimated US\$1.5 billion in

35 Interview with agrifood expert from agribusiness conglomerate, virtual, August 3, 2023.

36 Ibid.

37 Interview with former SAF industry employee, virtual, September 11, 2024.

annual revenues.³⁸ Over time, it has expanded into the horticulture value chain, with a large nursery for preparing high-quality seedlings for citrus, banana, and mango production.³⁹ The company also houses one of Africa's largest plant tissue culture laboratories and engages in research on new seedling varieties, fruit and vegetable drying, waste management, and exports. By collaborating with European, South African, and US companies, Zadna has been working to enhance seed quality and establish demonstration farms aimed at increasing producers' technical skills and improving export quality to Gulf markets.⁴⁰

To explain why Zadna invested so heavily in horticulture, several respondents pointed to the lack of private sector engagement in the subsector: "The lack of competition with the private sector is giving this company [Zadna] an advantage in this area."⁴¹ Another interviewee noted that Zadna had the capacity to focus on horticulture at scale because it could bypass certain constraints that otherwise discouraged the private sector:

"I think they focused on fresh fruits and vegetables because the private sector wasn't really focused on this on a larger scale. There were some small companies selling seeds in the fruits sector. City Seeds had greenhouses where they were breeding and selling plants, but really the private sector wasn't even looking at this market because it really required a lot of work from the production and processing side and the logistics didn't make sense and the Port [of Sudan] has always had its issues."⁴²

Moreover, investments in horticulture were designed not only to supply domestic consumption of fruits and vegetables but also to export to the world market. The company's model has relied on partnerships with private entrepreneurs to whom they lease their land and provide a series of services, including the distribution of high-quality horticultural tissue cultures.⁴³ In turn, they can sell the horticultural products for export to generate more revenue

38 Interview with former senior Central Bank official, virtual, February 13, 2024.

39 Interviews with agrifood export from agribusiness conglomerate (August 3, 2023) and former researcher with public agricultural research body (May 28, 2024), virtual.

40 Interview with resistance committee member (January 25, 2024), former member of transitional government (January 30, 2024), and agrifood expert from agribusiness conglomerate (April 3, 2024), virtual.

41 Interview with former research with public agricultural research body, virtual, May 28, 2024.

42 Interview with agrifood expert from agribusiness conglomerate, virtual, April 3, 2024.

43 Interview with government transparency expert, virtual, July 13, 2023.

for the military:⁴⁴ “At the end of the day, their aim is to sell.”⁴⁵ Yet, as with other business enterprises run by armed actors, rather than technical professionals, who do not need to care about operational planning and expenses, mismanagement and corruption have been problematic for the company.⁴⁶

Summary and conclusions

The SAF’s and RSF’s competing yet complementary commercial interests, not only in agrifood industries but also across a diverse range of sectors, are among the key drivers of the conflict in Sudan, perpetuated by what Walter (2017) calls “external spoilers,” meaning foreign actors who prolong the civil war for access to land, water, and other resources in exchange for financing and weapons support. At the same time, Sudan’s vibrant war economy⁴⁷ is a classic example of Keen’s (2008) observation that many wars are fought more for the continued accumulation of wealth than to actually win territory or ideology, thereby providing an incentive to continue perpetuating violence rather than to sue for peace.

As the chapter shows, Al-Bashir’s efforts to create rival sources of political power with entrenched economic interests have caused Sudan’s political settlement to be especially brittle in the post-Bashir era. The SAF’s leadership increasingly has resented the growing economic power of the RSF, as reflected in the RSF’s expansion into productive economic sectors such as agriculture and banking. Moreover, the RSF’s fiscal autonomy, facilitated by external networks and its own banking infrastructure, has enabled the paramilitary group to further expand its accumulation of economic rents.

The chapter offers a novel perspective on the diverse sets of strategies used by these armed actors across different agrifood value chains to amass profits that facilitate purchasing goods and equipment for continued warfare. Capture dominates in low-complexity value chains with limited private sector activity, such as livestock trade. Here, the SAF and RSF focus on extracting profits to fund their operations without investing in upgrading. Since the outbreak of the civil war, livestock markets have been bombed multiple times and the main vaccination lab in Khartoum was destroyed. Yet, the trade has continued with an oddly synergistic relationship between the RSF and SAF, as

44 Interview with former member of transitional government (January 30, 2024) and former Central Bank official (February 13, 2024), virtual.

45 Interview with livestock expert, agribusiness platform, virtual, February 28, 2024.

46 Interview with government transparency expert, virtual, July 13, 2023.

47 Ibid.

the former buys cattle in western Sudan and then sells to SAF-affiliated companies, which in turn export herds out via Port Sudan.⁴⁸

In value chains such as wheat milling, where substantial private sector involvement exists but technical complexity remains lower, the SAF historically employed a competitive strategy. By leveraging mechanisms such as preferential access to import licenses and financing, the SAF skewed the market in its favor, disadvantaging private sector competitors. The civil war has effectively further displaced the private sector through the destruction, for instance, of Sayga's factories in Khartoum (Rickett and Snehneh 2023).

Finally, in highly complex sectors with limited private sector presence, such as the horticulture value chain, the SAF (and RSF via Zadna) adopted an innovation strategy. By investing in high-quality seedlings and tissue culture labs, they started filling a gap left by the private sector, positioning themselves as key players in a potentially lucrative value chain. But with US and EU sanctions imposed on Zadna because of the company's alleged money laundering (U.S. Department of the Treasury 2024), and given limited sales prospects due to significantly lower household incomes resulting from the war, innovation in the horticulture sector is not a priority. Ironically, at least one observer noted that due to the historical militarization of the Sudanese state, SAF and RSF businesses will be critical to resolving food insecurity when the war ends, at least until the private sector can regain the confidence of investors and build up its infrastructure and supply chains.⁴⁹

Importantly, these scenarios in livestock, wheat milling, and horticulture predominantly reflect the prewar constellation of activities and interests between the SAF, RSF, and private sector. When the war ultimately concludes, a more in-depth mixed methods analysis can be employed to identify how the conflict impacted the private sector and shifted these armed actors' business strategies and financial flows.

More broadly, the chapter has illustrated that a desire for off-budget resources to gain financial autonomy has not only been at the root of the SAF's and RSF's empire building but also led to efforts to take control of certain value chains when the level of technical complexity is low and/or the private sector is relatively absent. At least two policy implications emerge from the chapter. First, divesting armed actors from business enterprises, including those in the agrifood system, is a fundamental prerequisite for a peaceful

⁴⁸ Interviews with government transparency expert (July 13, 2023) and livestock expert, agribusiness platform, (February 28, 2024), virtual.

⁴⁹ Interview with former senior Central Bank official, virtual, February 13, 2024.

transition, as it limits opportunities for financial autonomy by armed actors that will otherwise continue to threaten the state's legitimacy. Consequently, peace settlements need to include incentives for armed actors to forfeit such activities, including through guaranteed pensions, stable and attractive salaries, and other social benefits. Countries such as Argentina and Chile that successfully reduced the military's control of the economy may serve as examples. Second, for international partners interested in mitigating armed actors' role in the economy, more creative ways to support the private sector are needed. As the findings show, the private sector is adept at higher value-added and technically advanced value chain activities. As such, technology sharing, skills exchanges, and enhanced compliance with international phytosanitary regulations can enable the private sector to maintain this advantage over armed actors and allow it to expand into lucrative areas, such as horticulture, where it has been less active.

APPENDIX 1 Distribution of informants

Affiliation	Share of sample
Agricultural private sector	30%
Unions and associations	16%
Government and public sector	26%
Civil society (including international and domestic nongovernmental organizations)	24%
Agricultural finance	4%

Note: The agricultural private sector includes a broad range of large agrifood processors, input suppliers and logistics companies, and agrifood start-ups. Government and public sector informants are former government officials who served during the transitional period before the cabinet was dissolved following the 2021 military coup.

References

- ACLED (Armed Conflict Location & Event Data). 2025. ACLED Explorer, September 19, 2025 update. <https://acleddata.com/explorer/>
- Africa Confidential. 2021. "Between Money and the Military." *Africa Confidential* 62:15.
- Alfadul, H., K. Siddig, M. Ahmed, H. Abushama, and O.K. Kirui. 2024. "Sustainable Livestock Development in Sudan: Challenges, Opportunities, and Policy Priorities." Sudan SSP Working Paper 19. IFPRI. <https://hdl.handle.net/10568/151697>
- Baldo, S. 2021. *Sudan's Exchange Rate: How to Sustain Progress and Preempt Risks*. The Sentry. <https://thesentry.org/reports/sudans-exchange-rate/>
- Behuria, P., L. Buur, and H. Gray. 2017. "Studying Political Settlements in Africa." *African Affairs* 116 (464):508–525. <https://doi.org/10.1093/afraf/adx019>
- Buur, L., and P. Salimo. 2018. "The Political Economy of Social Protection in Mozambique." ESID Working Paper No. 103. ESID Research Centre (Effective States and Inclusive Development). <https://www.effective-states.org/working-paper-103/>
- Cartier, C., E. Kahan, and I. Zukin. 2022. *Breaking the Bank: How Military Control of the Economy Obstructs Democracy in Sudan*. C4ADS (Center for Advanced Defense Studies). <https://c4ads.org/reports/breaking-the-bank/>
- Sudan, CBoS (Central Bank of Sudan). 2022. *Sudan Economic & Financial Statistics Review*. Policies, Research & Statistics Department, CBoS. <https://cbos.gov.sd/en/content/4th-quarter-2022-0>
- Creswell, J.W., and V.L. Plano Clark. 2018. *Designing and Conducting Mixed Methods Research*. Third ed. SAGE Publications, Inc.
- D'Silva, B., R. Hassan, A. Hutur et al. 2023. *Political Constraints and Opportunities for Agricultural Investment in Sudan*. Sudan SSP Policy Note 4. IFPRI. <https://hdl.handle.net/10568/140269>
- D'Agoût, M. 2025. "Beyond State Capture: The Case of the Rapid Support Forces (RSF) in Sudan." *Small Wars & Insurgencies* 36 (4):698–726. <https://doi.org/10.1080/09592318.2025.2464435>
- Daily Sabah. 2021. "Turkey, Sudan Vow to Boost Relations, Lift Trade Volume to \$2b." *Daily Sabah*, August 13. <https://www.dailysabah.com/business/economy/turkey-sudan-vow-to-boost-relations-lift-trade-volume-to-2b>
- Di John, J., and J. Putzel. 2009. *Political Settlements*. GSDRC Issues Paper. GSDRC (Governance and Social Development Resource Centre). <https://gsdrc.org/publications/political-settlements-2/>
- Dorosh, P.A., K. Siddig, and O.K. Kirui. 2022. *The Implications of Market Liberalization and World Price Movements for Wheat Price Policy in Sudan*. Sudan SSP Policy Note 2. IFPRI. <https://hdl.handle.net/10568/141078>

- El-Battahani, A. 2016. *The Sudan Armed Forces and Prospects of Change*. CMI Insight No. 3. Chr. Michelsen Institute. <https://www.cmi.no/publications/5790-the-sudan-armed-forces-and-prospects-of-change>
- El Gizouli, M. 2020. *Mobilization and Resistance in Sudan's Uprising: From Neighbourhood Committees to Zanig Queens*. Rift Valley Institute Briefing Paper. Rift Valley Institute. <https://riftvalley.net/publication/mobilization-and-resistance-sudans-uprising/>
- FEWS NET (Famine Early Warning Systems Network). 2015. *Sudan: Staple Food Market Fundamentals*. FEWS NET. <https://fewsn.net/east-africa/sudan/market-fundamentals/june-2015>
- Gallopín, J.-B. 2020. *Bad Company: How Dark Money Threatens Sudan's Transition*. ECRF (European Council on Foreign Relations). https://ecfr.eu/publication/bad_company_how_dark_money_threatens_sudans_transition/
- Global Witness. 2019. *Exposing the RSF's Secret Financial Network*. Global Witness. <https://globalwitness.org/en/campaigns/conflict-resources/exposing-rsf-secret-financial-network/>
- Hassan, M., and A. Kodouda. 2019. "Sudan's Uprising: The Fall of a Dictator." *Journal of Democracy* 30 (4):89–103. <https://doi.org/10.1353/jod.2019.0071>
- Humphrey, A., C. Jaquez, S. Levine, C. Stull-Lane, H. Sulieman, and S. Wiggins. 2021. *Impacts of Disruptions to Livestock Marketing in Sudan*. Technical Report. SPARC (Supporting Pastoralism and Agriculture in Recurrent and Protracted Crises). <https://www.sparc-knowledge.org/publications-resources/impacts-disruptions-livestock-marketing-sudan>
- Idris, B. 2007. *Livestock Marketing in Eastern and Central Sudan*. Sudan Multi-Donor Trust Fund National Sector Policy Note. World Bank.
- ISS (Institute for Security Studies). 2015. *View on Africa: Sudan's Military Discreetly Reorganised*, Addis Ababa, August 12. <https://issafrica.org/events/view-on-africa-sudans-military-discreetly-reorganised>
- Keen, D. 2008. *Complex Emergencies*. Polity Press.
- Kelsall, T. 2018. "Thinking and Working with Political Settlements: The Case of Tanzania." ODI Global Working Paper. ODI Global. <https://odi.org/en/publications/thinking-and-working-with-political-settlements-the-case-of-tanzania/>
- Khan, M. 2011. "Political Settlements and the Governance of Growth-Enhancing Institutions." Growth-Enhancing Governance Working Paper. SOAS Repository. <https://soas-repository.worktribe.com/output/389203/political-settlements-and-the-governance-of-growth-enhancing-institutions>
- Kurtz, Gerrit. 2024. *Power Relations in Sudan after the Fall of Bashir*. SWP Research Paper 2024. SWP (German Institute for International and Security Affairs). <https://doi.org/10.18449/2024RP05>

- Lanfranchi, G., and A. Hoffman. 2023. *Kleptocracy Versus Democracy: How Security-Business Networks Hold Hostage Sudan's Private Sector and the Democratic Transition*. Clingendael Institute. <https://www.clingendael.org/publication/kleptocracy-versus-democracy>
- Marshall, M.N. 1996. "Sampling for Qualitative Research." *Family Practice* 13 (6):522–526. <https://doi.org/10.1093/fampra/13.6.522>
- McNabb, D.E. 2015. *Research Methods for Political Science: Quantitative and Qualitative Approaches*. Second ed. Routledge.
- North, D.C., J.J. Wallis, and B.R. Weingast. 2012. *Violence and Social Orders: A Conceptual Framework for Interpreting Recorded Human History*. Cambridge University Press.
- Palinkas, L.A., S.M. Horwitz, C.A. Green, J.P. Wisdom, N. Duan, and K. Hoagwood. 2015. "Purposeful Sampling for Qualitative Data Collection and Analysis in Mixed Method Implementation Research." *Administration and Policy in Mental Health and Mental Health Services Research* 42 (5):533–544. <https://doi.org/10.1007/s10488-013-0528-y>
- Palys, T. 2008. *Purposive Sampling*. SAGE Publications, Inc.
- Radio Dabanga. 2015. "Major Sudanese Miller Halts Production." *Radio Dabanga*, August 2. <https://www.dabangasudan.org/en/all-news/article/major-sudanese-miller-halts-production>
- Radio Dabanga. 2016. "Bill Allows Saudi Arabia to Cultivate Sudan Lands." *Radio Dabanga*, July 19. <https://www.dabangasudan.org/en/all-news/article/bill-allows-saudi-arabia-to-cultivate-sudan-lands>
- Reno, W. 1998. *Warlord Politics and African States*. Lynne Rienner Publishers.
- Resnick, D. 2021. "Political Economy of Wheat Value Chains in Post-Revolution Sudan." Sudan SSP Working Paper 1. IFPRI. <https://hdl.handle.net/10568/142128>
- Resnick, D., H. Abushama, M. Ahmed, O.K. Kirui, and K. Siddig. 2026. "Under the Gun: Military and Paramilitary Actors in Sudan's Agrifood System." *The Journal of Development Studies*, 1–22. <https://doi.org/10.1080/00220388.2025.2601585>
- Rickett, O., and M.A. Sneineh. 2023. "Sudan Faces Dire Food and Medicine Shortages as Fighting Wreaks Havoc." *Middle East Eye*, April 28. <https://www.middleeasteye.net/news/sudan-food-medicine-shortages-dire-fighting-wreaks-havoc>
- Roberts, L. 2025. "How Many Have Died in Sudan's Civil War? Satellite Images and Models Offer Clues." *Science* 387 (6737):914–915. <https://doi.org/10.1126/science.zvussc0>
- Sarkar, A., and A. de Waal. 2023. "Thinking Politically About Money: The Changing Role of Political Finance in the Political (Un-) Settlements in Ethiopia and Sudan." ERF Working Paper No. 1625. ERF (Economic Research Forum). <https://erf.org.eg/publications/thinking-politically-about-money-the-changing-role-of-political-finance-in-the-political-un-settlements-in-ethiopia-and-sudan/>

- Sayigh, Y. 2023. *Sudan's Military Companies Go Civilian: How the Recent Divestment Agreement Can Succeed*. Carnegie Endowment for International Peace. <https://carnegieendowment.org/research/2021/04/sudans-military-companies-go-civilian-how-the-recent-divestment-agreement-can-succeed?lang=en>
- Siddig, K. 2016. "Wheat Imports Subsidy in the Sudan: A Waste of State Funds, an Oligopoly or a Food Security Mechanism?" *IFPRI Egypt SSP* (blog). June 23. <https://egyptssp.ifpri.info/2016/06/23/wheat-imports-subsidy-in-the-sudan-a-waste-of-state-funds-an-oligopoly-or-a-food-security-mechanism/>
- Siddig, K, M. Raouf, and M.O.M. Ahmed. 2023. "The Economy-Wide Impact of Sudan's Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty." Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>
- The Arab Weekly. 2021. "Sudan, Saudi Arabia Discuss Red Sea Investments." *The Arab Weekly*, March 10. <https://thearabweekly.com/sudan-saudi-arabia-discuss-red-sea-investments>
- Thomas, E, and M. El Gizouli. 2020. *Sudan's Grain Divide: A Revolution of Bread and Sorghum*. Rift Valley Institute. <https://riftvalley.net/publication/sudans-grain-divide-revolution-bread-and-sorghum/#:~:text=This%20briefing%20unpacks%20the%20connected,Sudan's%20bread%20and%20sorghum%20eaters>
- U.S. Department of the Treasury. 2024. *Treasury Targets Entities Funding the Conflict in Sudan*. U.S. Department of the Treasury.
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNITAMS (United Nations Integrated Transition Assistance Mission in Sudan). 2022. *Trilateral Mechanism Statement on the Signing of a Political Framework Agreement*. UNITAMS.
- Usman, Z. 2020. "The Successes and Failures of Economic Reform in Nigeria's Post-Military Political Settlement." *African Affairs* 119 (474):1–38. <https://doi.org/10.1093/afraf/adz026>
- Verhoeven, H. 2023. "Surviving Revolution and Democratisation: The Sudan Armed Forces, State Fragility and Security Competition." *The Journal of Modern African Studies* 61 (3):417–437. <https://doi.org/10.1017/S0022278X23000174>
- Walter, B.F. 2017. "The New New Civil Wars." *Annual Review of Political Science* 20:469–486. <https://doi.org/10.1146/annurev-polisci-060415-093921>
- World Bank. 2020. *Sudan: Agriculture Value Chain Analysis* World Bank. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/731741593616746051>

SECTION II

Economic, Social, and Humanitarian Impacts

MONITORING ECONOMIC ACTIVITIES: LEVERAGING SATELLITE AND REMOTE-SENSING TECHNOLOGIES

Zhe Guo, Hala Abushama, Khalid Siddig, Oliver K. Kirui, Anne Timu, Shuang Zhou, Kibrom Abay, and Liangzhi You

Understanding disruptions to economic activities in conflict-affected regions such as Sudan is essential for policymakers, humanitarian organizations, and researchers seeking to develop effective response strategies. However, traditional data collection methods, such as official government statistics and household surveys, become unreliable or impractical in these contexts due to security risks, displacement, and institutional breakdowns. In such environments, satellite and remote-sensing technologies provide a powerful alternative, offering near real-time, scalable, and objective insights into economic disturbances, infrastructure damage, population displacement, and environmental degradation. Advances in Earth observation technologies now allow researchers to monitor the economic consequences of conflicts with great accuracy and efficiency, even in regions where on-the-ground data collection is impossible (Hoogeveen et al. 2016; Hoogeveen and Pape 2020; Abay et al. 2023).

Among the most widely used remote-sensing data, nightlight has emerged as a key proxy for economic activity. Satellites such as the Visible Infrared Imaging Radiometer Suite (VIIRS) and the Defense Meteorological Satellite Program capture nightlight imagery, allowing researchers to track changes in economic intensity across urban and industrial regions (Ezran et al. 2023). Typically, brighter nightlight corresponds to increased commercial activity, urbanization, and industrial development. These data have proven particularly valuable in conflict settings, where sudden drops in nightlight intensity can indicate economic downturns, displacement of populations, or destruction of infrastructure. However, nightlight data also have limitations—they are affected by cloud cover, do not capture daytime economic activities, and cannot provide insights into industries that do not rely on artificial lighting.

Recently, nitrogen dioxide (NO₂) emissions estimated from satellite data have gained increasing favor as an economic proxy (Morris and Zhang 2019). NO₂ is closely linked to industrial activity, transportation networks, and power generation, making it a useful indicator of production and energy

consumption (Goldberg et al. 2021). Satellite instruments such as Sentinel-5P/TROPOMI and OMI/Aura provide high-resolution NO₂ concentration data, allowing researchers to assess economic disruptions with near real-time precision. Unlike nightlight data, NO₂ emissions capture daytime activities and have a short atmospheric lifespan, ensuring that emission levels reflect recent economic behavior. However, interpreting NO₂ data requires careful calibration, as atmospheric conditions such as wind patterns and precipitation can influence emissions dispersion.

Sudan provides a critical case for examining the use of satellite and remote-sensing technologies in monitoring economic activities under conflict conditions. The country has faced recurrent political instability and, most recently, the large-scale armed conflict that erupted in April 2023, between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF). The conflict has caused severe disruptions to livelihoods, infrastructure, and economic systems—particularly in Khartoum, Sudan’s principal economic hub. This chapter applies remote-sensing data to analyze how these disruptions have reshaped economic activity patterns across Sudan in near real-time.

The conflict in Sudan and its economic implications

The conflict between the SAF and RSF has severely disrupted economic activities, infrastructure, and public services, with Khartoum suffering the most intense impacts. Reports indicate widespread bank closures, shortages of essential goods, and mass displacement, leading to worsening humanitarian conditions. As of mid-October 2023, more than 70 percent of Sudan’s health-care facilities had ceased operation due to violent clashes, with disruptions to Khartoum’s centralized medical infrastructure leaving millions with limited access to health services (UNHCR 2023). The displacement crisis was intensifying; as of February 2026, 7 million people had been internally displaced, while 4.5 million had fled to neighboring countries, including Chad, Egypt, South Sudan, Ethiopia, and the Central African Republic (UNHCR 2026). The ongoing fighting had also strained regional resources, increasing food insecurity and putting additional pressure on host communities (Siddig et al. 2023).

The economic consequences of the Sudanese conflict extend beyond immediate humanitarian concerns. Disruptions in trade, industry, and agriculture have significantly weakened Sudan’s economy. Infrastructure damage and disruptions to domestic and international trade have further diminished the country’s productive capacity, making economic recovery increasingly difficult.

The economic crisis is particularly concerning due to the damage sustained by Khartoum—Sudan’s primary commercial hub and home to its largest industrial, financial, and service sectors. Industrial statistics for 2011 reported about 248,000 industrial establishments in all of Sudan, 64 percent of which were based in Khartoum (Sudan, Ministry of Environment, Forestry and Urban Development and UN-Habitat 2014). Khartoum has also been a major trade center for agricultural commodities, linking rural production areas to domestic and international markets. At the onset of the conflict, the city’s economic activity nearly collapsed as businesses were shuttered and residents fled (Abushama et al. 2023; Kirui et al. 2023). The decline of economic activity in Khartoum has also had serious effects on supply chains, employment, and overall market stability.

Using satellite data to monitor economic disruptions

Recent studies highlight the growing importance of NO₂ satellite data in economic analysis (Guo et al. 2024). Morris and Zhang (2019) demonstrated how NO₂ emissions could serve as an independent measure of economic growth, particularly in cases where official GDP figures may be unreliable. Their study validated data on China’s industrial activity by correlating NO₂ emissions with economic output, revealing discrepancies in official statistics. Ezran and colleagues (2023) expanded on this concept by integrating NO₂ satellite data with nightlight imagery to refine the estimation of business cycles. Their research found that NO₂-based economic estimates more accurately tracked real-time business fluctuations than nightlight data alone, particularly in developed economies where NO₂ emissions closely follow industrial production. Furthermore, their study demonstrated that NO₂ data are highly responsive to economic shocks, such as the downturn experienced during the COVID-19 pandemic, highlighting its potential as a near-instantaneous economic monitoring tool.

Beyond NO₂ and nightlight data, additional satellite-based indicators further enrich economic assessments. Land cover changes, observed through Landsat and Sentinel-2 imagery, reveal patterns of urban expansion, destruction, and shifts in agricultural land use. Vegetation indices, such as the Normalized Difference Vegetation Index (NDVI), are instrumental in tracking agricultural output and food security risks in conflict-affected regions. Maritime trade activity, monitored via Automatic Identification System (AIS) data, provides insights into disruptions in supply chains and shifts in regional

commerce. By integrating these multiple data sources, researchers can develop a more comprehensive, multidimensional view of economic activity in unstable environments.

Given the challenges of collecting accurate socioeconomic data in conflict zones, the capacity of remote sensing to provide large-scale observations over inaccessible areas makes it an indispensable tool for monitoring economic conditions, guiding policy interventions, and supporting humanitarian operations (Henderson et al. 2012). In the case of Sudan, remote sensing provides important information on the evolution of economic activities before and after the outbreak of conflict. By analyzing changes in NO₂ emissions and nightlight intensity, this study provides a near real-time assessment of how economic activity patterns have been reshaped by the ongoing conflict. The findings carry significant implications for food security, infrastructure planning, and crisis response strategies, particularly in regions where ground-based economic data are unavailable or unreliable. The following sections provide an in-depth discussion of the methodologies employed, findings from the Sudan case study, and broader policy implications for integrating satellite remote sensing into economic monitoring frameworks in conflict-affected regions.

Methodology

Nitrogen dioxide (NO₂) is a harmful air pollutant released from both human and natural sources, including industrial processes, power generation, transportation, wildfires, lightning, and soil microbial activity. Among anthropogenic sources, fossil fuel combustion—especially from vehicles, power plants, and industrial operations—is the primary driver of NO₂ emissions (Keola and Hayakawa 2021). Because of its strong association with human activity, NO₂ serves as a valuable proxy for economic and industrial performance, particularly in areas where conventional economic data are limited or unreliable. Analyzing the spatial and temporal patterns of NO₂ helps identify activity hotspots and shifts linked to human development. Monitoring these trends over time enables policymakers and planners to evaluate economic dynamics, assess the effectiveness of interventions, and design strategies to reduce air pollution.

The Sentinel-5P OFFL NO₂ product marks a significant advancement in Earth observation and atmospheric monitoring (ESA 2018). Developed by the European Space Agency's Sentinel-5 Precursor mission, it leverages the TROPospheric Monitoring Instrument (TROPOMI)—a state-of-the-art imaging spectrometer—to deliver high-resolution measurements of atmospheric gases, including NO₂ (Goldberg et al. 2021).

The Sentinel-5P NO₂ product delivers a comprehensive range of insights, including:

- High-resolution maps of NO₂ concentrations at approximately 1 km² spatial resolution
- Near real-time measurements, enabling timely assessments of air pollution and economic activity
- Vertical profiles and time-series data, allowing researchers to analyze long-term and short-term NO₂ trends

These capabilities make Sentinel-5P a powerful tool for tracking NO₂ emissions and their association with human activity. It has also been instrumental in detecting conflict-related disruptions in economic activity (Cooper et al. 2022). In areas affected by armed conflict or political instability, disruptions to industrial operations, restricted transportation, and shutdowns of economic hubs often lead to significant declines in NO₂ emissions—serving as a clear signal of reduced human and industrial activity.

In the Sudan case study, NO₂ satellite data were used to examine both the baseline distribution of economic activities and the impact of conflict on emissions patterns over time. To understand the preconflict economic landscape, we first construct an NO₂ concentration baseline map for 2022, identifying the locations of human settlements, industrial hubs, and major economic activity areas. This is achieved by processing daily NO₂ data from 2022, covering Sudan at a high temporal and spatial resolution. The dataset is then aggregated to compute the annual average NO₂ concentration at the pixel level, allowing us to create a spatially explicit map of economic intensity across Sudan. By comparing NO₂ levels with known urban centers and industrial zones, we can assess whether NO₂ concentrations align with established economic hubs such as Khartoum, Nyala, and El-Obeid. It also serves as a foundational dataset for tracking subsequent changes in emissions patterns related to conflicts. The baseline NO₂ map captures Sudan's pre-war industrial footprint, highlighting major cities and manufacturing zones, which were expected to experience significant disruptions during wartime.

To assess the impact of conflict on economic activity at the onset of the war, we examined NO₂ concentration trends in key cities before and after the outbreak of hostilities. Our approach combines high-resolution spatial visualization at the pixel level with quantitative aggregation at the administrative unit level, ensuring a comprehensive evaluation of conflict-induced economic disruptions. The analysis has two components: (1) mapping NO₂

concentrations at the pixel level to capture localized changes before and after the conflict, and (2) analyzing temporal NO₂ emission trends over April 2023, distinguishing between cities directly affected by conflict and those experiencing indirect economic disruptions.

To visualize the spatial distribution of emissions, we generated high-resolution NO₂ concentration maps at the 1 × 1 km² pixel level for two time periods: April 1–7, 2023 (before the conflict), and April 14–21, 2023 (during the conflict). These two maps provide a detailed representation of NO₂ fluctuations across different regions, enabling us to identify specific cities and industrial hubs that experienced the most significant economic slowdowns due to the conflict. This pixel-level analysis highlights localized variations in economic activity, distinguishing between areas with severe economic contractions and those that remained relatively stable. For instance, Khartoum, Bahri, and Omdurman, which were major battlegrounds, experienced disruptions in industrial output, transportation networks, and commercial activities. Conversely, Kassala, which reportedly was largely insulated from direct fighting, showed limited impact from the conflict.

While pixel-level mapping provides detailed insights, a systematic quantification of these changes at the municipal level—referred to as the administrative unit—is necessary to facilitate regional comparisons. To accomplish this, we calculated the average NO₂ concentration for each five-day interval throughout April 2023 at the administrative unit level. A series of representative cities were selected and grouped into two categories: conflict-affected and less- or non-conflict-affected. The selection of cities was informed by multiple sources, including recommendations from local experts, information from news and media reports, and insights obtained through virtual meetings with local staff. These selections were subsequently verified using conflict event data from Armed Conflict Location and Event Data (ACLED) (Ali and Ada 2023; Ali 2023). By aggregating NO₂ emissions data, we assessed how different administrative units responded to the conflict, identifying areas that experienced sharp economic declines and those that remained relatively stable, including both units directly affected by conflict and units outside the conflict zone. This approach provides a clearer understanding of how the conflict reshaped economic dynamics over time.

While NO₂ data provide near real-time insights into economic activities, we also incorporated VIIRS nightlight data to validate our findings (NCEI 2023). Nightlight intensity serves as a complementary economic indicator, capturing nighttime activity patterns in urban and industrial areas. However, VIIRS nightlight data is only available at monthly intervals and has

a 3–4-month processing delay, making it more suitable for long-term trend validation rather than immediate real-time monitoring.

Thus, for the nightlight analysis, we utilized nightlight data from March 2023 as a preconflict baseline and May 2023 as the postconflict observation. As with the NO₂ data, we analyzed changes in nightlight intensity across key cities to assess whether trends observed in nightlight data aligned with NO₂-based findings. By comparing these datasets, we ensured the reliability and robustness of our assessment, reinforcing the conclusion that Sudan's conflict zones experienced substantial economic disruptions following the conflict's outbreak.

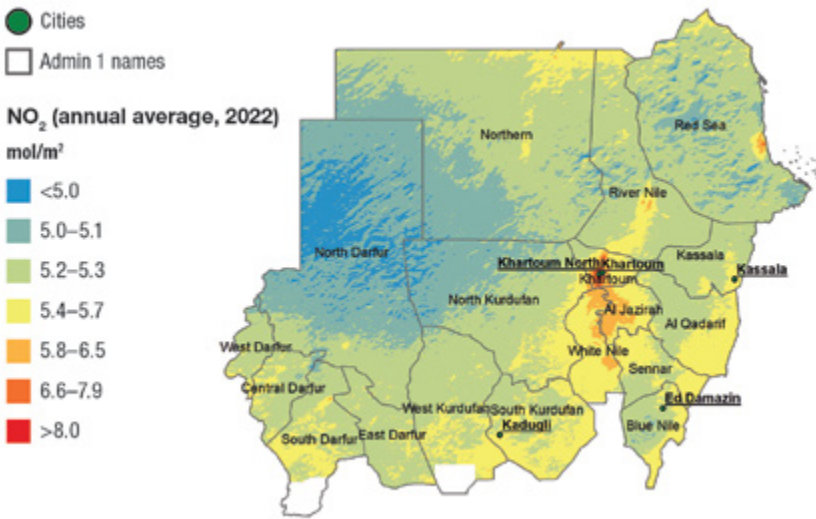
Results and discussion

The annual mean TROPOMI-derived pixel-level NO₂ concentrations for 2022 (expressed in moles per square meter, mol/m², representing the total vertical column density of atmospheric NO₂) serve as a foundational baseline to demonstrate the utility of NO₂ as a proxy for mapping and monitoring economic activity across Sudan (Figure 4.1). By establishing this baseline, we could identify industrial hotspots and assess how spatial patterns of NO₂ emissions correspond to ground-level economic activities, thus providing a reference for future comparisons and monitoring.

The NO₂ distribution map for 2022 reveals distinct spatial heterogeneity across Sudan, highlighting variations in emissions intensity related to urbanization, industrial activity, and transportation infrastructure:

- High NO₂ concentrations are predominantly observed in urban and industrial regions, where emissions from factories, power plants, and heavy vehicular traffic are most significant.
- The cities of Khartoum and Omdurman, and other urban areas, exhibit the highest NO₂ levels, reflecting their roles as major economic hubs with dense industrial operations, extensive road networks, and significant energy consumption.
- Rural areas, particularly in western and southern Sudan, show significantly lower NO₂ levels, a result of limited industrial activity, sparse transportation infrastructure, and lower population density.

By establishing this annual baseline, we could systematically compare preconflict NO₂ emissions with postconflict patterns, allowing for a detailed assessment of the impact of the April 2023 conflict on economic activity

FIGURE 4.1 Average of NO₂ concentration (mol/m²) in 2022

Source: Authors' depiction based on Sentinel-5P OFFL TROPOMI-derived NO₂.

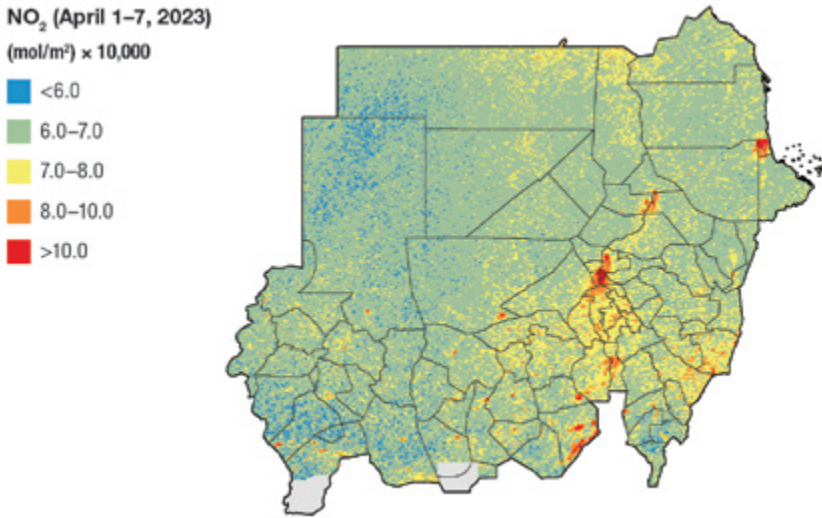
Note: The figure uses the alternative spellings of Al Qadarif for El-Gedaref and Al Jazirah for Aj Jazirah.

across different regions of Sudan. The highest intensity of armed confrontation was recorded in Khartoum State, particularly in Khartoum City, where the military headquarters and key public institutions are concentrated. The conflict also affected the twin cities of Omdurman and Khartoum North, though fighting in these areas was somewhat less intense. Given that Khartoum serves as Sudan's primary economic and administrative hub, these hostilities had profound implications for commercial activity, infrastructure stability, and population displacement.

Figures 4.2 and 4.3 illustrate the spatial distribution of NO₂ levels before and during the conflict based on Sentinel-5P OFFL TROPOMI-derived NO₂ data.

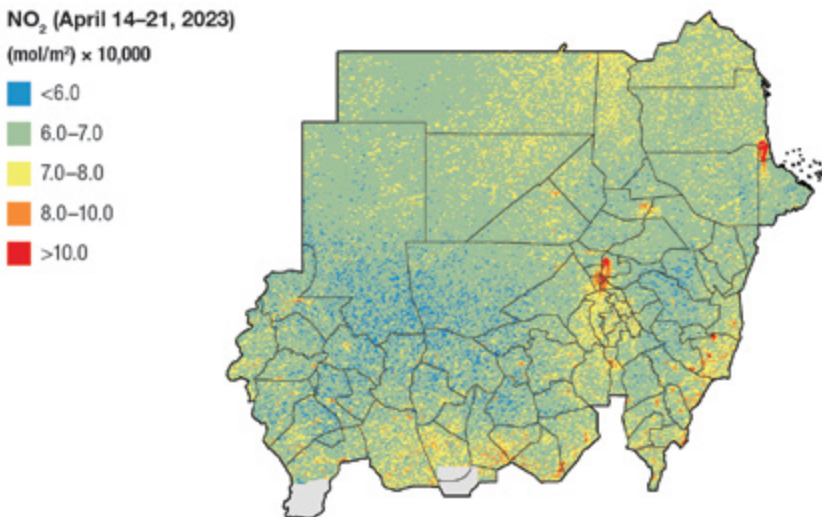
- Preconflict period (April 1–7, 2023): NO₂ concentrations were relatively high and widespread, particularly in Khartoum and major industrial and transportation corridors across central, eastern, and southern Sudan. This reflects normal economic activity, including industrial emissions and vehicular movement.

FIGURE 4.2 NO₂ levels (mol/m²) in Sudan before the conflict (April 1–7, 2023)



Source: Authors' depiction based on Sentinel-5P OFFL TROPOMI-derived NO₂.

FIGURE 4.3 NO₂ levels (mol/m²) in Sudan during the conflict (April 14–21, 2023)



Source: Authors' depiction based on Sentinel-5P OFFL TROPOMI-derived NO₂.

- During conflict (April 14–21, 2023): Following the eruption of conflict, there was a notable decline in NO₂ levels across conflict-affected regions, particularly in Khartoum, River Nile state (Atbara area), Gedaref state, Aj Jazirah state, and other parts of Central Sudan. This reduction suggests a sharp decrease in economic and industrial activity, likely due to business closures, reduced transportation, and displacement of the workforce.

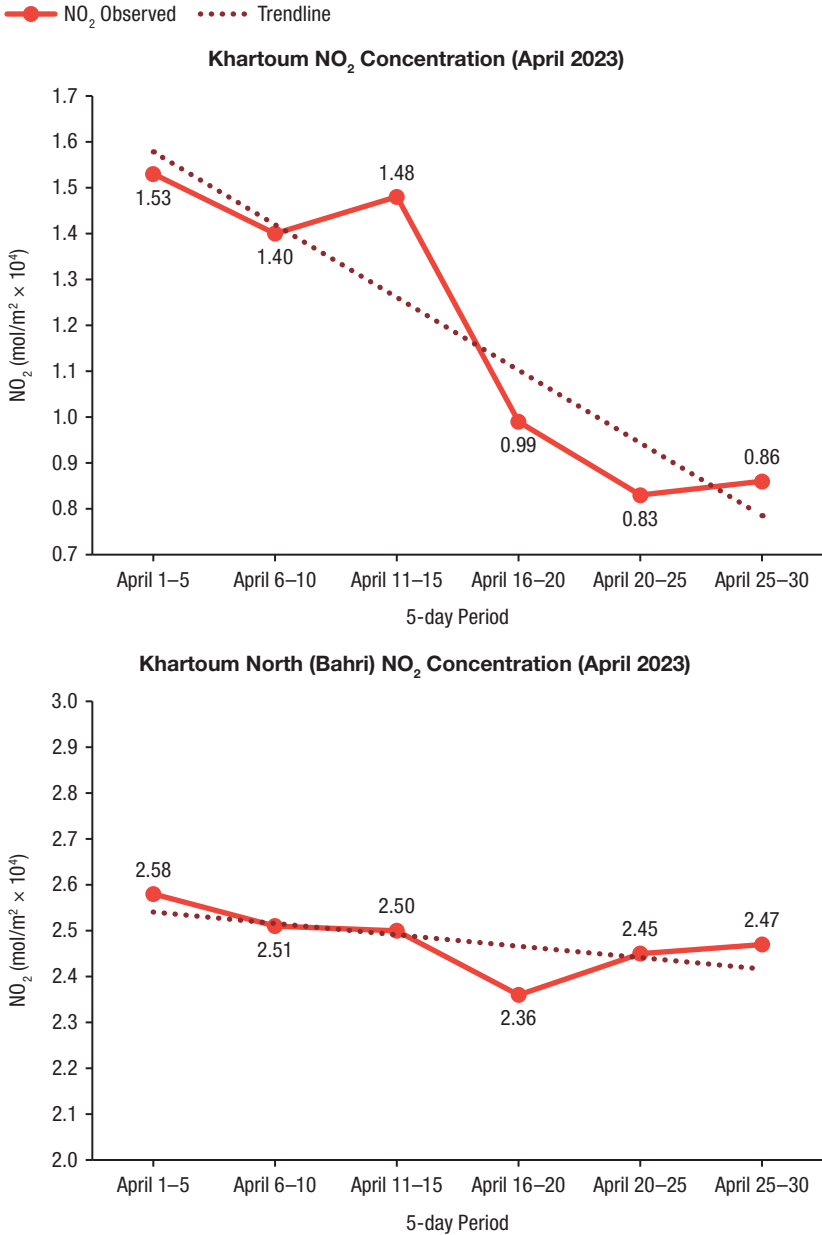
These findings highlight the immediate economic consequences of the conflict, as industrial and vehicular emissions—key proxies for economic activity—declined significantly in heavily affected regions. The spatial heterogeneity of NO₂ changes also underscores the varying degree of conflict-related disruptions, with some regions experiencing steeper declines due to the greater severity of hostilities and population displacement.

Beyond the comparison of NO₂ concentration snapshots before and after the conflict, we also examined trends throughout the entire month of April, utilizing daily NO₂ observations from satellite data. Figures 4.4 and 4.5 provide a closer look at the mean NO₂ concentrations at the administrative level for April 2023, distinguishing between regions directly impacted by the conflict and those that remained relatively unaffected. The data indicate notable shifts in NO₂ levels around Greater Khartoum, where a clear downward trend is observed in Khartoum and Khartoum North following the outbreak of conflict on April 15. The abrupt cessation of movement in and around Khartoum, resulting from mass displacement and the disruption of industrial and commercial activities, likely contributed to the reduction in NO₂ emissions, reflecting the broader economic slowdown triggered by the conflict.

In contrast to the sharp decline in NO₂ concentrations observed in Khartoum state, several regions that were less directly affected by the conflict, such as Ed Damazin, Kadugli, and Kassala, show an upward trend in NO₂ levels throughout April, as shown in Figure 4.5. These areas, located farther from the immediate conflict zones, experienced increased human activity and movement, as they became major destinations for internally displaced persons (IDPs) fleeing the violence in Khartoum. The influx of IDPs, coupled with the continued operation of transportation networks, commercial activity, and temporary settlements, contributed to the rise in NO₂ emissions between April 16 and 30.

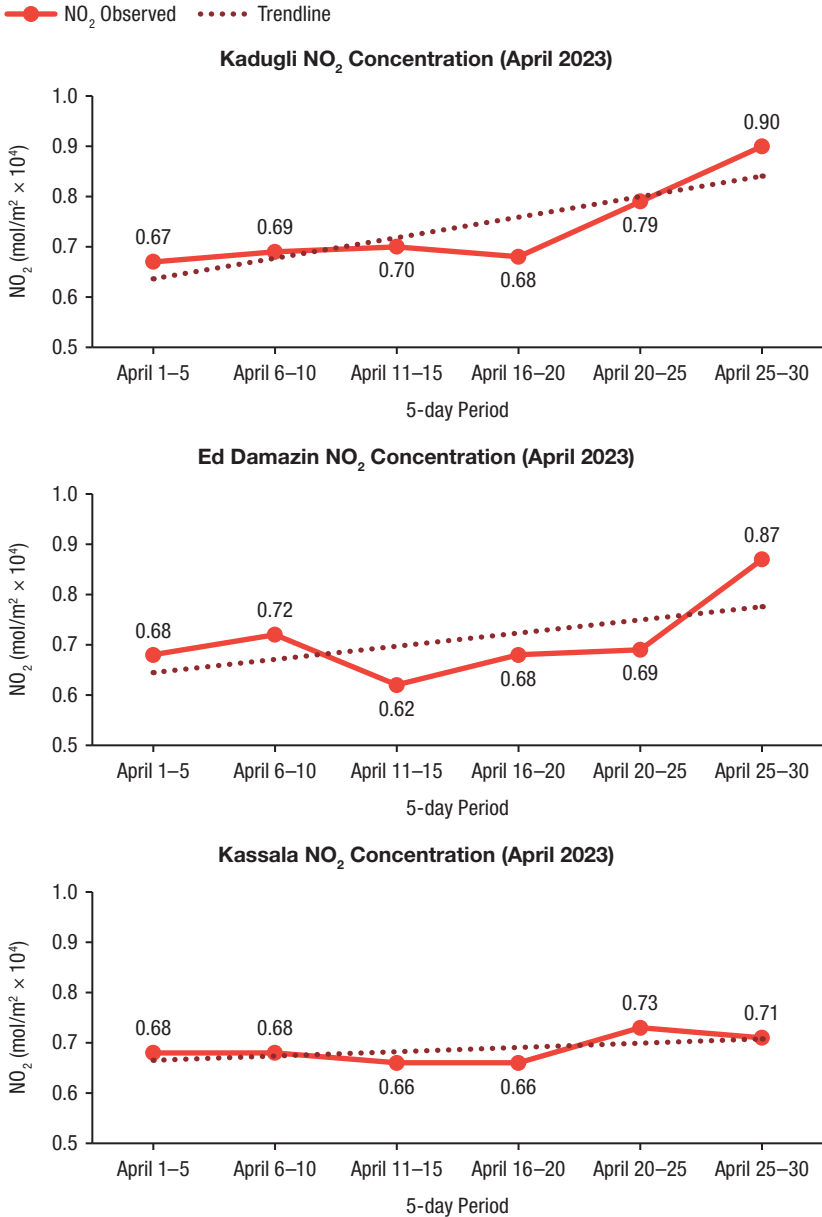
Over time, Kassala evolved into a *de facto* administrative and economic hub, with several government offices and businesses relocating there to continue operations. However, many migrants only passed through Kassala and

FIGURE 4.4 NO₂ levels (mol/m²) in the Khartoum cities (conflict-affected area)



Source: Authors' calculation based on Sentinel-5P OFFL TROPOMI-derived NO₂.

FIGURE 4.5 NO₂ levels (mol/m²) in Ed Damazin, Kadugli, and Kassala (less conflict-affected areas)



Source: Authors' calculation based on Sentinel-5P OFFL TROPOMI-derived NO₂.

other cities on their way to more permanent settlements, including in Saudi Arabia, Egypt, and other neighboring countries.

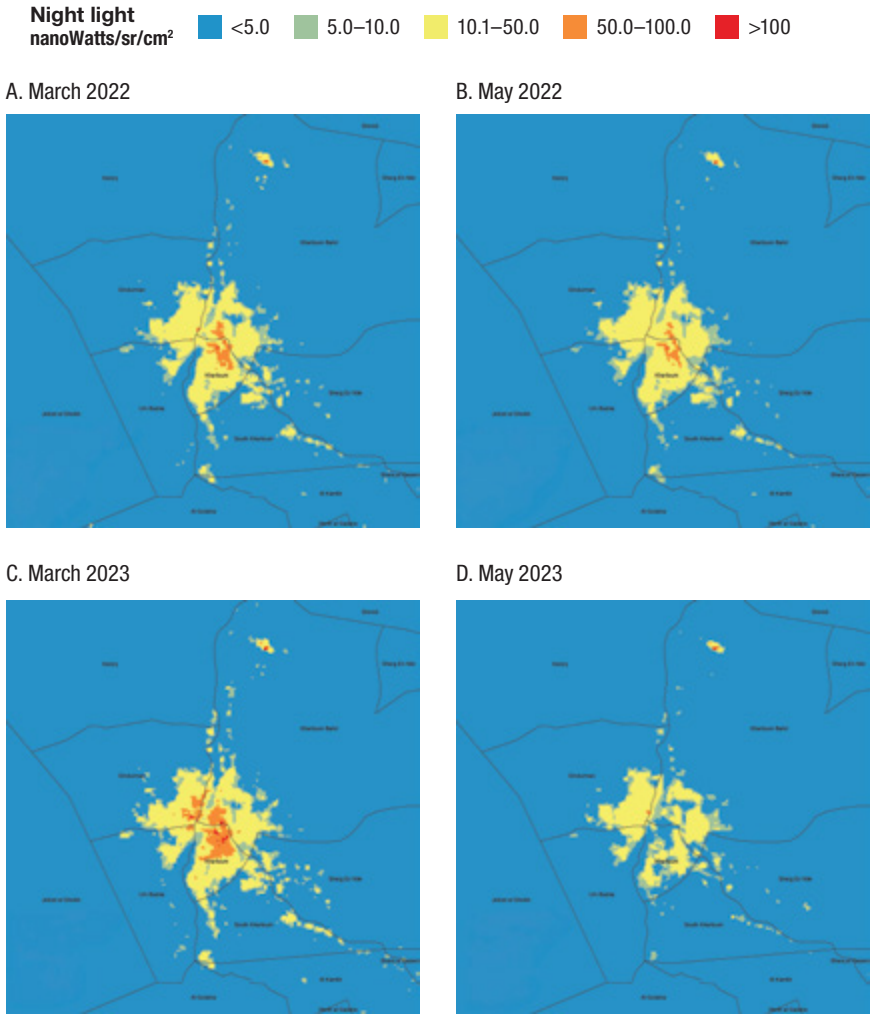
As a complement to the analysis of NO_2 concentrations, we also analyze VIIRS nightlight data. Our analysis focused on two key cities: Khartoum, which experienced direct conflict, and Ed Damazin, which saw fewer conflict-related disturbances. To account for potential seasonal variations, we also examined VIIRS nightlight data from March and May 2022, ensuring that any observed changes in 2023 were primarily attributable to the conflict rather than seasonal effects or temporary changes in infrastructure.

Figure 4.6 presents a comparative analysis of nightlight intensity before and after the onset of the conflict. The data clearly show a marked decrease in nightlight intensity from March 2023 to May 2023, aligning with the observed decline in NO_2 concentrations. This reduction suggests a significant disruption in economic activity, infrastructure usage, and urban illumination due to the conflict. In contrast, an analysis of nightlight intensity for the same period in 2022 (March to May) reveals no substantial differences, indicating that, in the absence of conflict, seasonal or external factors had a minimal impact on nightlight variability.

To facilitate a comparative analysis, we also examined changes in nightlight intensity in Ed Damazin, a region where NO_2 levels remained stable (Figure 4.7). Consistent with the NO_2 observations, no significant decrease in nightlight intensity was detected, suggesting that economic activity in this area was relatively unaffected by the conflict. Interestingly, some locations within Ed Damazin exhibited increases in nightlight intensity, potentially reflecting an influx of IDPs or shifts in local economic activities. These spatiotemporal patterns observed in nightlight data closely align with those seen in NO_2 measurements.

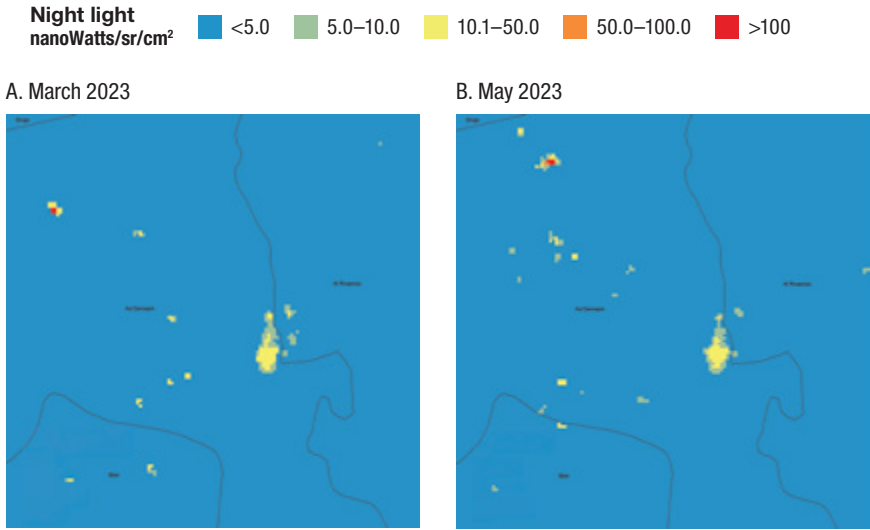
TROPOMI-derived weekly mean ground-level NO_2 concentrations for the periods of April 1–7, 2023 (pre-war) and April 14–21, 2023 (first week of the conflict) across selected cities that were either directly affected by conflict or remained relatively stable are shown in Table 4.1. These results indicate that all conflict-affected urban regions experienced a decline in NO_2 concentrations, with the exception of El-Geili in northern Khartoum state and Sawakin in Red Sea state, both of which exhibited a slight increase. The rise in NO_2 levels in El-Geili is likely attributable to the presence of a major oil refinery, which remained operational due to its strategic economic importance, and to the influx of IDPs from central Khartoum and Khartoum North. Similarly, Sawakin did not experience a decline, as it is geographically distant from the conflict's epicenter and remained largely unaffected during the initial phase of the war.

FIGURE 4.6 Nightlight intensity (nanowatts per square centimeter per steradian, $nW\cdot cm^{-2}\cdot sr^{-1}$) of March 2022 (upper left), May 2022 (upper right), March 2023 (bottom left), and May 2023 (bottom right)



Source: Authors' calculation based on VIIRS nightlight data.

FIGURE 4.7 Nightlight intensity (nanowatts per square centimeter per steradian, $nW \cdot cm^{-2} \cdot sr^{-1}$) of March 2023 (left) and May 2023 (right).



Source: Authors' calculation based on VIIRS nightlight data.

TABLE 4.1 NO_2 concentrations (mol/m^2) and changes in selected cities of Sudan in April 2023

City	April 1–7, 2023 (mol/m^2) *10000	April 14–21, 2023 (mol/m^2) *10000	Change (percent)	Conflict?
Khartoum	1.53	1.01	-33.99	Yes
El-Geili	0.79	0.81	2.53	Yes
Es Sileit	0.76	0.73	-3.95	Yes
Khartoum North	1.03	0.85	-17.48	Yes
Omdurman	2.58	2.39	0.00	Yes
Sawakin	0.97	0.99	2.06	No
Kassala	0.68	0.68	0.00	No
El-Fashir	0.67	0.64	-5.88	No
Kadugli	0.69	0.69	0.00	No
Ed Damazin	0.68	0.68	0.00	No

Source: Authors' calculation based on Sentinel-5P OFFL TROPOMI-derived NO_2 data.

Among the cities that recorded the most significant NO₂ reductions, Khartoum saw the steepest decline (−34%), followed by Khartoum North (−17%), El-Fashir (−6%), and Es Sileit (−4%). The substantial decreases in Khartoum and Khartoum North align with their status as key economic and administrative hubs, where intense fighting led to the closure of industries, commercial activities, and transportation networks. El-Fashir and Es Sileit—both of which host RSF military bases targeted by the SAF—also exhibited notable NO₂ reductions, likely reflecting disruptions in industrial operations and vehicular movement.

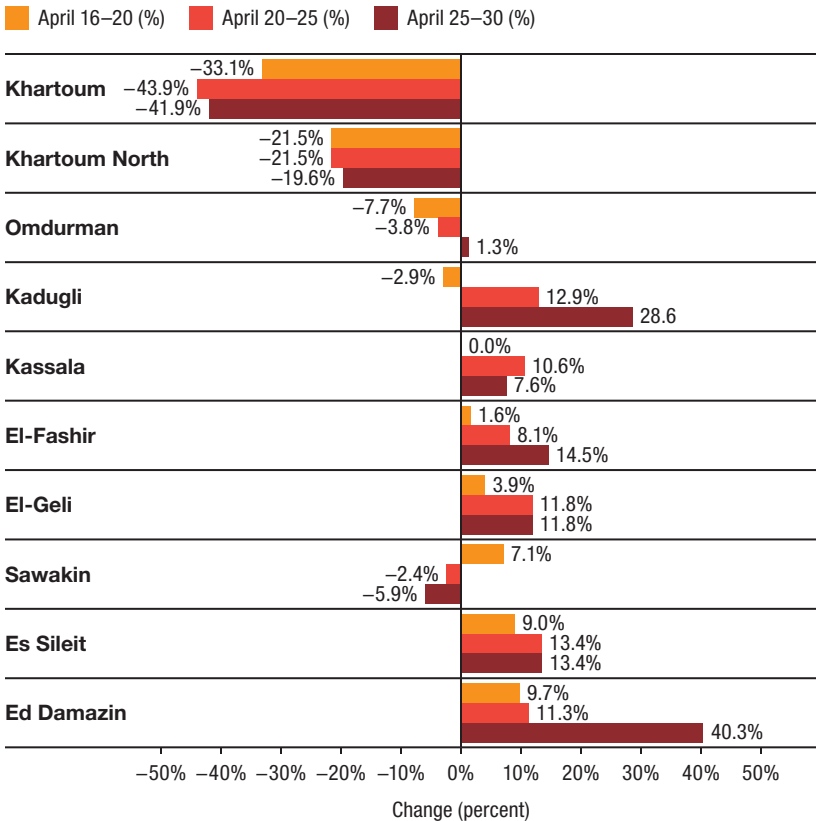
In contrast, cities outside the primary conflict zones showed either no significant change or a slight increase in NO₂ levels. The minor uptick in NO₂ concentrations observed in some nonconflict areas is likely due to their role as receiving centers for IDPs. As people fled war-affected regions, certain cities—such as Kassala, Ed Damazin, and Kadugli—may have experienced a temporary increase in transportation activity and localized emissions, contributing to stabilized or slightly elevated NO₂ levels.

We also analyzed percentage changes in NO₂ concentrations over three distinct periods (April 16–20, April 20–25, and April 25–30, 2023) relative to the immediate pre-war baseline (April 10–15, 2023) (Figure 4.8). These time windows allow a detailed breakdown of how emissions fluctuated in both conflict-affected and relatively stable regions, offering insights into the dynamics of economic disruptions, industrial slowdowns, and population displacement.

In Khartoum, NO₂ concentrations dropped between 33 and 44 percent, while in Khartoum North, they declined between 20 and 22 percent during the three periods analyzed.¹ These two cities were at the heart of the conflict and experienced heavy fighting, large-scale displacement, and a near-total economic standstill. The drastic reduction in NO₂ emissions in these areas was primarily linked to mass civilian evacuations, which significantly reduced vehicle traffic and transportation-related emissions. Additionally, industrial shutdowns, particularly in Khartoum North, where there are a significant number of factories and manufacturing plants, contributed to the observed declines. The closure of key industrial facilities and disruptions in power generation further contributed to the decrease in NO₂ emissions, reflecting a steep contraction in economic activity. The economic paralysis in Khartoum

1 Khartoum, Khartoum North, and Omdurman are the three cities that make up the Greater Khartoum metropolitan area. Khartoum serves as the national capital and administrative center; Khartoum North is a major industrial and commercial zone; and Omdurman, the largest of the three by population, is a cultural and historical hub. The cities are interconnected by a network of bridges and roads, forming Sudan's primary urban and economic core.

FIGURE 4.8 Changes in NO₂ concentrations (mol/m²) in selected cities for three periods after the conflict began compared to the April 11–15 period



Source: Authors' calculation based on Sentinel-5P OFFL TROPOMI-derived NO₂ data.

was further reinforced by the halt in business operations, the shutdown of government institutions, and the widespread collapse of local markets.

The case of Sawakin, a port city in northeastern Sudan, is particularly notable, as it initially exhibited minimal change in NO₂ levels in the first few days of the conflict. This suggests that the city continued to operate during the initial phase of the war, benefiting from its distance from the primary conflict zone. However, in subsequent days, a sharp decline in NO₂ levels was observed, likely due to the reduction in import and export activity, disruptions in logistical supply chains, and particularly the loss of connectivity between Khartoum and major trade hubs, as conflict-related instability made

it difficult to maintain normal trade flows. Likewise, the decline in vehicles using transportation and trade routes to and from Port Sudan likely contributed to this decline, as well.

While conflict-affected cities witnessed significant declines in NO₂, several other regions exhibited a gradual increase in emissions. Cities such as El-Geili, Kassala, El-Fashir, Ed Damazin, and Kadugli saw a steady rise in NO₂ levels in April 2023. These trends can be attributed to the influx of IDPs and shifts in local economic activity. Many of these regions served as primary destinations for IDPs fleeing from conflict zones. Kassala and El-Geili, for example, saw increased emissions due to heightened transportation activity and the arrival of large numbers of refugees. Ed Damazin and Kadugli functioned as transitional hubs where displaced individuals gathered before seeking refuge in neighboring countries. This movement resulted in increased vehicular traffic, emergency transport, and heightened commercial activity in certain urban centers, causing an uptick in NO₂ emissions.

El-Geili, situated north of Khartoum, became a key refuge for displaced civilians escaping the conflict in Khartoum and Khartoum North. The increase in emissions in this region can be linked to the expansion of temporary settlements and the continued operation of essential industries, particularly energy and fuel processing facilities. Similarly, Kassala and El-Fashir experienced an uptick in NO₂ emissions due to increased movement of people, vehicles, and humanitarian aid operations. The rise in emissions in these regions suggests that while Khartoum and Khartoum North faced economic collapse, certain areas became hubs for emergency activity, further reflecting the spatial redistribution of economic and social activity in the wake of conflict.

Conclusion

Crises—from COVID-19 to the wars in Ukraine and Sudan—demand rapid, cost-effective decisions precisely when conventional data systems are disrupted, unsafe, or too slow to guide urgent action. In such settings, real-time, spatially resolved information is indispensable. Remote sensing—via satellites and, where feasible, drones or mobile platforms—offers a scalable way to generate timely geospatial intelligence, reveal local heterogeneity, and illuminate how social, demographic, biophysical, and climate factors interact with policy outcomes. This study leverages that capability to track the economic and environmental consequences of Sudan's ongoing conflict using NO₂ concentrations and nighttime intensity.

The spatial and temporal variations in NO₂ concentrations provide valuable insights into how different cities responded to the unfolding conflict. Our findings indicate that the most pronounced declines in NO₂ concentrations and nighttime intensity occurred in Khartoum, Khartoum North, and Omdurman, where the conflict was most severe in its early days. While heavy artillery and ongoing military activity may contribute to emissions, these effects are far outweighed by the collapse of normal economic activity, as evidenced by the sharp declines in both indicators. The closure of factories and manufacturing plants, the suspension of commercial activity, and the large-scale displacement of residents all contributed to the observed reductions in emissions. Additionally, disruptions in intracountry trade, particularly through Khartoum—a key transportation and commercial hub—further contributed to the economic slowdown.

Tragically, the crisis in Khartoum has continued for more than two years, posing severe risks to Sudan's broader economic stability, particularly in the agriculture sector. Many of Sudan's centralized institutions, such as the Agricultural Bank, the Animal Resources Bank, and key government ministries, are located in Khartoum. These institutions play a vital role in supporting agricultural production by facilitating the distribution of inputs, financial services, and infrastructure support. However, the ongoing conflict has severely disrupted these functions, jeopardizing the ability of farmers to access resources needed for the planting season. Moreover, many of Sudan's agricultural processing and value-added industries are concentrated in Khartoum, meaning that food processing activities have largely come to a halt.

Our analysis also indicates that nonconflict regions experienced fewer disruptions in NO₂ emissions and nighttime intensity, suggesting that the economic fallout has been geographically concentrated in specific war-affected areas, at least in the initial months of the conflict. However, in smaller cities and rural areas, the patterns are less clear and sometimes contradictory, as various factors such as wind patterns, seasonal changes, and local industrial activity can influence NO₂ levels.

In the absence of conventional economic data sources—such as national statistics and household surveys—remote sensing provides a crucial tool for monitoring economic activity in conflict zones. Given the impossibility of conducting large-scale ground-based data collection in Sudan at present, satellite-derived indicators can help policymakers, humanitarian organizations, and private sector stakeholders assess the economic impact of the conflict on agriculture, food supply chains, and market stability. These remote-sensing methods significantly enhance our ability to track atmospheric pollution,

assess air quality, and understand the interactions between human activity and environmental factors.

Despite these contributions, there are limitations to this study. NO₂ and nightlight data, while effective proxies for economic activity, cannot fully capture the complexity of conflict-related disruptions. For instance, military activity and the use of artillery may temporarily increase emissions, partially offsetting the observed decline in economic activity. Additionally, external environmental factors such as seasonal variability, meteorological influences, and industry-specific emissions fluctuations can introduce variability into NO₂ data. Therefore, while remote sensing provides valuable insights, it should be complemented with other sources of data to build a more comprehensive picture of economic conditions in conflict-affected areas.

Future research should aim to refine and expand this analysis by incorporating additional remote-sensing datasets and ground-truthing data where possible. A promising avenue for further study is the integration of NO₂ and nightlight data with geospatial conflict datasets such as the ACLED (Ali and Ada 2023; Ali 2023), which can provide a more granular understanding of the spatial relationship between armed confrontations and economic disruptions. Additionally, the use of high-resolution satellite imagery and geo-referenced household surveys could offer further insights into localized economic conditions and displacement patterns. These approaches would enable a more nuanced assessment of the war's economic impacts and help guide more effective policy responses and humanitarian interventions.

References

- Abay, K.A., K. Tafere, G. Berhane, J. Chamberlin, and M.H. Abay. 2023. "Near-Real-Time Welfare and Livelihood Impacts of an Active War: Evidence from Ethiopia." *Food Policy* 119:102526. <https://doi.org/10.1016/j.foodpol.2023.102526>
- Abushama, H., D. Resnick, K. Siddig, and O.K. Kirui. 2023. "Political and Economic Drivers of Sudan's Armed Conflict: Implications for the Agri-Food System." Sudan SSP Working Paper 15. IFPRI. <https://hdl.handle.net/10568/137896>
- Ali, M.A. 2023. "Sudan Situation Update: October 2023 | Ethnic Strife Amid Escalating Power Struggles." *ACLED Global Analysis* (blog). October 6. <https://acleddata.com/update/sudan-situation-update-october-2023-ethnic-strife-amid-escalating-power-struggles>
- Ali, M.A., and A. Ada. 2023. "Sudan Situation Update: May 2023 | Fighting Rages Amid Ceasefire Talks." *ACLED Global Analysis* (blog). May 26. <https://acleddata.com/update/sudan-situation-update-may-2023-fighting-rages-amid-ceasefire-talks>

- Cooper, M.J., R.V. Martin, M.S. Hammer et al. 2022. “Global Fine-Scale Changes in Ambient NO₂ during Covid-19 Lockdowns.” *Nature* 601 (7893):380–387. <https://doi.org/10.1038/s41586-021-04229-0>
- ESA (European Space Agency). 2018. *Sentinel-5 Precursor/TROPOMI Level-2 Product User Manual: Nitrogen Dioxide*. ESA. <https://sentinels.copernicus.eu/documents/247904/2474726/Sentinel-5P-Level-2-Product-User-Manual-Nitrogen-Dioxide.pdf>
- Ezran, I., S.D. Morris, M. Rama, and D. Riera-Crichton. 2023. “Measuring Global Economic Activity Using Air Pollution.” Policy Research Working Papers No. 10445. World Bank. <https://openknowledge.worldbank.org/handle/10986/39827>
- Goldberg, D.L., S.C. Anenberg, G.H. Kerr, A. Mohegh, Z. Lu, and D.G. Streets. 2021. “TROPOMI NO₂ in the United States: A Detailed Look at the Annual Averages, Weekly Cycles, Effects of Temperature, and Correlation with Surface NO₂ Concentrations.” *Earth's Future* 9 (4):e2020EF001665. <https://doi.org/10.1029/2020EF001665>
- Guo, Z., H. Abushama, K. Siddig, O.K. Kirui, K. Abay, and L. You. 2024. “Monitoring Indicators of Economic Activities in Sudan Amidst Ongoing Conflict Using Satellite Data.” *Defence and Peace Economics* 35 (8):992–1008. <https://doi.org/10.1080/10242694.2023.2290474>
- Henderson, J.V., A. Storeygard, and D.N. Weil. 2012. “Measuring Economic Growth from Outer Space.” *American Economic Review* 102 (2):994–1028. <https://doi.org/10.1257/aer.102.2.994>
- Hoogeveen, J., A. Dabalen, E. Mushi, A. Etang, Y. Schipper, and J. von Engelhardt. 2016. *Mobile Phone Panel Surveys in Developing Countries: A Practical Guide for Microdata Collection*. Directions in Development–Poverty. World Bank. <https://doi.org/10.1596/978-1-4648-0904-0>
- Hoogeveen, J., and U. Pape, eds. 2020. *Data Collection in Fragile States: Innovations from Africa and Beyond: Innovations from Africa and Beyond*. World Bank. <https://doi.org/10.1596/978-3-030-25120-8>
- Keola, S., and K. Hayakawa. 2021. “Do Lockdown Policies Reduce Economic and Social Activities? Evidence from NO₂ Emissions.” *The Developing Economies* 59 (2):178–205. <https://doi.org/10.1111/deve.12274>
- Kirui, O.K., K. Siddig, H. Abushama, and A.S. Taffesse. 2023. “Armed Conflict and Business Operations in Sudan: Survey Evidence from Agri-Food Processing Firms.” Sudan SSP Working Paper 11. IFPRI. <https://hdl.handle.net/10568/140193>
- Morris, S.D., and J. Zhang. 2019. “Validating China’s Output Data Using Satellite Observation.” *Macroeconomic Dynamics* 23 (8):3327–3354. <https://doi.org/10.1017/S1365100518000056>
- NCEI (National Centers for Environmental Information). 2023. *VIIRS Day/Night Band Nighttime Lights Version 2*. NCEI. <https://www.ngdc.noaa.gov/eog/viirs.html>

Siddig, K., M. Raouf, and M.O.M. Ahmed. 2023. "The Economy-Wide Impact of Sudan's Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty." Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>

Sudan, Ministry of Environment, Forestry and Urban Development, and UN-Habitat (United Nations Human Settlements Program). 2014. *Sudan National Report: Third United Nations Conference on Housing and Sustainable Urban Development*. UN-Habitat. <https://habitat3.org/wp-content/uploads/Sudan-National-Report.pdf>

UNHCR (United Nations High Commissioner on Refugees). 2023. *Sudan Situation - UNHCR External Update #31 - 16 October 2023*. UNHCR. <https://data.unhcr.org/en/documents/details/104124>

UNHCR. 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>

CEREAL PRODUCTION, MARKETS, AND POLICY IN SUDAN

Paul Dorosh, Oliver K. Kirui, and Khalid Siddig

Cereal production has long been a cornerstone of Sudan's food security and economy, especially wheat, sorghum, and millet. Given the importance of these staples, policy related to imports and prices of wheat (and sorghum, to a lesser extent) has major effects on food production and consumption. In particular, before 2023, government interventions in wheat markets involved huge implicit—and sometimes explicit—fiscal costs, including interventions on large food aid inflows, official sales prices, direct controls on commercial imports, and subsidies on wheat milling (D'Silva and Badawi 1988; Faki and Taha 2009; Abdelaziz et al. 2022). These policies have generally benefited urban consumers at the expense of rural producers and have not always been well-targeted to the poor (Resnick 2021; Resnick 2026, Chapter 3 in this volume).

The conflict in 2023 forced an end to the government's provision of wheat to domestic wheat mills and subsequent subsidized sales of flour in Khartoum, as well as the rest of the country. Moreover, the fighting has resulted in major disruptions to cereal markets, significantly adding to transport and marketing costs within the country, and greatly hindering flows of food aid and other cereal imports from the international market to western Sudan.

This chapter provides an analysis of Sudan's cereal markets, along with model simulations of the impacts of recent shocks and policy options to mitigate these adverse effects. The second section presents an overview of cereal production and consumption patterns, focusing on regional differences between western and eastern Sudan. The third section describes the evolution of wheat and sorghum prices in recent years, including a comparison of international border prices of wheat and domestic prices. In the fourth section, the major implications of wheat trade and price policy prior to 2023 are examined, including the complex set of subsidies on imports of wheat and wheat flour, wheat processing, and bread. We present an analysis of more recent wheat policy in the fifth section, including model simulations of the conflict's

disruption to regional wheat markets in 2023 and policy options to increase wheat production and consumption. The final section concludes with a summary of the findings, policy implications, and priorities for further research and analysis.

Cereal production and markets in Sudan

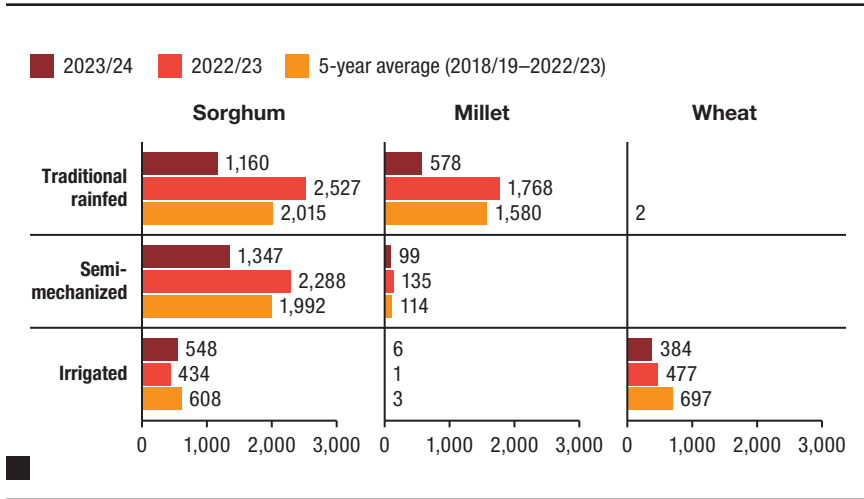
Structure of cereal production in Sudan before and during the conflict

Sorghum, millet, and wheat are the primary staples that form the foundation of Sudan's food security. These crops are cultivated across the country's three main farming systems (irrigated, semi-mechanized, and traditional rainfed), with each playing a distinct role in overall production. However, the conflict that erupted on April 15, 2023, has severely disrupted production patterns, posing significant threats to food security, livelihoods, and rural economies.

This section draws on the latest available data from the Crop and Food Supply Assessment Mission (CFSAM) (FAO 2024c) to compare production levels in the 2023/2024 season with the preceding five-year average (2018/2019–2022/2023). The five-year average serves as a robust baseline for assessing the spatial distribution of these staple crops, while the 2023/2024 data provide a critical reference point to quantify the impact of the first year of conflict on agricultural production and supply.

Differential impacts by farming system

The impact of the conflict on cereal production varied significantly across farming systems. Although the irrigated systems in some parts of the country showed resilience, particularly for wheat and sorghum, the reliance on stable infrastructure made them vulnerable to disruptions (Figure 5.1). For instance, wheat production in Aj Jazirah declined due to infrastructure damage and instability, though localized resilience was observed in the River Nile and Northern states. The entry of the Rapid Support Forces (RSF) into Aj Jazirah State in late 2023 coincided with the peak harvest season, during which farmers were compelled to pay exorbitant fees to access their fields, transport crops, and store harvested grains. Additionally, reports indicate that RSF forces looted significant quantities of wheat and chickpeas from storage facilities, exacerbating food insecurity (STPT and Istiqsa'i) 2025).

FIGURE 5.1 Production of sorghum, millet, and wheat in Sudan, 2018–2023 (thousand tons)

Source: Adapted from FAO (2024), licensed under CC BY NC SA 3.0 IGO. Reproduced with permission.

The semi-mechanized systems, particularly in Gedaref state, proved relatively stable, contributing significantly to sorghum production in 2023/2024 and benefiting from being away from confrontation and the inflow of workers and investments. Nevertheless, rising input costs and labor shortages posed challenges to sustained productivity.

The traditional rainfed systems, however, were the hardest hit by the conflict, particularly for millet (Figure 5.1). States such as West Darfur and South Darfur experienced catastrophic declines, with West Darfur reporting zero millet production. Conversely, North Darfur managed to increase its share of millet production, highlighting the complex and localized nature of conflict impacts.

War-induced changes in patterns of cereal production

The ongoing conflict has reshaped the geographical distribution of cereal production in Sudan, altering traditional production hubs and amplifying regional disparities. While some areas have managed to sustain cultivation, others have suffered a near-total collapse due to displacement, insecurity, and restricted access to inputs and markets. In the following subsection, we examine the shifting production landscape for sorghum, millet, and wheat, highlighting the differential impacts of the conflict across states and farming systems. This analysis underscores the extent to which the conflict has reconfigured Sudan's agricultural map, with potentially lasting implications for food security and rural economies.

SORGHUM

Sorghum has traditionally been the most widely produced cereal in Sudan, accounting for the largest share of national cultivated land and cereal production. Traditional rainfed systems dominated sorghum production over the five-year average, contributing 44 percent of total output, followed by semi-mechanized systems at 43 percent, and irrigated systems at 13 percent (Figure 5.1). During this period, Gedaref emerged as the leading sorghum-producing state, contributing 16.1 percent of national output, followed by Aj Jazirah (9.4 percent) and Sennar (8.1 percent) (Figure 5.2).

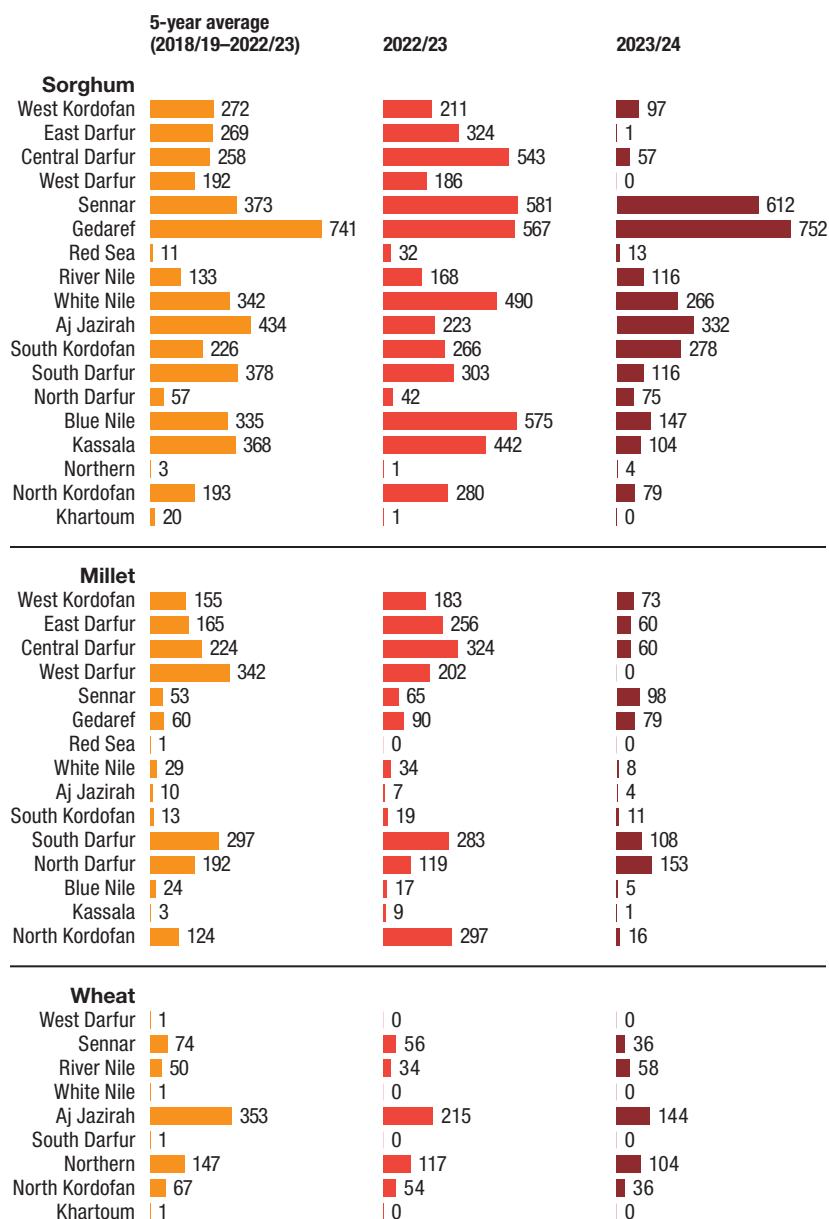
The 2023/2024 season marked a dramatic decline in national sorghum production, shrinking by 34 percent compared to the five-year average (2018/2019–2022/2023) and 42 percent of the level of the 2022/2023 season. The shares of Gedaref and Sennar states rose to 24.7 percent and 20.1 percent, respectively, reflecting the relative stability of the regions until the harvest at the end of the summer in 2024. By contrast, traditional rainfed systems suffered significant disruptions, with production in South Darfur and Blue Nile declining sharply. South Darfur's contribution fell from 8.2 percent to 3.8 percent, while Blue Nile's share dropped from 7.3 percent to 4.8 percent. Aj Jazirah's contribution increased slightly to 10.9 percent, highlighting localized resilience in irrigated systems. Meanwhile, conflict-affected states such as West Darfur and Central Darfur reported zero production (Figure 5.2).

The decline in sorghum production was further exacerbated by rising input costs, logistical challenges, and delayed planting. CFSAM noted that while the provision of certified seeds mitigated some losses, the overall production decline underscores the vulnerability of rainfed systems to conflict-induced disruptions (FAO 2024c).

MILLET

Predominantly grown in traditional rainfed systems, millet plays a vital role in the diets of communities in Sudan's arid and semi-arid regions (Figure 5.1). Over the five-year average, traditional rainfed systems accounted for 93 percent of millet production. West Darfur was the largest producer, contributing 20.2 percent, followed by South Darfur (17.5 percent) and Central Darfur (13.2 percent).

The military conflict had a devastating impact on millet production in 2023/2024. West Darfur's share plummeted to zero, reflecting the complete disruption of agricultural activities in the region. North Darfur, on the other hand, experienced a significant increase in its contribution,

FIGURE 5.2 Production of sorghum, millet, and wheat in Sudan by state, 2018–2023, thousand tons

Source: Adapted from FAO (2024), licensed under CC BY NC SA 3.0 IGO. Reproduced with permission.

rising from 11.3 percent to 22.6 percent, possibly due to localized shifts in production dynamics. South Darfur maintained a relatively high contribution of 16 percent, while Sennar and Gedaref emerged as notable contributors, with shares of 14.5 percent and 11.7 percent, respectively. These changes highlight the uneven impact of the conflict, with some regions managing to sustain production while others have faced total collapse (Figure 5.2).

WHEAT

Primarily cultivated in irrigated systems, wheat follows a winter cropping cycle, making it less susceptible to immediate disruptions caused by the conflict. Over the five-year average, irrigated systems accounted for almost all wheat production, with Aj Jazirah contributing 50.8 percent, Northern 21.2 percent, and Sennar 10.7 percent (Figure 5.2).

The 2023/2024 season, however, exposed vulnerabilities within the wheat sector. Aj Jazirah's contribution fell to 38.1 percent, largely due to damage to irrigation infrastructure and logistical constraints imposed by the conflict. Benefiting from relative stability, Northern and River Nile increased their shares to 27.5 percent and 15.4 percent, respectively. Sennar's contribution declined slightly from 10.7 percent to 9.5 percent, reflecting localized disruptions imposed by the conflict. While interventions, including the provision of seeds, from the Food and Agriculture Organization of the United Nations (FAO) and World Food Programme helped sustain some production, overall wheat output remained significantly below the five-year average (2018/2019–2022/2023) and 2022/2023 season by 45.7 percent and 20.7 percent, respectively (Figure 5.2).

The East–West divide in cereal production

The 2023/2024 season highlighted the critical impact of political and territorial control on cereal production, with the country effectively divided based on regions under the control of the Sudanese Armed Forces (SAF) and those under the RSF. This division was not strictly geographic, as key agricultural states such as Aj Jazirah were primarily under RSF control, despite being in central Sudan. The implications of this divide are reflected in the production and supply dynamics of sorghum, millet, and wheat.

Under SAF control in 2024, even during the season affected by the conflict (2023/2024), states such as Gedaref and Sennar accounted for significant shares of cereal production. Gedaref alone contributed

38.4 percent of sorghum output and 40.6 percent of millet in SAF regions, leveraging the resilience of its semi-mechanized systems. Sennar also played a crucial role in cereal supply, contributing 25 percent of sorghum and 40.3 percent of millet under SAF control, reflecting the importance of stability in these areas. However, logistical disruptions and rising input costs tempered these contributions and reduced overall production compared to other seasons.

In RSF-controlled regions in 2024, including Aj Jazirah and large parts of Darfur, cereal production faced severe disruptions. Aj Jazirah, a historically dominant wheat-producing state, experienced a significant drop in its share from 50.8 percent in the five-year average (2019–2023) to only 38.1 percent. Within the SAF regions, Aj Jazirah’s contribution to wheat production was only 6.8 percent, while in the RSF-controlled wheat production regions, it contributed 77.5 percent as it remained mainly under the RSF from December 2024 until January 2025. Meanwhile, Darfur states, traditionally reliant on rainfed systems, saw drastic declines. West Darfur reported zero production for millet and sorghum, and Central Darfur recorded sharp reductions across all cereals. These challenges reflect the compounded effects of displacement, insecurity, and restricted market access.

Comparatively, SAF-controlled areas were expected to supply a larger proportion of national cereal output, albeit at levels well below historical averages. RSF-controlled regions, meanwhile, have faced acute deficits, with food insecurity exacerbated by limited production and constrained distribution networks. This polarized dynamic underscores the urgent need for interventions tailored to the specific challenges in SAF and RSF regions. In SAF zones, stabilizing semi-mechanized and irrigated systems should be prioritized, while RSF regions require immediate humanitarian assistance to address food shortages and revive rainfed agriculture.

In conclusion, the 2023 conflict has had a profound and multifaceted impact on Sudan’s cereal production. National output for sorghum, millet, and wheat in 2023/2024 is estimated to be 46 percent below the previous year’s levels and 40 percent below the five-year average. The stark variations across states and farming systems underscore the need for targeted, context-specific interventions. Immediate priorities include restoring irrigation infrastructure in the irrigated farming systems, ensuring the availability of agricultural inputs to farmers across the country, and supporting displaced farming communities. These measures are essential to mitigate the long-term consequences of the conflict and stabilize Sudan’s agricultural sector.

The structure of Sudan's cereal markets and regional price integration

Wheat and sorghum market price movements¹

The armed conflict that began in mid-April 2023 had a profound impact on wheat prices across Sudan (Figure 5.3). Prior to the conflict, wheat prices exhibited moderate seasonal fluctuations but remained relatively stable. However, as the crisis intensified, prices soared, with some regions experiencing increases of more than fivefold compared to early 2023. The most significant price hikes were recorded in Al Fashir and El-Obeid, where access to staple foods was severely constrained. By late 2024, price disparities across regions widened, further reducing affordability in conflict-affected areas.

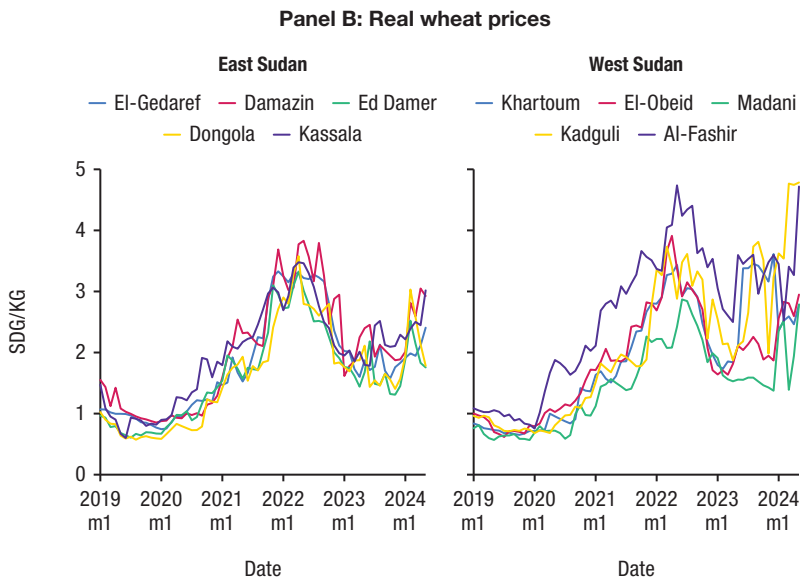
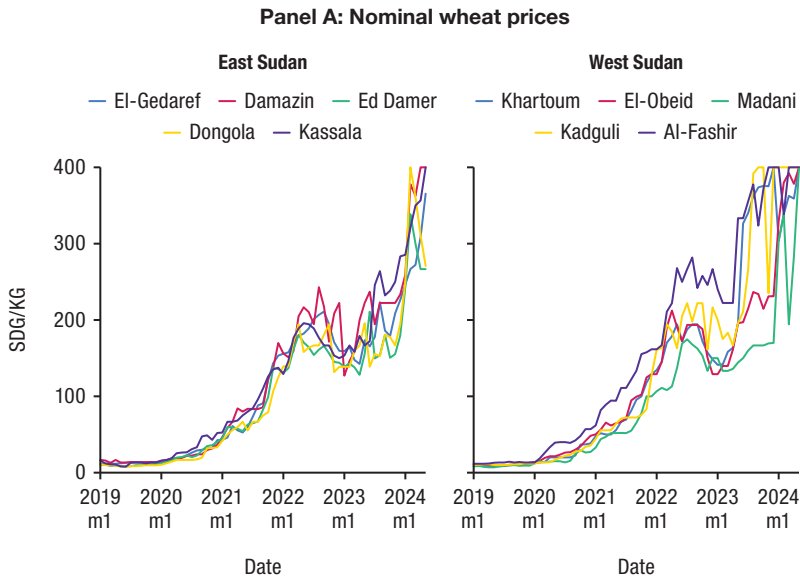
Sorghum prices also saw substantial increases during this period, though at a lower rate than wheat. While relatively stable in early 2023, sorghum prices surged by the end of 2024 in most markets (Figure 5.4). Some regions experienced more than sixfold increases in prices compared to early 2023, driven by disruptions in agricultural production, displacement of farmers, and supply chain instability. Remote regions, which were already vulnerable, saw some of the steepest increases, reflecting their reliance on increasingly expensive and insecure supply routes.

Wheat and sorghum market integration

To assess the degree of market integration, we applied standard time-series econometric techniques. First, Augmented Dickey-Fuller (ADF) unit root tests were used to test whether wheat and sorghum price series were stationary in levels or in first differences (Dickey and Fuller 1979; Said and Dickey 1984). Since most series were found to be nonstationary in levels but stationary after first differencing, we proceeded with Johansen cointegration tests to examine whether long-run equilibrium relationships exist between pairs of markets (Johansen 1988; 1991). The Johansen framework is based on a vector autoregressive model of order k (Engle and Granger 1987; Johansen and Juselius 1990), which can be expressed in its error-correction form as:

¹ The primary variables analyzed were nominal retail prices of wheat and sorghum in selected markets across eastern and western Sudan between January 2019 and August 2024. The cointegration models tested whether these prices exhibit long-run equilibrium relationships across regions, thereby indicating market integration. All data were sourced from FEWS NET market monitoring.

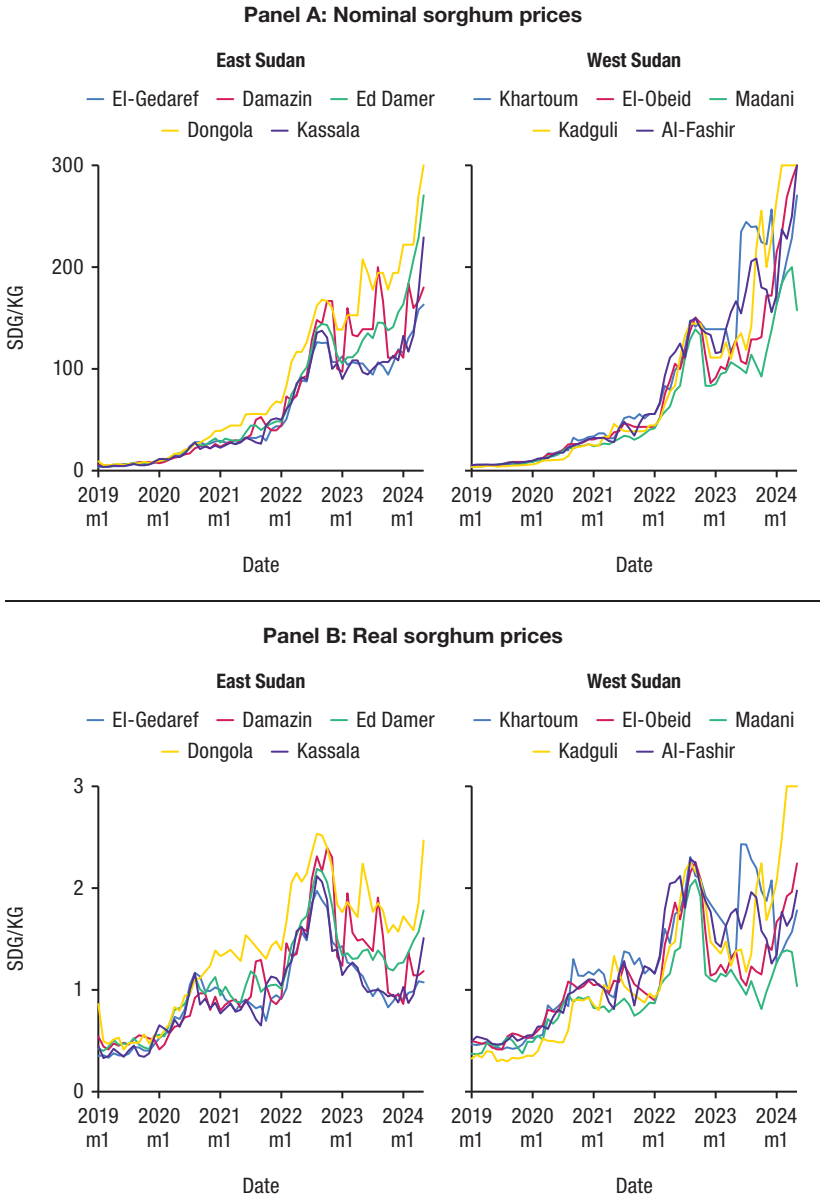
FIGURE 5.3 Retail prices of wheat in markets in Sudan, 2019–2024



Source: Authors' calculations using FEWS NET data (2025).

Note: m1 = month 1 (January).

FIGURE 5.4 Retail prices of sorghum in markets in Sudan, 2019–2024



Source: Authors' calculations using FEWS NET data (2025).

Note: m1 = month 1 (January).

TABLE 5.1 Co-integrated cereal market pairs in Sudan, January 2015–August 2024 data (nominal prices)

Series	Total Market Pairs	Co-Integrated Market Pairs	
	(Number)	(Number)	(Names)
Panel A: Wheat (among 7 markets in eastern Sudan) ^a	21	4	Gedaref–Damazin, Gedaref–Kassala, Gedaref–Dongola, Damazin–Kassala
Panel B: Wheat (among 8 markets in western Sudan) ^b	28	7	Madani–Kosti, Madani–Zalingei, Madani–Kadugli, Kosti–Zalingei, Khartoum–Madani, Khartoum–Kosti, Nyala–Zalingei
Panel C: Sorghum (among 8 markets in eastern Sudan) ^c	28	5	Gedaref–Damazin, Kassala–Port Sudan, Damazin–Singa, El-Damer–Dongola, Sennar–Gedaref
Panel D: Sorghum (among 8 markets in western Sudan) ^b	28	4	Khartoum–Madani, Kosti–Zalingei, Kadugli–Nyala, Geneina–Zalingei

Source: Authors' calculations based using FEWS NET data (2025).

Note: a = Gedaref, Al Damazin, Dongola, Kassala, El-Damer, Singa, and Sennar. b = Khartoum, El-Obeid, El-Fasher, Kosti, Madani, Kaduqli, Nyala, and Zalingei. c = Port Sudan, Gedaref, Al Damazin, Dongola, Kassala, El-Damer, Singa, and Sennar.

$$\Delta P_t = \Pi P_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta P_{t-1} + \epsilon_t$$

where P_t is a vector of wheat or sorghum prices across markets at time t ; Δ is the first-difference operator; Π is the long-run impact matrix, whose rank determines the number of cointegrating vectors (long-run relationships); Γ_i are short-run adjustment coefficients; and ϵ_t is a vector of error terms. The cointegration tests were therefore applied to the price vectors across markets to determine whether the series move together in the long run, which is taken as evidence of market integration (Fackler and Goodwin 2001; Abdulai 2000).

To test for co-integration (co-movement) of price series across markets over the period January 2019 through August 2024, we first conducted ADF tests on the raw price series to check for stationarity (the absence of a trend in the series). Nearly all price series for both wheat and sorghum were found to be nonstationary, but ADF test results for the first differences of both wheat and sorghum price series showed strong evidence of stationarity.

Johansen tests of the residuals from regressions of market prices from various pairs of markets indicated distinct patterns of market integration in eastern and western Sudan. In eastern Sudan, the results shown in Table 5.1 indicate moderate evidence of cointegration within the region, with four cointegrating

relationships among seven markets for wheat (Panel A) and five cointegrating relationships among eight markets for sorghum (Panel C). However, the trace statistics in both panels are close to, but below, the 5 percent critical values, suggesting that while some degree of market integration exists, it is not particularly strong. In contrast, markets in western Sudan show stronger evidence of integration within the region, particularly for wheat. Panel B identifies seven cointegrating relationships among eight markets for wheat, with the trace statistic very close to the critical value, indicating robust market linkages. For sorghum, we found co-integration between prices for four of the eight markets.

Wheat trade and price policy

Wheat subsidies, foreign exchange markets, and market prices

Sudan has a long history of intervening in the domestic markets and international trade of wheat, the only major cereal in the country that is widely traded internationally (world markets for sorghum and millet are much smaller than the world wheat market in terms of volumes traded and value).² Before 2023, successive Sudanese governments attempted to keep food prices low by providing wheat grain and/or flour to millers and bakers at subsidized prices and setting low official sales prices for traditional bread.³ However, persistent domestic inflation, partly caused by increases in money supply, necessitated frequent adjustments in prices. Moreover, periodic devaluations of the Sudanese pound (SDG) resulted in large increases in border prices (international market prices, including transport and marketing costs, converted to Sudanese pounds using official exchange rates), which necessitated major adjustments in official prices.

Three major devaluations of the Sudanese pound occurred between 2018 and 2021, including in January 2018 (169 percent, from 6.7 to 18 SDG/US\$) and in October 2018 (164 percent, from 18 to 47.5 SDG/US\$). In February 2021, the exchange rate policy shifted from a fixed nominal exchange rate to a managed float policy, with an initial depreciation of almost 400 percent (from 55

2 See D'Silva and Elbadawi (1988), Faki and Taha (2009), and Dorosh (2021) for a more extensive discussion of wheat and overall agricultural trade policies in Sudan.

3 This subsidy on (traditional) bread was not well-targeted. Calculations based on the patterns of consumption derived from the 2009 national household survey data (NBHS 2009), along with data on prices and wheat supply, showed that urban poor and nonpoor households received similar amounts (18,900 and 20,800 SDG/capita, respectively) in 2021. Rural poor households received far less—only 2,700 SDG/capita. See Dorosh (2021).

TABLE 5.2 Wheat prices in various markets, Sudan, 2023–2024

	El-Obeid	Om Durman	Port Sudan	El-Gedaref	Al Fashir
Average retail price (SDG/kg)					
(1) Jan.–Apr. 2023	427	441	592	461	680
(2) May–Dec. 2023	668	1,114	639	578	1,107
(3) Jan.–Apr. 2024	1,110	–	1,193	820	1,397
(4) May–Dec. 2024	2,573	1,550	1,564	1,585	3,290
Jan. 2023–Dec. 2024	1,251	1,059	972	875	1,691
(4) / (1)	6.02	3.51	2.64	3.44	4.84
Margins (SDG/kg) ^a					
(5) Jan.–Apr. 2023	(164)	(151)	–	(131)	88
(6) May–Dec. 2024	1,009	(14)	–	21	1,726
Change (6) – (5)	1,173	136	–	152	1,637

Source: Authors' calculations from FAO (2025) price data.

Note: ^a = Marketing margin to Port Sudan.

to 378 SDG/US\$), which essentially unified the official and parallel markets until September 2023. Thereafter, a moderate premium on the parallel market emerged again: the parallel exchange rate in December 2024 was 2,445 SDG/US\$, 23 percent above the official rate of 1994 (SDG/US\$).⁴

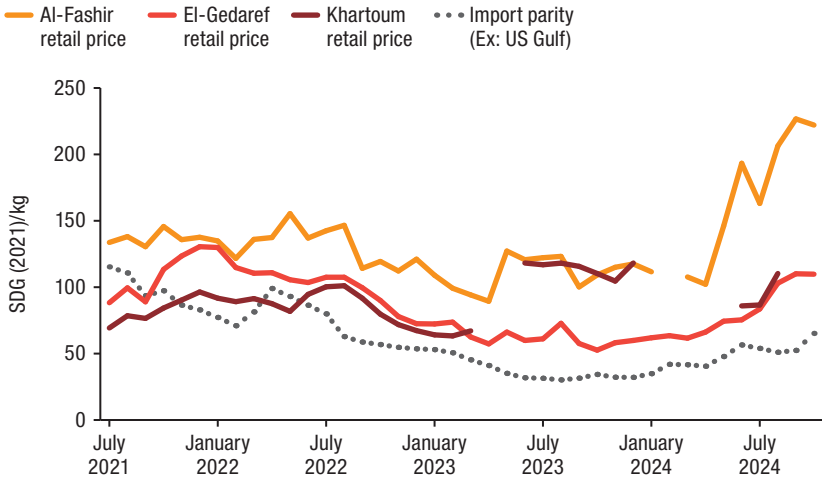
Between the middle of 2021 and 2022, just before the start of the civil war, significant market imperfections kept the retail prices of wheat in major Sudanese markets from closely tracking import parity prices (the full financial cost of imported wheat) (in Khartoum) (Figure 5.5).⁵ Subsequently, the civil war brought about a disruption in market flows and a significant increase in costs, reflected in a widening margin between prices in western and eastern Sudan (Figure 5.6).

Average wheat prices in Al Fashir and El-Obeid in western Sudan were 6 and 4.8 times higher, respectively, from May to December 2024 than from January to April 2023 (Table 5.2). In the same periods, prices in Port Sudan and Gedaref in eastern Sudan were only 2.6 and 3.4 times higher, respectively. Marketing margins between these two western markets and Port Sudan thus increased by more than 1,600 SDG/kg, while margins between Gedaref and Port Sudan increased by less than 200 SDG/kg, as did the margins between Om Durman and Port Sudan.

⁴ Calculated from data in the WFP Market Monitors (various dates).

⁵ The prices plotted in Figure 5.5 are nominal prices deflated by the consumer price index (CPI). Note that the CPI from February 2023 to December 2024 is estimated using the CPI growth rate between January and February 2023, that is, an annual rate of 23.2 percent.

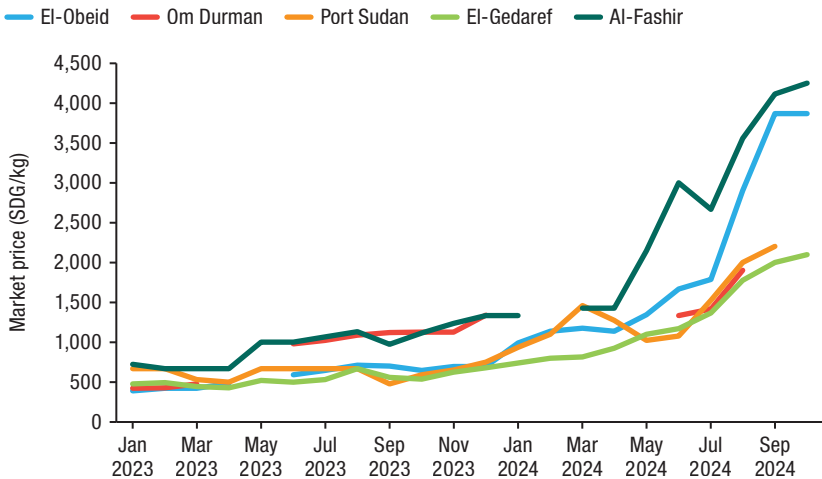
FIGURE 5.5 Domestic and import parity wheat prices in Sudan (2021 SDG/kg), 2021–2024



Source: Authors' calculations using IMF (2025), World Bank (2025), WFP 2025, and FAO (2025) price data.

Note: Calculations of import parity use parallel market exchange rates from October 2024 (no commercial exchange rate data were available for this period). Note that the parallel exchange rate averaged 26.3 percent above the commercial market exchange rate from September 2023 through September 2024.

FIGURE 5.6 Retail wheat prices in Sudan (SDG/kg), 2023–2024



Source: Authors' calculations from FAO (2025) price data.

From July 2022 through July 2024, the wholesale price of wheat in Gedaref in eastern Sudan broadly tracked the estimated import parity price (see Figure 5.6). In this period, the monthly average ratio of Gedaref's prices to estimated import parity prices was 1.60. However, from August through October 2024, import parity prices rose faster than domestic prices, such that this ratio rose to an average of 1.91. This increase in margins may have reflected quantitative restrictions on imports or increased domestic trade and transport costs. If the earlier price ratio had been maintained, the market price would have been about 20 percent lower.⁶

By comparison, sorghum prices rose faster during this period than wheat prices in Om Durman (sorghum and wheat were 4.6 and 3.5 times higher, respectively) and Gedaref (4.4 and 3.4 times higher). The marketing margins for sorghum between major markets also exhibited considerable instability. Sorghum price margins between western Sudan (El-Obeid and Al Fashir) and Port Sudan were consistently higher than the margins between eastern Sudan and Port Sudan. However, the marketing margins between Om Durman and Port Sudan, which increased by only 136 SDG/kg for wheat, increased much more sharply for sorghum (by 899 SDG/kg). This likely reflects the effect of a shift in the region's control from the RSF to SAF, which controlled much of the Port Sudan area in this period. In contrast, given the shorter distance and generally greater security, the marketing margins between Gedaref and Port Sudan remained relatively small for both wheat and sorghum (Table 5.3 and Figure 5.7). Intense fighting in Darfur region reduced local production and greatly inhibited market flows in 2025, however, leading to a huge surge in average sorghum price margins between Al Fashir and Port Sudan, from 1,700 SDG/kg from May to December 2024 to 27,400 SDG/kg from June to August 2025.

IMPLICATIONS OF WHEAT SUBSIDIES AND FOREIGN EXCHANGE RATIONING⁷

Model simulations by Dorosh (2021) indicate that increased wheat imports, such as those financed by food aid, added to supplies for processing into wheat flour, flatbread, and other wheat products, which resulted in reduced prices for consumers and increased consumption. The analysis showed that these imports also led to disincentives for production: a 300,000-ton increase in wheat imports, as occurred in early 2021, led to an 8 percent increase in wheat consumption and a 35 percent decline in the market price of non-flatbread wheat products. In this

6 As of late 2025, data on market prices of wheat after December 2024 were not available on the Food and Agriculture Organization's or World Food Programme's websites.

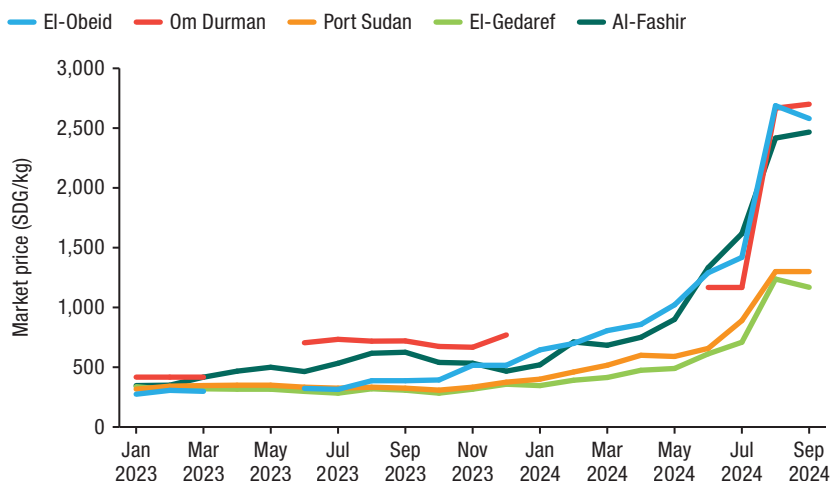
7 This section summarizes results from Dorosh (2021).

TABLE 5.3 Sorghum prices in various markets, Sudan, 2023–2024

	El-Obeid	Om Durman	Port Sudan	El-Gedaref	Al Fashir
Average retail price (SDG/kg)					
(1) Jan.–Apr. 2023	293	417	339	321	395
(2) May–Dec. 2023	405	712	335	310	535
(3) Jan.–Apr. 2024	752	–	494	406	666
(4) May–Dec. 2024	2,000	1,910	1,088	889	1,747
(5) June–Aug. 2025	1,358	1,231	1,179	1,169	30,299
Jan. 2023–Dec. 2024	936	1,153	613	521	822
(4) / (1)	6.82	4.58	3.21	2.77	4.42
Margins (SDG/kg)^a					
(6) Jan.–Apr. 2023	293	417	339	321	395
(7) May–Dec. 2024	2,000	1,910	1,088	889	1,747
Change: (7) – (6)	1,707	1,493	750	568	1,352
(8) June–Aug. 2025	179	52	–	(11)	29,119
Change: (8) – (7)	(1,821)	(1,858)	(1,088)	(899)	27,373

Source: Authors' calculations using FAO (2025) price data.

Note: ^a = Marketing margin to Port Sudan.

FIGURE 5.7 Sorghum prices in various markets, Sudan, 2023–2024

Source: Authors' calculations from FAO (2025) price data.

scenario, production fell by 12 percent. Since flatbread prices are unchanged in this simulation, wheat consumption increased by only 4 percent among the urban poor, for whom flatbread is the major wheat product consumed.

Other simulations show that raising flatbread prices by 30 percent to reduce the size of the fiscal subsidy would lead to a 17 percent reduction in total consumption of flatbread, sharply reduced wheat consumption, and lower real incomes of the urban poor. All households would suffer a loss in this scenario, by 41 to 45 percent in the value of flatbread subsidies received. The urban poor would experience the largest decline in total consumption of wheat (14 percent) and in total income (11 percent). Thus, reducing the flatbread subsidy without a compensating income transfer would significantly reduce the welfare of the urban poor and likely threaten political stability. These results suggest that a combination of key wheat policies involving high levels of imports—including the injection of food aid wheat into the economy in late 2020—and subsidized flatbread would have significantly benefited urban poor households.

Thus, Sudan's wheat policies immediately before 2022, such as increased wheat imports, price subsidies in the wheat value chain, and low prices of flatbread, generally favored consumers to the detriment of producers. These interventions in the wheat value chain, especially those related to subsidies on flatbread, had especially large effects on the welfare of urban households, making these policies particularly politically sensitive. However, because of their high fiscal costs, these policies also threatened macroeconomic stability and crowded out other possible investments to promote growth and poverty reduction.

Impacts of exogenous shocks and policy changes on Sudan's wheat economy: Model simulations

Model structure

For this analysis, we utilize a simple partial equilibrium model of Sudan's wheat economy following that of Dorosh (2021) and earlier models of other countries by Dorosh (2001), Coady and colleagues (2009), and Schmidt and colleagues (2021). Model simulations provide estimates of the effects of supply and income shocks, as well as the impact of changes in the import parity price of wheat on its production, imports, and consumption by various household groups. Unlike in Dorosh (2021) and simulations using the other models cited above, these model simulations include changes in marketing costs between regions, but they do not include the effects of changes in production and prices on wheat farmer incomes.

Annex Table 5.1 lists the equations and variables used in the model. Wheat production is a function of the domestic wheat price with a constant own-price elasticity of supply. Household demand for wheat for each of the eight household groups (urban poor, urban nonpoor, rural poor, and rural nonpoor in each of the two regions, namely western and eastern Sudan) is a function of household incomes and prices. Household incomes are exogenous, though some simulations include shocks to the incomes of selected households. In most simulations, the level of imports is exogenous, and the domestic price of wheat adjusts to equilibrate total supply and demand. In simulations of liberalized international wheat trade, however, the domestic price is set equal to the import parity price, and imports adjust to balance supply and demand.

The model's base data on national levels of wheat production, imports, seed, feed, and other uses are sourced from the U.S. Department of Agriculture (USDA) Supply Utilization Tables for 2022 (USDA 2024) and FAO Food Balance Sheets (FAO 2024b). Household demand for wheat for the eight household groups is constructed using data from national household surveys of Sudan (Sudan, Central Bureau of Statistics 2009), following calculations similar to those used in Dorosh (2021).

Model simulation results

The civil war that began in April 2023 has resulted in hundreds of thousands of casualties, as well as massive displacements of people and disruptions to the economy. Given these cataclysmic events, the wheat harvest in March 2024 was only 384,200 tons, which is 19.5 percent less than in 2023 (FAO 2024a). Assuming imports of 2.1 million tons (somewhat less than the 2.4 million ton estimate of USDA), total availability in 2023/2024 was 2.48 million tons (excluding deductions for losses).⁸ Thus, per capita supply fell from 58.4 kgs/person in 2022 to 49.6 kgs/person in 2024 (a 15 percent drop).⁹ These assumptions for production and trade are used in the base simulation, in which the simulated price of wheat is 28.3 percent higher than in 2022 (Simulation 0 in Annex Table 5.2).

Beginning from this base simulation, we ran two simulations designed to simulate other shocks that affected the wheat economy between 2022 and 2024: a 50 percent increase in the marketing margins between eastern and western Sudan (Simulation 1) and, in addition, a 20 percent reduction in

8 These calculations use ratios of seed, feed, and other uses from USDA (2024) and assume a population increase of 3 percent per year.

9 A model simulation using these assumptions for production and trade results in a 30.8 percent increase in the market price of wheat, from 470.8 SDG/kg to 616 SDG/kg (in 2021/2022 prices).

TABLE 5.4 Sudan model simulation results

	Sim. 0	Sim. 1	Sim. 2	Sim. 3	Sim. 4	Sim. 5
Production	384.2	367.2	359.3	426.0	412.0	429.4
	0.0%	-4.4%	-6.5%	10.9%	7.2%	11.8%
Imports	2,100.0	2,100.0	2,100.0	2,100.0	2,300.0	2,300.0
	0.0%	0.0%	0.0%	0.0%	9.5%	9.5%
Total supply	2,484.2	2,467.2	2,459.3	2,526.0	2,712.0	2,729.4
	0.0%	-0.7%	-1.0%	1.7%	9.2%	9.9%
Price (SDG/kg)*						
East	603.9	519.4	483.0	464.2	415.3	476.5
	0.0%	-14.0%	-20.0%	-23.1%	-31.2%	-21.1%
West	603.9	779.1	724.4	696.3	622.9	476.5
	0.0%	29.0%	20.0%	15.3%	3.1%	-21.1%
Average Sudan	603.9	611.7	560.8	539.1	482.4	476.5
	0.0%	1.3%	-7.1%	-10.7%	-20.1%	-21.1%
(Relative to 2022)	28.3%	29.9%	19.1%	14.5%	2.5%	1.2%
Consumption						
East	1,369.4	1,507.2	1,578.7	1,619.1	1,738.4	1,592.2
	0.0%	10.1%	15.3%	18.2%	27.0%	16.3%
West	983.7	830.5	751.8	771.8	830.8	992.7
	0.0%	-15.6%	-23.6%	-21.5%	-15.5%	0.9%
All Sudan	2,353.0	2,337.7	2,330.5	2,390.9	2,569.2	2,584.9
	0.0%	-0.7%	-1.0%	1.6%	9.2%	9.9%

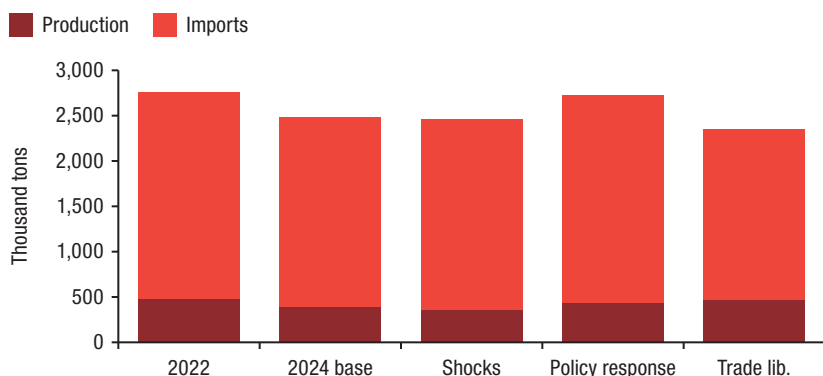
Source: Authors' model simulations.

Note: * Percentage change relative to 2022. Quantities expressed in thousands of metric tons. Sim. 0 = 2022 base data; Sim. 1 = +50% marketing margin to western Sudan; Sim. 2 = -20% household incomes in western Sudan; Sim. 3 = Sim. 2 with +20% wheat productivity; Sim. 4 = Sim. 3 with +200K wheat imports; Sim. 5 = Sim. 4 with integrated domestic wheat markets.

household incomes in western Sudan, an estimate of the direct effects of the conflict on households and enterprises (Simulation 2).

The 50 percent increase in marketing costs to western Sudan raises market prices there by 29 percent, and because more of the wheat supply remains in eastern Sudan, market prices there fall by 14 percent. National average prices are essentially unchanged, increasing by only 1.3 percent. Given the reduction in wheat prices in eastern Sudan, where most of the country's wheat production occurs, national wheat production falls by 4.4 percent.¹⁰ Wheat consumption increases by 10.1 percent in eastern Sudan but decreases by 15.6 percent in western Sudan; total wheat consumption in Sudan is almost unchanged, falling by 0.7 percent (Table 5.4 and Figure 5.8).

10 The model assumes that wheat production is a function of wheat prices in eastern Sudan.

FIGURE 5.8 Model simulation results for wheat production and imports, Sudan

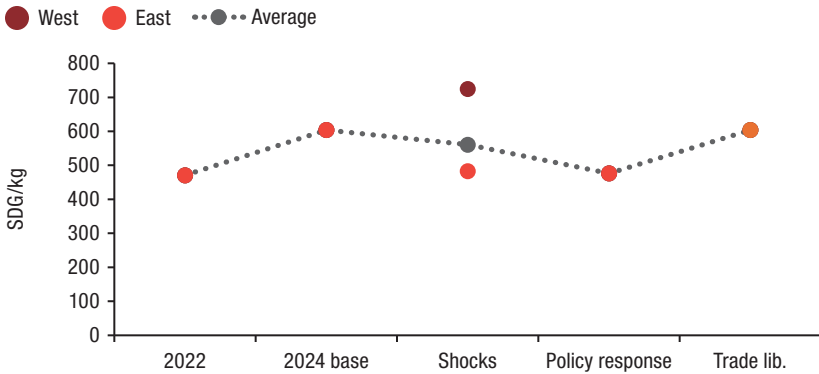
Source: Authors' model simulations.

Note: The "shocks" simulation (Sim. 2, Table 5.1) includes higher marketing costs and lower household incomes in the West. The "policy response" simulation (Sim. 5, Table 5.1) includes both shocks from Sim. 2, a 20 percent productivity increase, 200,000 increase in imports, and integration of domestic markets.

The 20 percent reduction in exogenous household incomes in western Sudan results in a further reduction in wheat demand there (relative to Simulation 1). Wheat prices in western Sudan rise by only 20 percent relative to the base simulation, as compared to the increase of 29 percent in Simulation 1 (Figure 5.8). Wheat consumption in this area falls by 23.6 percent, an additional 8 percentage points relative to the decline in Simulation 1 (–15.6 percent). As in Simulation 1, with imports held fixed, the decline in consumption in western Sudan results in higher supplies in eastern Sudan, and consumption there increases by 15.3 percent relative to the base simulation (5.3 percentage points relative to Simulation 1) (Figure 5.8). Wheat prices in eastern Sudan fall by 20 percent (an additional 6 percentage points compared to Simulation 1).¹¹

Simulations 3 through 5 explore the effects of potential policy measures to promote recovery of the wheat economy. In Simulation 3, we model a 20 percent increase in the productivity of wheat production, implicitly achieved through increased distribution of improved seeds and greater fertilizer use. Wheat production increases by 10.9 percent relative to the base

11 Note that because marketing margins are assumed to be a fixed value in terms of SDG/kg, in general, percentage price changes in western Sudan are not equal to percentage price reductions in eastern Sudan.

FIGURE 5.9 Model simulation results for wheat prices, Sudan

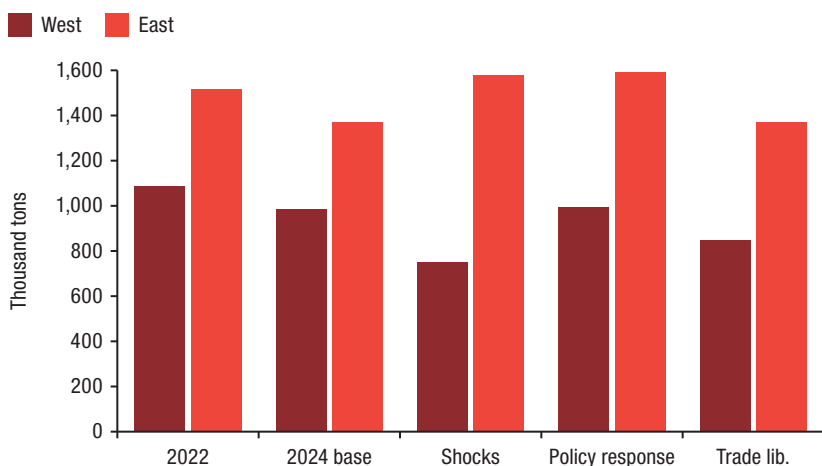
Source: Authors' model simulations.

Note: "Shocks" simulation (Sim. 2, Table 5.1) includes higher marketing costs and lower household incomes in the West. "Policy response" simulation (Sim. 5, Table 5.1) includes both shocks from Sim. 2, a 20 percent productivity increase, 200,000 increase in imports, and integration of domestic markets.

simulation; national average wheat prices fall by 3.2 percentage points relative to Simulation 2 and by 10.7 percent relative to the base simulation; and national wheat consumption rises by 1.6 percent, as compared to a 1 percent decrease relative to the base in Simulation 2.

The 200,000-ton increase in imports in Simulation 4 increases national supply and national wheat consumption by 9.2 percent above the base level. Average wheat prices fall to 20.1 percent below the base level (that is, 9.4 percentage points below the price level in Simulation 3). Prices in eastern Sudan fall to 31.2 percent below the simulation price, while prices in western Sudan are only 3.1 percent above the base level, despite the increased marketing margins. Consumption of wheat in western Sudan is only 15.5 percent of the base level.

Simulation 5 models an integrated market like that which existed in 2022 (removing the 50 percent increase in marketing margins to western Sudan of Simulations 1–4), while keeping the lower household incomes in western Sudan of Simulation 2, the productivity shock of Simulation 3, and the higher import volumes of Simulation 4. In this scenario, wheat prices in both regions are 21.1 percent below the price level in the base simulation, that is, 10.1 percentage points higher than in eastern Sudan (Simulation 5) and 18 percentage points higher than in western Sudan (Simulation 5) (Figure 5.9). Wheat consumption thus increases by 16.4 percentage points

FIGURE 5.10 Model simulation results for wheat consumption by region, Sudan

Source: Authors' model simulations.

Note: The "shocks" simulation (Sim. 2, Table 5.1) includes higher marketing costs and lower household incomes in the West. The "policy response" simulation (Sim. 5, Table 5.1) includes both shocks from Sim 2, a 20 percent productivity increase, 200,000 increase in imports, and integration of domestic markets.

relative to Simulation 4 in western Sudan, but it falls by 10.7 percentage points relative to Simulation 4 in eastern Sudan (Figure 5.10). The results of Simulations 4 and 5 suggest that increases in imports generally remain the most effective means of reducing market prices and raising consumption. For western Sudan, however, restoring market flows of wheat from eastern Sudan can lead to even greater positive impacts on consumption.

Finally, Simulation 6 (Table 5.5) shows the impact of a trade liberalization in which private imports are allowed, up to the point at which the domestic price equals the simulated base market price of 2024, namely 604 SDG/kg in 2021/2022 prices (Simulation 0). Assuming no change in the other assumptions of Simulation 2, production falls from 359,000 tons in Simulation 2 to 336,000 tons in Simulation 6, a 6.5 percent decline. Imports increase by 19.1 percent relative to those in Simulation 2 due to lower market prices. Wheat consumption increases by approximately the same percentages in eastern Sudan (15.3 percent) as in western Sudan (15.9 percent). Thus, trade liberalization has major benefits for consumers, as lower prices spur additional consumption.

TABLE 5.5 Model simulation results for wheat trade liberalization, Sudan

	Sim. 0	Sim. 2	Sim. 6
Production (thousand tons)	384.2	359.3	336.0
	–	–	–6.5%
Imports (thousand tons)	2,100.0	2,100.0	2,500.8
	–	–	19.1%
Total supply (thousand tons)	2,484.2	2,459.3	2,836.8
	–	–	15.4%
Price (SDG/kg)*			
East	–	–	–20.0%
West	–	–	–20.0%
All Sudan	–	–	–20.0%
Consumption (thousand tons)			
East	1,369.4	1,578.7	1,820.6
	–	–	15.3%
West	983.7	751.8	871.6
	–	–	15.9%
All Sudan	2,353.0	2,330.5	2,692.2
	–	–	15.5%

Conclusion

As key components of Sudan's food economy, cereal production and markets have changed dramatically in the last 10 years due to conflict-related disruptions, as well as earlier changes in government policy. In parts of Sudan, particularly Darfur and surrounding regions, the conflict has prevented many farming activities and greatly reduced domestic production. In many other areas of the country, however, the planting and harvesting of cereal crops have not been significantly disrupted, though marketing costs have risen substantially.

Regional differences in production and consumption patterns have long existed in Sudan, largely driven by water availability. The current conflict has added an important additional regional dimension to the picture, one that shifts with the ebbs and flows of military control over cities and surrounding agricultural areas. Wheat production in Aj Jazirah, a state largely under RSF control in 2023/2024, was only 144,000 tons, 59 percent below the five-year (2018/2019–2022/2023) average of 353,000 tons. At 104,000 tons, wheat production in the SAF-controlled Northern state was only 29 percent below its previous five-year average. Sorghum production in East, Central, and West Darfur fell by 91 percent, from a five-year average of 719,000 tons to only 58,000 tons (see Figure 5.2).

Consistent with the decline in production (and limited wheat imports), market prices of both wheat and sorghum increased sharply from 2021 to 2024. Wheat prices rose particularly fast in 2024 in Al Fashir and El-Obeid in western Sudan, where they increased more than fivefold compared to early 2023, reflecting increased marketing costs from Port Sudan and other parts of eastern Sudan to markets in western Sudan. Overall, sorghum prices rose less than wheat prices but nonetheless surged by the end of 2024 in most markets.

Wheat market model simulations suggest that the disruption of regional wheat markets due to conflict in 2023 had significant adverse effects on wheat consumption. In the absence of this conflict-induced shock to marketing costs, wheat consumption could have been 10 percentage points higher in western Sudan, assuming wheat imports were allowed to increase to meet demand at import parity prices. Moreover, when domestic market prices are higher than import parity levels, increasing the volume of wheat imports to reduce domestic prices to import parity levels can generally be an effective means of reducing market prices and raising consumption.

In the short term, if war continues, humanitarian aid flows will still be needed to help meet food security needs, since households in conflict areas will likely lack the purchasing power to acquire sufficient food in the market. In the medium term, rebuilding market infrastructure could help to lower marketing costs and thus help raise the incomes of net wheat-consuming households. In addition, these investments in market infrastructure would likely raise the incomes of urban households and all farm households that produce a marketable surplus of other crops.

TABLE 5.A1 Sudan wheat model equations

Production:	$X = X0 * (P/P0)^{es}$
Supply:	$QS = X * (1 - loss) + M$
Seed use:	$QSD = seed * X$
Feed use:	$QF = feed * QS$
Household demand:	$QD(h) = QD0(h) * ((P/P0) ^ ey(h)) * (Y(h)/Y0(h) ^ ey(h)$
Household incomes:	$Y(h) = Y0(h) * yshock(h)$
Regional prices:	$P(\text{"west"}) = P(\text{"east"}) * (1 + marg)$
Equilibrium:	$QS = QSD + QF + \sum h QD(h)$
Endogenous variables:	Exogenous variables:
M = Imports [exogenous]	QD0(h) = Base-level demand (consumption) by household h
QD(h) = Demand (consumption) by household h	P0 = Base domestic price
QF = Feed use	X0 = Base-level production
P = Domestic price	Y0(h) = Base-level household income
S = Total supply	
X = Production	
Y(h) = Household income	
Parameters:	
es = Own-price elasticity of wheat supply	
ed(h) = Own-price elasticity of wheat demand for household h	
ey(h) = Income elasticity of demand for household h	
feed = Feed use as a share of total supply	
loss = Seed, feed, and storage as a percentage of domestic production	
marg = Percent marketing margin between region 1 and region 2	

Source: Authors.

TABLE 5.A2 Sudan wheat model, base data and simulation, 2024

	2022	USDA 2024	Sim. 0 2024
Production	477	400	384
	–	–16.2%	–19.5%
Imports	2,276	2,400	2,100
	–	5.4%	–7.7%
Total supply	2,753	2,800	2,484
	–	1.7%	–9.8%
Per capita supply (kgs)	58.4	55.9	49.6
	–	–4.1%	–15.0%
Wheat price (SDG/kg)*	470.8	–	603.9
	–	–	28.3%
Consumption	2,605	2,654	2,353
	–	1.9%	–9.7%

Source: USDA (2024), FAO (2025), and authors' model simulations.

References

- Abdelaziz, F., A. William, K.A. Abay, and K. Siddig. 2022. "An Assessment of Sudan's Wheat Value Chains: Exploring Key Bottlenecks and Challenges." Sudan SSP Working Paper 4. IFPRI. <https://hdl.handle.net/10568/141081>
- Abdulai, A. 2000. "Spatial Price Transmission and Asymmetry in the Ghanaian Maize Market." *Journal of Development Economics* 63 (2):327–349. [https://doi.org/10.1016/S0304-3878\(00\)00115-2](https://doi.org/10.1016/S0304-3878(00)00115-2)
- Coady, D., P. Dorosh, and B. Minten. 2009. "Evaluating Alternative Policy Responses to Higher World Food Prices: The Case of Increasing Rice Prices in Madagascar." *American Journal of Agricultural Economics* 91 (3):711–722. <https://doi.org/10.1111/j.1467-8276.2009.01266.x>
- D'Silva, B.C., and I. El Badawi. 1988. "Indirect and Direct Taxation of Agriculture in Sudan: The Role of the Government in Agriculture Surplus Extraction." *American Journal of Agricultural Economics* 70 (2):431–136. <https://doi.org/10.2307/1242088>
- Dickey, D.A., and W.A. Fuller. 1979. "Distribution of the Estimators for Autoregressive Time Series with a Unit Root." *Journal of the American Statistical Association* 74 (366a):427–431. <https://doi.org/10.1080/01621459.1979.10482531>
- Dorosh, P.A. 2001. "Trade Liberalization and National Food Security: Rice Trade between Bangladesh and India." *World Development* 29 (4):673–689. [https://doi.org/10.1016/S0305-750X\(00\)00121-2](https://doi.org/10.1016/S0305-750X(00)00121-2)

- Dorosh, P.A. 2021. “Distributional Consequences of Wheat in Sudan: A Simulation Model Analysis” Sudan SSP Working Paper 2. IFPRI. <https://hdl.handle.net/10568/142129>
- Engle, R.F., and C.W.J. Granger. 1987. “Co-Integration and Error Correction: Representation, Estimation, and Testing.” *Econometrica* 55 (2):251–276. <https://doi.org/10.2307/1913236>
- Fackler, P.L., and B.K. Goodwin. 2001. “Chapter 17 Spatial Price Analysis.” In *Handbook of Agricultural Economics*, Vol. 1B, eds. B.L. Gardner and G.C. Rausser, 971–10240. Elsevier. [https://doi.org/10.1016/S1574-0072\(01\)10025-3](https://doi.org/10.1016/S1574-0072(01)10025-3)
- Faki, H., and A. Taha. 2009. “Sudan.” In *Distortions to Agricultural Incentives in Africa*, eds. W.A. Masters and K. Anderson, Chapter 10, 283–306. World Bank. <https://doi.org/10.1596/978-0-8213-7652-2>
- FAO (Food and Agricultural Organization of the United Nations). 2024a. FAOStat Database. Accessed February 6, 2026. <http://www.fao.org/faostat/en/#data>
- FAO. 2024b. “Food Balances (2010-).” FAOStat database. Accessed October 28, 2025. <https://www.fao.org/faostat/en/#data/FBS>
- FAO. 2024c. *Special Report – 2023 FAO Crop and Food Supply Assessment Mission (CFSAM) to the Republic of the Sudan*. FAO. <https://openknowledge.fao.org/handle/20.500.14283/cd0053en>
- FAO. 2025. Food Price Monitoring and Analysis (FPMA) Tool. Accessed August 28, 2025. <https://fpma.fao.org/gIEWS/fpmat4/global/#/dashboard/home>
- FEWS NET (Famine Early Warning Systems Network). 2025. Markets and Trade data. Accessed August 28, 2025. <https://fews.net/data/markets-and-trade>
- IMF (International Monetary Fund). 2025. International Financial Statistics. Accessed August 28, 2025. <https://data.imf.org/regular.aspx?key=61545850>
- Johansen, S. 1988. “Statistical Analysis of Cointegration Vectors.” *Journal of Economic Dynamics and Control* 12 (2-3):231–254. [https://doi.org/10.1016/0165-1889\(88\)90041-3](https://doi.org/10.1016/0165-1889(88)90041-3)
- Johansen, S. 1991. “Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models.” *Econometrica* 59 (6):1551–1580. <https://doi.org/10.2307/2938278>
- Johansen, S., and K. Juselius. 1990. “Maximum Likelihood Estimation and Inference on Cointegration— with Applications to the Demand for Money.” *Oxford Bulletin of Economics and Statistics* 52 (2):169–210. <https://doi.org/10.1111/j.1468-0084.1990.mp52002003.x>
- Resnick, D. 2021. “Political Economy of Wheat Value Chains in Post-Revolution Sudan.” Sudan SSP Working Paper 1. IFPRI. <https://hdl.handle.net/10568/142128>
- Resnick, D., H. Abushama, O. Kirui, and K. Siddig. 2026. “State Failure and Elite Capture of Sudan’s Agrifood System.” In *War and Resilience: The Multifaceted Impacts of Sudan’s Conflict and Pathways to Recovery*, eds. K. Siddig, O.K. Kirui, and P.A. Dorosh, Chapter 3.

- Said, S.E., and D.A. Dickey. 1984. "Testing for Unit Roots in Autoregressive-Moving Average Models of Unknown Order." *Biometrika* 71 (3):599–607. <https://doi.org/10.2307/2336570>
- Schmidt, E., P. Dorosh, and R. Gilbert. 2021. "Impacts of Covid-19 Induced Income and Rice Price Shocks on Household Welfare in Papua New Guinea: Household Model Estimates." *Agricultural Economics* 52 (3):391–406. <https://doi.org/10.1111/agec.12625>
- STPT (The Sudan Transparency and Policy Tracker) and Istiqsa'i (New Features Multimedia). 2025. *Corruption in Revenue Collection in Wartime Sudan*. STPT. <https://sudantransparency.org/corruption-in-revenue-collection-in-wartime-sudan/>.
- Sudan, Central Bureau of Statistics. 2009. *National Baseline Household Survey 2009*. Central Bureau of Statistics. <https://microdata-catalog.afdb.org/index.php/catalog/17/variable/F8/V385?name=d11>
- USDA (U.S. Department of Agriculture). 2024. "Foreign Agricultural Service Production Supply and Distribution Release Schedule." <https://apps.fas.usda.gov/psdonline/app/index.html#/app/downloads>
- WFP (World Food Programme). 2025. *WFP Sudan Market Monitor - March 2025*. WFP. <https://reliefweb.int/report/sudan/wfp-sudan-market-monitor-march-2025>
- World Bank. 2025. "World Bank Commodities Price Data (The Pink Sheet)." Accessed August 28, 2025. <https://thedocs.worldbank.org/en/doc/18675f1d1639c7a34d463f59263ba0a2-0050012025/world-bank-commodities-price-data-the-pink-sheet>

CONFLICT-INDUCED TRADE DYNAMICS: A GRAVITY FRAMEWORK ANALYSIS OF SUDAN'S AGRICULTURAL EXPORTS

Enock Kojo Ayesu, Lukas Kornher, Daniel Sakyi, and Hala Abushama

Long before the April 2023 eruption of armed conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF), Sudan's economy was crippled by conflicts. The country's agricultural production and productivity, internal trade, exports, and overall macroeconomic performance have all been adversely affected, and disruptions to the agrifood system, food insecurity, poverty, and malnutrition will likely remain if the conflict continues.

Conflicts cause insecurity and instability, reduce investor confidence, and often lead to trade embargoes, sanctions, and border closures imposed on the country experiencing the conflict.¹ Sustained efforts were made to improve Sudan's position within the global economy during the 2019–2021 period of transition toward democracy, including macroeconomic stabilization measures, pursuit of debt relief, promotion of public–private partnerships and global trade agreements, capacity building in the agriculture and industry sectors, and the provision of social protection programs (Bacchetta et al. 2021; Elobaid and Alhelo 2023). However, the October 2021 coup led to renewed embargoes and a reduction in Sudan's participation in global trade (Khalifa 2020), as well as a decline in investor confidence and increased domestic market uncertainty. The most recent conflict has further undermined progress in economic growth and human capital development, and the Sudanese economy remains hampered by disruptions to domestic production, damaged infrastructure, high trade costs, limited access to markets and essential services, and broken supply chains.²

Sudan is known for its major exports, including numerous agricultural products—gum arabic, millet, sesame, livestock, meat, and cotton—as well as gold (Asare et al. 2021). Nonetheless, between 2015 and 2023, the country

1 See Marano et al. 2013; Ali 2013; Seid et al. 2021; Caramuta et al. 2023; Siddig et al. 2023; Taralashvili 2024.

2 See Abiad et al. 2018; Didier 2020; Rauschendorfer and Shepherd 2020; Li et al. 2021; Seid et al. 2021; Fernandes et al. 2023; Siddig et al. 2023; Taralashvili 2024.

had a significant deficit in its merchandise trade balance, coupled with a steady decline in inflows of foreign direct investment (FDI) and in its trade openness (UNCTAD 2024). Moreover, the ongoing conflict within Sudan has cut off direct access of the RSF and western Sudan to Port Sudan, the main export port. This has important implications, as international trade plays an essential role in a country's economic development,³ and it can reduce poverty and malnutrition, improve food security and food trade balances, and enhance the accessibility of diverse and nutritious food (Kornher and Kalkuhl 2019).

Despite extensive research on the relationship between conflict and trade globally, no previous empirical work has quantitatively investigated the impact of Sudan's ongoing civil war on its agricultural export performance. This is a significant gap in both the empirical literature on conflict economics and the policy understanding of how intrastate conflicts affect economic activities in these states and their potential to participate in the global market. This study addresses this gap by providing the first quantitative analysis of the impact of Sudan's 2023 civil war on the country's agricultural trade performance, with a particular focus on the country's major food crops and livestock exports.

Our analysis makes three key contributions to the empirical literature. First, we apply a structural gravity modeling framework with a two-way fixed effects estimator, using a difference-in-differences approach that compares Sudan's export performance to that of its major African competitors as a synthetic control group. Second, we provide evidence by disaggregating export effects based on the geographic production patterns of different commodities, distinguishing between products mainly produced in areas controlled by the RSF and those produced in SAF-controlled areas. This disaggregation allows us to empirically identify which agricultural export products—including sesame, groundnuts, livestock, sorghum, and cotton—have been most severely affected by the ongoing conflict. Third, using the product-specific analysis—based on the geographic division of Sudan into areas controlled by the RSF and SAF—we also make a contribution to the conflict–trade literature, showing how territorial control and access to export infrastructure shape conflict impacts on trade performance and providing critical insights for the design of postconflict recovery policies.

The rest of the chapter is structured as follows: The next section provides some background on the impact of the conflict on Sudan's agrifood system.

3 See Sakyi et al. 2018; Sakyi and Afesorgbor 2019; Li et al. 2021; and Taralashvili 2024.

We then review conceptual frameworks on conflict and trade as well as the related empirical literature. The following section describes the data and methodology, including stylized facts on the performance of border and transport efficiency, logistics performance, and trade cost indicators in conflict and nonconflict countries. We then discuss the results and conclude with policy suggestions.

Conflict and Sudan's agrifood system

Domestic agricultural production has been severely affected by the conflict in Sudan (Kirui et al. 2023; Wahlstedt and Sulieman 2024). In 2023, the country's cereal production fell 46 percent below the previous year's, with the most severe declines (up to 80 percent below average) occurring in the conflict-ridden Greater Kordofan and Darfur regions (FAO 2024). According to Kirui and colleagues (2023), 40 percent of farmers reported that they could not adequately prepare for the 2023 summer planting season because of conflict-related factors, including the inability to procure essential inputs such as seeds and fertilizers. These challenges, compounded by adverse weather conditions and increased input prices, have led to a concerning reduction in cultivated land area (Kirui et al. 2023). The displacement of farmers from conflict areas also continues to disrupt farming production, practices, and livelihoods; 28 percent of surveyed farmers were displaced in 2023 (Kirui et al. 2023; FAO 2024; Wahlstedt and Sulieman 2024).

The geographically dispersed nature of the conflict in Sudan, coupled with the control of regional trade routes by the warring factions, significantly limits agricultural activities in both the SAF- and RSF-controlled areas. Well-functioning checkpoints, taxation, and customs authorities are critical for the efficient movement of goods; the control of this trade infrastructure by different factions affects the transaction costs associated with the movement of goods between these regions. While the RSF controls many parts of Darfur and Kordofan in the west, the SAF maintains a stronger presence in nonconflict regions in eastern Sudan, including Port Sudan and ports in Suwakin (Abushama et al. 2023; SPARC 2025). This situation impedes the operation of production and trade networks within the agrifood system, particularly in RSF-controlled areas, which may lead to stronger impediments in these areas. Merchants surveyed in 2025 confirm these disruptions; they report road blockages, high transport costs, checkpoint fees, and restricted trade routes throughout Sudan (Kirui et al. 2023). In conflict zones, domestic traders are disproportionately affected by informal taxation systems and unofficial fees

imposed by nonstate actors. This is particularly alarming given the country's heavy reliance on inland trucking, which accounts for 95 percent of food transportation (Abushama et al. 2023). Exporters operating within the non-conflict regions where federal trade regulations are largely upheld (Kirui et al. 2023) are also affected, further exacerbating the challenges to Sudan's agri-food system and overall economy.

Related literature and empirical evidence

The relationship between intrastate conflict and trade

While several studies have focused on the impact of *interstate* conflict on trade,⁴ researchers have also often highlighted a negative relationship between *intrastate* conflict and trade performance.⁵ Researchers have also shown that intrastate conflict impairs state economic capabilities, reducing the purchasing power of residents and decreasing per capita gross domestic product (GDP) and production activities (see Marano et al. 2013 and, on Sudan, Siddig et al. 2023).

The empirical literature also shows that intrastate conflict leads to a decline in the volume and/or intensity of trade (exports and imports) between neighboring countries. For instance, a recent study of the internal conflict in Sudan reported that neighboring countries, including Chad and South Sudan, were significantly affected by reduced Sudanese exports (Siddig et al. 2023). Looking at the relationship between conflict and trade across 134 countries, Marano and colleagues (2013) found that intrastate conflict has negative impacts on both imports and exports, but the impact is greater in conflict-affected exporting countries than conflict-affected importing countries, because conflict reduces production capacity.

Conflict affects trade and the export capacity of economies through several channels. It disrupts supply chains and transportation networks essential for market access by damaging or destroying infrastructure such as ports, roads, and airports, making it difficult to transport goods both domestically and internationally.⁶ Relatedly, trade costs rise because traders may need to

⁴ See Fuchs and Klann 2013; Marano et al. 2013; Heilmann 2016; Du et al. 2017; Didier 2020; Li et al. 2021; and Estrada and Koutronas 2022.

⁵ See, for example, Didier 2020; Collier 2003; Koubi 2017; Marano et al. 2013; Qureshi 2013; Karam and Zaki 2016; Seid et al. 2021; Siddig et al. 2023.

⁶ See Cali et al. 2015; Abiad et al. 2018; Caramuta et al. 2023; Fernandes et al. 2023; Siddig et al. 2023.

use alternative routes or pay higher costs to transport their products. Higher trade costs in turn reduce their potential to participate competitively in international trade (Didier 2019; Rauschendorfer and Shepherd 2020; Seid et al. 2021; Siddig et al. 2023; Taralashvili 2024).

Conflict causes a deterioration in investors' confidence and the business environment (Marano et al. 2013; Siddig et al. 2023), a decrease in human capital (Cali et al. 2015; Rauschendorfer and Shepherd 2020; Siddig et al. 2023), displacement of labor and skills shortages (Spittaels and Weyns 2014; Cali et al. 2015; Rauschendorfer and Shepherd 2020; Seid et al. 2021), imposition of sanctions by the international community (Afesorgbor 2019; Nguyen and Do 2021; Estrada and Koutronas 2022; Bove et al. 2023; Doan and Tran 2023; Larch et al. 2024), and informal trade isolation, as the private sector withdraws (Lin et al. 2019; Siddig et al. 2023).

In addition, the political uncertainty created by conflict deters both domestic and foreign investors, who fear risk to their investments and anticipate disruptions to business operations (Marano et al. 2013; Siddig et al. 2023). This can lead to a redirection of investments to safer options, thus decreasing productivity, including in export sectors (Collier and Duponchel 2013; Siddig et al. 2023).

Conflict also weakens a country's export capacity and trade by decreasing the workforce and skill level of workers, that is, the human capital (Rauschendorfer and Shepherd 2020; Seid et al. 2021; Siddig et al. 2023). Additionally, the labor supply often decreases as conflict displaces young workers in export-oriented industries (Cali et al. 2015; Rauschendorfer and Shepherd 2020; Seid et al. 2021). Thus, industries in conflict areas may experience long-term skill and labor gaps that diminish their competitiveness.

Beyond these internal factors, the export capacity of a conflict-affected country may also be constrained by sanctions, imposed by the international community, that restrict access to global markets (Afesorgbor 2019; Nguyen and Do 2021; Bove et al. 2023; Larch et al. 2024). Generally, the sanctions imposed on conflict-affected countries aim to limit a country's ability to trade in certain products, access financial services, and participate in international trade agreements, which in turn weakens its ability to export (Afesorgbor 2019; Bove et al. 2023). For instance, the imposition of financial restrictions makes it difficult for firms to acquire loans internationally, which are often vital for maintaining export operations.

Informal trade isolation occurs as foreign companies and investors pull out of conflict-affected regions due to security concerns. Studies by Lin and colleagues (2019) and Siddig and Ahmed (2023) observed that the withdrawal of

foreign firms and investors reduces FDI, which is crucial for expanding export capacity, especially for low- and middle-income countries. Reduced FDI limits the resources required for expansion and innovation, which can lead to lower production volumes and decreased competitiveness of industries located in conflict-affected regions in the long run (Lin et al. 2019).

Similarly, informal traders and workers are often vulnerable to risks such as violence, extortion, and harassment during conflict, as well as logistical barriers due to damaged transport infrastructure (Abushama et al. 2023; Benjamin 2023; Lewis et al. 2019; Siddig et al. 2023). These risks often deter these traders and workers from doing business in conflict-affected countries, leading to a decline in trading activities with neighboring countries (Lewis et al. 2019).

Summary of the empirical evidence review

The empirical literature shows that conflict has a negative impact on trade (exports and, to a lesser extent, imports), and that different types of conflict have different impacts on trade (see for example, Caramuta et al. 2023; Fernades et al. 2023; Marano et al. 2013; Siddig et al. 2023; Taralashvili 2024). Although a negative impact of both interstate and intrastate conflict on trade performance was largely reported by researchers, the evidence above shows that their impact on trade performance in terms of magnitude differs, depending on the intensity and duration of the conflict (Fuchs and Klann 2013; Heilmann 2016; Marano et al. 2013; Siddig et al. 2023). The negative effects of intrastate conflict translate into higher trade costs and lower institutional export capacity as the comparison of standard trade indicators between conflict-affected and non-conflict-affected countries has shown (Marano et al. 2013; Siddig et al. 2023).

The negative effects of interstate conflict on factors such as infrastructure, trade costs, investors' confidence, sanctions, and informal trade isolation tend to be smaller than effects of intrastate conflict on international trade because interstate conflict is often disputed within a structure of international rules and usually has a narrow geographical focus not involving the entire territory of a society (Collier et al. 2003; Marano et al. 2013). In contrast, since intrastate conflict occurs within a country and directly affects specific regions and/or population groups, it leads to extensive damage to the affected country's human capital, including skills and knowledge, and social capital, as well as transportation and communication infrastructure, and governance policy support for firms' productive activities, which all decrease a country's ability to trade (Marano et al. 2013; Seid et al. 2021; Siddig et al. 2023; Taralashvili 2024).

Given that the social capital and policies and institutions that support international trade are destroyed during intrastate conflict, the impact on a country's trading potential tends to be more pervasive and damaging than is the case with interstate conflict (Collier and Hoeffler 2004; Marano et al. 2013; Siddig et al. 2023). We conclude that conflict will lead to the largest reduction in trade levels if it occurs within one (or both) trading economies, given its direct impact on their productive resources.

Methodology and data

This section presents the methodology and data employed in analyzing trends in the trade costs for conflict and nonconflict countries and then describes the empirical approach used in the gravity model analysis.

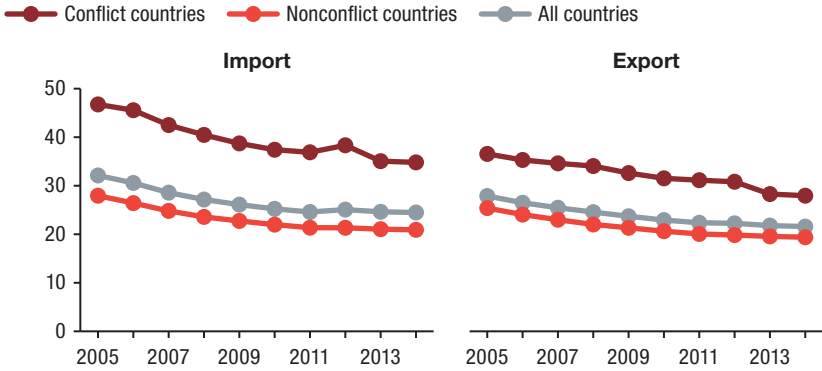
Trade costs in conflict and nonconflict countries

This subsection presents the method used to analyze the trends in trade costs across conflict and nonconflict countries. The indicators covered border and transport efficiency, logistics performance, and direct trade costs. For each indicator, we computed sample averages, capturing the overall level, as well as the annual percentage changes over the sample. The border and transport efficiency indicators used are time to export, time to import, cost to export, cost to import, number of documents to export, and number of documents to import. The tariff rate is used as the indicator for tariff costs. We use the overall Logistics Performance Index score. We then compare the conflict and nonconflict countries to highlight differences in trade cost patterns.

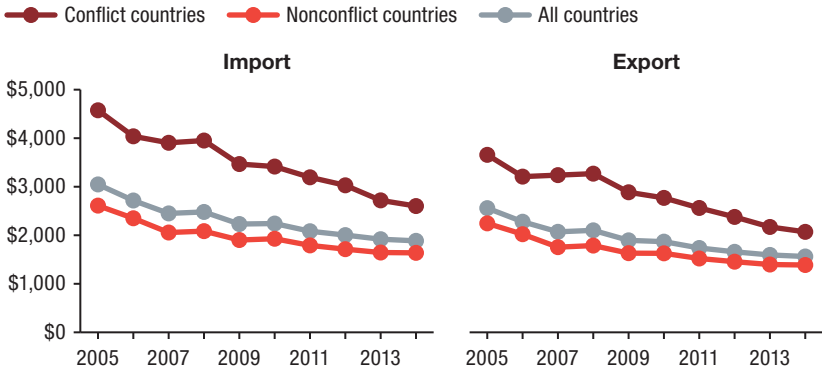
To select the conflict-affected countries, we used the Armed Conflict Location and Event Data (ACLED) conflict index (with categories of extreme, high, and turbulent levels of conflict), and the World Bank's classification of countries in terms of fragility, conflict, and violence (ACLED 2023; World Bank 2024a). A global sample of 48 conflict countries was compared with the performance of 113 nonconflict countries for the years 2007–2022 for logistic performance indicators, 2005–2014 for border and transport efficiency indicators, and 2014–2021 for tariff costs. The selection of countries and time period was driven by data availability. In the case of the border and transport efficiency indicators, consistent comparable data were only collected until 2014, after which methodological changes affected data consistency and cross-country comparability. Figures 6.1 and 6.2, as well as Tables 6.A1 and 6.A2 in the appendix to this chapter, present the trends in trade cost indicators for conflict and nonconflict countries.

FIGURE 6.1 Average time and costs to export and import

Panel A: Time to import (left) and export (right) in days

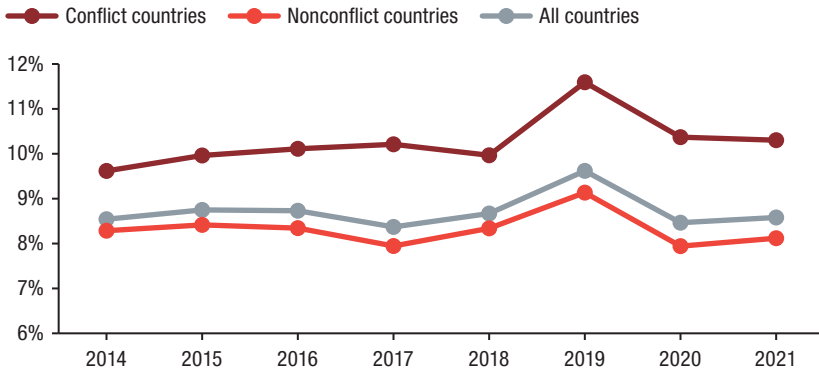


Panel B: Costs to import (left) and export (right) in US\$ per container



Source: Authors' illustration based on data from World Bank (2024a).

Figure 6.1 shows the evolution and performance of time and costs to trade, while Figure 6.2 shows the tariff rates. The mean values for all indicators, including the logistics performance index, are summarized in Tables 6.A1 and 6.A2. Trade costs and applied tariff rates are generally higher in conflict countries as compared to nonconflict countries. For example, while on average in conflict-affected countries, exports (imports) require approximately 7(9) documents, 32(39) days, and US\$2,774 (\$3,435) per container, requirements in nonconflict countries are 6(7) documents, 21(23) days, and \$1,675 (\$1,963). The average applied tariff rate is 10 percent for conflict-affected countries and

FIGURE 6.2 Average tariff rate, most favored nation, simple mean, all products (%)

Source: Authors' illustration based on data from the World Bank (2024a).

8 percent for nonconflict countries. Logistics Performance Index scores range from 1 (lowest performance) to 5 (highest performance), with higher values indicating more efficient logistics and lower trade costs. The overall logistics performance index for conflict-affected countries is 2.6, while that of nonconflict countries is 2.9. From this analysis, we conclude that trade costs are generally higher in conflict-affected countries.

Econometric approach

Looking at Sudan, we use a standard structural gravity model to examine bilateral export trade flows from the country to its trade partners before and during the civil war that started in 2023. To identify the possible effect of the civil war on Sudan's export performance, we employ a difference-in-differences analysis framework with multiple pretreatment periods using the two-way or three-way fixed effects model. Our baseline model takes the following form:

$$\ln Y_{ijpt} = \beta_0 + \gamma(G_1 \times P_{2023}) + P_t \delta + G_i \theta_1 + G_j \theta_2 + G_{ij} \theta_3 + T_p \theta_4 + \varepsilon_{ijpt} \quad (1)$$

where subscripts i and j are exporters and importers, respectively; t denotes the time period; and p is the product. Y_{ijpt} is the dependent variable denoting the values of exports from country i to country j for product p . P_t are time fixed effects. Cross-sectional fixed effects (written in vectors) are denoted as G_i (exporter fixed effects), G_j (importer fixed effects), and T (product fixed

effects). G_{ij} denotes exporter-importer (country-pair fixed effects). δ , θ_1 , θ_2 , θ_3 , θ_4 are the corresponding coefficient vectors. The exporter-importer fixed effects capture all time-invariant gravity variables of the dyadic relationship between i and j , such as distance, common language, and existence of a free trade agreement, among others. $G_1 \times P_{2023}$ is 1 if the exporter is Sudan ($i=1$) and the year is 2023 and represents the treatment measured by γ .

The two-way (or three-way) estimator reduces to the simple difference-in-differences estimator if only two periods are considered. The consistent estimation rests on the parallel trend assumption, which postulates that all unobserved variation in y is absorbed by cross-sectional and time fixed effects but unrelated to time-varying cross-sectional variation. That is, in our case, the product-level (and exporter-importer) export trends for all i are identical before the civil war. This is a strong assumption that proves difficult to falsify. To remove trend heterogeneity, we use a synthetic control group ($i=i+1$) approach. In doing so, we select five exporters per product (HS-6 level) as the control group. We choose the five largest African exporters (other than Sudan) for each product. Hence, other than $i=1$ for Sudan, i ($i=2,3,4,5,6$) may vary across different products. More intuitively, we compare Sudan's export performance with the export performance of its closest African competitors before and after the onset of the civil war.

As pointed out by several studies from the gravity literature (Baier and Bergstrand 2007; Yotov et al. 2018; Freeman et al. 2025), bilateral trade is subject to importer- and exporter-specific determinants that may vary over time. This outcome is referred to as multilateral resistance terms (MRTs). Our model (1) does not include MRTs because otherwise the treatment effect is absorbed by the MRTs. To be more precise, the single MRT for Sudan in 2023 represents our treatment, but including all MRTs would yield a comparison of the treatment to a specific MRT base category, which will not identify the treatment effect. Hence, we are only able to control for time-invariant MRTs in this model.

As discussed in the introductory sections of this chapter, we expect that the effect of the onset of the civil war in 2023 could have either positive or negative effects on Sudan's export performance, depending on the production location of the respective product. In particular, agricultural products produced in the area controlled by the RSF may have less access to the international market because of limited access to the main export port. We test this hypothesis using a triple difference-in-differences framework interacting with a dummy variable that is 1 if the product is mainly produced in RSF-controlled areas with the treatment effect from equation (1).

$$\ln Y_{ijpt} = \beta_0 + \gamma(G_1 \times \text{RSF}_p \times P_{2023}) + P_t\delta + G_i\theta_1 + G_j\theta_2 + G_{ij}\theta_3 + T_p\theta_4 + \varepsilon_{ijpt} \quad (2)$$

where fixed effects are as in equation (1), RSF_p denotes a dummy variable that is 1 if the product is mainly produced in the RSF-controlled area. Thus, γ becomes a triple difference-in-differences instead of the difference-in-differences estimator.

Using the triple difference-in-differences approach in equation (2) allows us to compare Sudan's exports of products from RSF-controlled areas with SAF-controlled areas. Technically, it is possible to combine the importer and product fixed effects with the time fixed effects without absorbing the treatment effect. Due to the high correlation between these fixed effects with the treatment, we also estimate equation (1) with importer-time and product-time fixed effects separately for products from RSF-controlled and SAF-controlled areas. By doing so, we avoid the treatment effect being limited to the comparison between exports of some products (as the treated units) and other products (as the untreated units) of the same exporter: Sudan. One reason is that parallel trends are more realistic to hold across different countries than across different products. In this case, equation (2) changes to:

$$\ln Y_{ijpt} = \beta_0 + \gamma(G_1 \times P_{2023}) + G_i\theta_1 + G_jP_t\theta_2 + G_{ij}\theta_3 + P_tT_p\theta_4 + \varepsilon_{ijpt} \quad (3)$$

where P_tT_p and G_jP_t are importer-time and product-time fixed effects, respectively. G_jP_t is the MRT_j (importer-year fixed effects).

Equations (1) to (3) can be estimated either by the ordinary least squares (OLS) or the Poisson pseudo maximum likelihood (PPML) estimators. We use the PPML that applies logarithmic transformation to the dependent variable (Y) and can better deal with the inflated number of zero bilateral trade flows and general forms of heteroscedasticity (Santos Silva and Tenreiro 2006). Thus, in essence, we interpret the treatment coefficient as written in equation (1) to (3) and obtain percentages in exports by $(e^{\gamma}-1)*100$.

Data description: Sudan's top agricultural exports

In this study, we select Sudan's top 20 agricultural exports during the period between 2018 and 2022 (before the onset of the civil war) to include in the analysis. To identify these products and the top five African exporters (other than Sudan) of these agricultural commodities, we used the BACI dataset by CEPII (Gaulier and Zignago 2010). Table 6.1 shows Sudan's top agricultural exports and lists the five African competitors considered.

TABLE 6.1 Sudan's major agricultural export products between 2018 and 2022 (HS-6)

	HS-6 code	Product name	Export value (US\$ millions) (2018–2022)	Main African competitors
1	120740	Oil seeds: sesamum seeds	622.72	Nigeria, Niger, Ethiopia, Tanzania, Togo
2	10410	Sheep, live	330.10	Namibia, Mali, Djibouti, Somalia, Ethiopia
3	120242	Groundnut	304.10	Senegal, Ethiopia, Tanzania, Egypt, Malawi
4	520100	Cotton	194.02	Burkina Faso, Côte d'Ivoire, Benin, Egypt, Cameroon
5	130120	Gum arabic	125.35	Nigeria, Chad, Senegal, Mali, Egypt
6	10613	Mammals: camels, live	77.12	Somalia, Niger, Ethiopia, South Africa, Djibouti
7	120770	Oil seeds: melon seeds	73.51	Morocco, Ghana, Tanzania, Kenya, Egypt
8	10290	Bovine animals, live	50.53	Niger, Egypt, South Africa, Ethiopia, Rwanda
9	71320	Vegetables, leguminous: chickpeas	35.50	Egypt, Ethiopia, Morocco, Tanzania, Malawi
10	121490	Forage products	30.29	South Sudan, Egypt, Ethiopia, Nigeria, South Africa
11	71360	Vegetables, leguminous: pigeon peas	31.38	Malawi, Tanzania, Mozambique, Uganda, Kenya
12	230230	Bran, sharps and other residues	31.04	Uganda, Tanzania, Mozambique, Nigeria, Kenya
13	150810	Vegetable oils: groundnut oil	28.89	Nigeria, Senegal, Sierra Leone, Gambia, South Africa
14	20120	Meat: of bovine animals, cuts with bone	26.21	Ethiopia, Namibia, Kenya, Eswatini, South Africa
15	121410	Lucerne (alfalfa) meal and pellets	14.60	South Africa, South Sudan, Namibia, Egypt, Ethiopia
16	20410	Meat: of sheep, lamb carcasses	14.49	Kenya, Ethiopia, South Africa, Egypt, Tanzania
17	100790	Cereals: grain sorghum	13.64	Kenya, South Africa, Uganda, Tanzania, Ethiopia
18	20421	Meat: of sheep	12.09	Ethiopia, Namibia, Tanzania, Kenya, South Africa
19	20110	Meat: of bovine animals	11.88	South Africa, Egypt, Ethiopia, Tanzania, Botswana
20	10229	Cattle, live	3.82	Botswana, Somalia, Namibia, South Africa, Mali

Source: Authors based on BACI data (Gaulier and Zignago 2010).

We note that the BACI dataset is updated later than official UN statistics because data entries are scrutinized to mirror export and import flows between two countries. At the time of the analysis in December 2024, the 2023 data were not published and, therefore, the BACI data were unsuitable for the examination of the effects of the onset of the civil war in 2023 on Sudan's export performance. For this reason, we use data from the World Bank's World Integrated Trade Solution (WITS) (2024b). WITS, however, is solely based on COMTRADE data and so is missing several values. To reduce the number of missing values, we downloaded import trade flows of reporter j from the African exporter i (Sudan + countries listed in Table 3). Import data usually measure actual trade flows more accurately than export data because the exporting country lacks information on the final destination of shipments. With very few exceptions, these data are complete. We consider the period 2018 to 2023, which yields 174,960 observations (20 products \times 6 years \times 6 exporters \times 243 importers). In our approach, we only utilize observations if there is trade at any point over the six-year period (in any of the 20 products) between the exporter and the importer. Removing the constant zero trade flows leaves us with 38,244 observations.

Data description: Regional production of export goods in Sudan

The disruption of Sudan's export trade routes has affected exports of different agricultural products, depending on the production location of the different crops. The SAF and RSF's dominance over production in different regions is attributed to various factors (Abushama et al. 2023; Resnick et al. 2026). The RSF's direct and indirect ownership of land in the Darfur and Kordofan regions is a determining factor in those regions, impacting agricultural production and trade of key cash crops, such as gum arabic and groundnuts (Abushama et al. 2023). The SAF controls agricultural production facilities and land in regions including Northern state as well as state-owned enterprises in Khartoum, Aj Jazirah, White Nile, and River Nile states (Abushama et al. 2023). We infer that the warring parties continue to control regions where their businesses are dominant (Resnick et al. 2026), as well as the trade routes serving these locations.

Further, we mapped Sudan's agricultural production by state using data from IFPRI's Spatial Production Allocation Model (SPAM) (IFPRI 2024) and the Ministry of Livestock (2021), as summarized by Alfadul and colleagues (2024). Shapefiles and subnational population statistics were obtained from the Humanitarian Data Exchange (HDX 2024). These maps include a rough characterization of the frontline between the RSF and SAF based

on the Sudan War Monitor.⁷ Accordingly, we define all Darfur states and North Kordofan as RSF-controlled and northern and eastern Sudan as SAF-controlled. Khartoum, West Kordofan, and South Kordofan are considered disputed and are not assigned to either faction. Based on this classification, we compute per capita livestock ownership and production for the total area controlled by the RSF and SAF, respectively. The details are presented in Table 6.A3 in the appendix to this chapter. When no data were available, we relied on other publications. Data for sheep (RSF), camel (RSF), sorghum (RSF), groundnuts (SAF), sesame seeds (SAF), melon seeds (SAF), alfalfa (SAF), vegetable oil (SAF), and cotton (SAF) show a relatively clear picture. Figures 6.3 and 6.4 provide maps of sheep ownership and sesame production. For forage products and cattle, there is no clear tendency. While information on per capita livestock ownership gives an indication of export origin, it is unclear where meat processing takes place, but we have considered meat to originate from the same areas as the live animals. Table 6.2 summarizes the classification of products into the RSF- and SAF-controlled areas (henceforth RSF and SAF products).

This classification, based on past data, may not be perfectly accurate. The COVID-19 pandemic and the evolving conflict may have led to changes in production patterns that are not reflected in the SPAM data. For instance, there have been reports that sorghum production has increased in eastern Sudan in recent years (Osman et al. 2025). Therefore, we also disaggregate econometric results by product type to allow a more nuanced discussion.

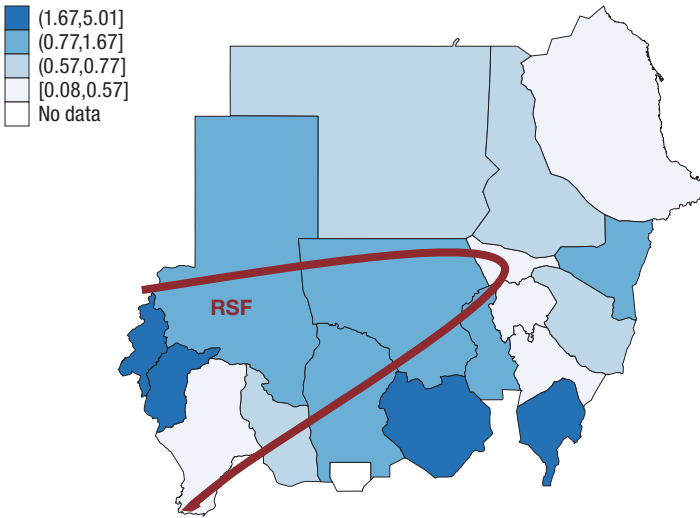
Results and discussion

In this section, we present and discuss the empirical results of the gravity models described in the previous section. First, we look at the general results of the two-way fixed effects model using the simple difference-in-differences framework. Second, we show disaggregated results from the model using the triple difference-in-differences framework and subsample regressions, and then discuss the results.

Table 6.3 shows a positive but insignificant association (when including controls) between the civil war and Sudan's agricultural exports for both models estimated by OLS and PPML. The coefficient estimates are substantially lower if we control for exporter, importer, exporter-importer, and product

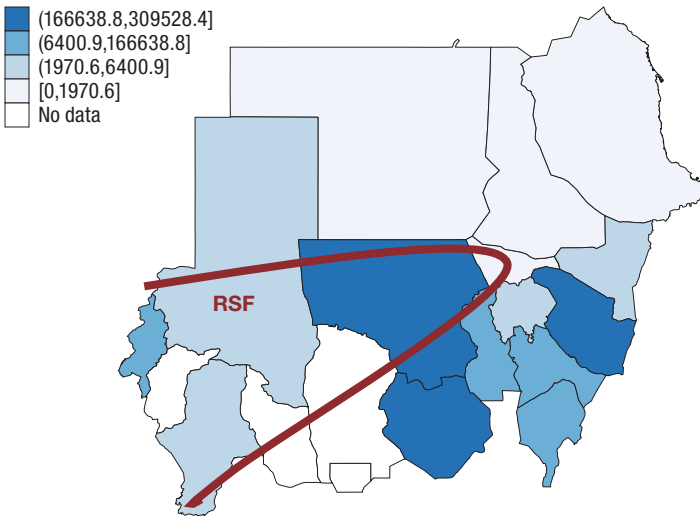
⁷ The Sudan War Monitor data are also used by international media such as *The Economist* (ACLEED, 2023).

FIGURE 6.3 Per capita sheep ownership in Sudan



Source: Authors' illustration based on Alfadul et al. (2024).

FIGURE 6.4 Per capita sesame production in Sudan



Source: Authors' illustration based on IFPRI (2025).

TABLE 6.2 Classification of agricultural products into RSF- and SAF-controlled areas

HS-6	Product	RSF	SAF	Neither RSF nor SAF	Source
10229	Cattle, live	0	0	1	Alfadul et al. (2024)
10290	Other than cattle, live	0	0	1	Alfadul et al. (2024)
10410	Sheep, live	1	0	0	Alfadul et al. (2024)
10613	Camels, live	1	0	0	Alfadul et al. (2024)
20110	Meat, bovine	0	0	1	Alfadul et al. (2024)
20120	Meat, bovine	0	0	1	Alfadul et al. (2024)
20410	Sheep, meat	1	0	0	Alfadul et al. (2024)
20421	Sheep, meat	1	0	0	Alfadul et al. (2024)
71320	Vegetables, chickpeas	0	0	1	IFPRI (2024)
71360	Vegetables, pigeon peas	0	0	1	IFPRI (2024)
100790	Sorghum	1	0	0	IFPRI (2024)
120242	Groundnuts	0	1	0	IFPRI (2024)
120740	Oil seeds, sesame	0	1	0	IFPRI (2024)
120770	Oil seeds, melon	0	1	0	IFPRI (2024)
121410	Alfalfa	0	1	0	Mwendia et al. (2023)
121490	Forage products	0	0	1	Mwendia et al. (2023)
130120	Gum arabic	0	0	1	UNOPS (2024)
150810	Vegetable oil, groundnut	0	1	0	IFPRI (2024)
230230	Bran, sharps	0	0	1	Mwendia et al. (2023)
520100	Cotton	0	1	0	IFPRI (2024)

Source: Authors' compilation based on sources listed in the table.

Note: Details on the underlying data and methodology can be found in Table 6.A3 in the annex to this chapter.

TABLE 6.3 General war effects on Sudan's agricultural exports

Independent variables	(1) OLS	(2) OLS	(3) PPML	(4) PPML	(5) PPML
Sudan \times war	280,375 (192,498)	66,396 (48,821)	1.080** (0.491)	0.173 (0.117)	0.187 (0.121)
Observations	38,244	38,244	38,244	38,244	37,734
Year FE	Yes	Yes	Yes	Yes	Yes
Exporter FE	No	Yes	No	Yes	Yes
Importer FE	No	Yes	No	Yes	Yes
Importer-year FE	No	No	No	No	No
Exporter-importer FE	No	Yes	No	Yes	Yes
Product FE	No	Yes	No	Yes	Yes
Product-year FE	No	No	No	No	No

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ In column (5), we exclude Saudi-Arabia. OLS = ordinary least squares estimator; PPML = Poisson pseudo maximum likelihood estimator.

TABLE 6.4 War effects on Sudan's agricultural exports disaggregated by RSF- and SAF-controlled products

Independent variables	(1) PPML	(2) PPML	(3) PPML	(4) PPML
Sudan \times war \times RSF	-0.499 (0.444)			
Sudan \times war		-0.530 (0.484)		0.296** (0.140)
Sudan \times war \times SAF			0.353*** (0.129)	
Observations	38,244	1,806	38,244	7,920
Year FE	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes
Importer FE	Yes	No	Yes	No
Importer-year FE	No	Yes	No	Yes
Exporter-importer FE	Yes	Yes	Yes	Yes
Product FE	Yes	Yes	Yes	No
Product-year FE	No	No	No	Yes
Subsample (RSF vs. SAF)	ALL	RSF	ALL	SAF

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. PPML = Poisson pseudo maximum likelihood estimator.

fixed effects. For interpretation, a coefficient estimate of 0.173 is equivalent to a treatment effect of 18.6 percent, but this effect is not statistically significantly different from zero.

We present the results of the triple difference-in-differences approach in Table 6.4, columns (1) and (3), using both RSF and SAF as the third dummy variable. In both cases, the reference group is non-RSF and non-SAF products. We clearly see that there is a difference between the RSF and SAF products. The treatment effect in the triple difference-in-differences framework is positive and statistically significant for SAF products and negative but not statistically significant for RSF products. Specifically, the treatment effect for SAF products is between 34.4 and 42.2 percent. Both the regressions based on the triple difference-in-differences framework and the subsample analyses produce the same results.

We further analyze the treatment effect across different product categories, estimating our model for subsamples of different products, as reported in Table 6.5. Namely, we analyze sorghum, vegetables and vegetable oil, live animals and meat, and oilseeds (sesame seeds, groundnuts, and melon seeds). We find that the treatment effect is positive and statistically significant for

TABLE 6.5 War effects on Sudan's agricultural exports disaggregated by type of product

Independent variables	(1) Sorghum	(2) Vegetables and veg. oil	(3) Live animals and meat	(4) Oilseeds
Sudan × war	−3.370*** (0.938)	0.556*** (0.124)	−0.834** (0.391)	0.257* (0.144)
Observations	266	1,520	2,835	8,668
Year FE	Yes	Yes	Yes	Yes
Exporter FE	Yes	Yes	Yes	Yes
Importer FE	No	No	No	No
Importer-year FE	Yes	Yes	Yes	Yes
Exporter-importer FE	Yes	Yes	Yes	Yes
Product FE	No	No	No	No
Product-year FE	Yes	Yes	Yes	Yes

Note: Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

vegetables and vegetable oil, as well as oilseeds, but negative and statistically significant for sorghum as well as live animals and meat. Notably, sorghum is an RSF product, as are live animals and meat. Oilseeds are SAF products. Vegetables and vegetable oils are neither RSF nor SAF products. The treatment effect is largest for sorghum (−96.5 percent) but also substantial for the other products (oilseeds +29.3 percent). Sorghum is almost exclusively produced in Darfur in western Sudan.

Why are these results (partly) unexpected, meaning not in line with most of the literature presented at the beginning of this chapter? We argue that there are three major reasons: First, Sudan has had a war economy since the onset of the civil war in 2023. Second, sanctions imposed by importing countries are expected to have negative impacts on exports but perhaps not in all cases (Gutmann et al. 2023; Larch et al. 2024). Third, we stress the importance of infrastructure and access to international ports for exports, as outlined early in the chapter.

War economies tend to be short-sighted and divert resources to war financing, including through disinvestment and expansive lending (Collier 1999), and there is ample evidence that natural resources are often a major source of war financing (Le Billon 2001). In Sudan, import data from Sudanese trade partners suggest that gold exports have continued in 2023 and 2024 despite the civil war (official statistics are not available). Gold is found in Darfur, North Kordofan, and Red Sea states. Further, exports from RSF-controlled areas are facilitated by an airfield in neighboring Chad, controlled by international political allies of the RSF. Against this background, it may be less

surprising to see that Sudan's agricultural exports have grown, at least in the short run. Besides export revenues from trade with allied partners, there are few options for either Sudanese war faction to finance their operations and meet their need for weapons.

While sanctions have been shown to reduce agricultural exports (Larch et al. 2024), the impact on Sudan's exports is likely minimal. Sudan has been sanctioned by Western countries and the United Nations for much of the past three decades. The literature shows that effects of sanctions decrease over time as actors begin to cope with the constrained situation and develop strategies to work around the sanction mechanisms (Gutmann et al. 2023; Larch et al. 2024). In addition, sanctions have led to a diversion of Sudan's trade from Western sanction sender countries (that is, those imposing sanctions) to trade partners in the Middle East and North Africa region that have not imposed sanctions, such as Saudi Arabia, Egypt, and the United Arab Emirates. Therefore, it can be considered unlikely that additional financial and trade sanctions would have a substantial effect on Sudan's costs of trade and agricultural exports.

The literature also suggests that trade in conflict countries will decrease because value chains are disrupted, infrastructure is destroyed, movements and transport become more difficult and expensive, and sanctions cause additional restrictions or prohibit transactions and trade. Our results provide evidence for continued but reduced exports of live animals and meat. This decrease may reflect the difficulty in accessing Port Sudan to export products originating from RSF-controlled areas, and the fact that most slaughterhouses are located in large urban centers (such as Khartoum), which are disputed areas. In addition, trading livestock and meat is more complicated than trading bulk commodities, such as sesame seeds and groundnuts, requiring additional infrastructure such as cooling facilities. Yet, the reductions in exports were not as severe as one might expect. This may be because meat trade in eastern Sudan has been resilient against the conflict and recovered quickly following reductions in the first half of 2023. For instance, Saudi Arabia supported the relocation of veterinary facilities and the establishment of a new modern slaughterhouse in River Nile state (Nougud 2024).

Conclusion

In this study, we investigate the short-run impact of Sudan's civil war on the country's agricultural export performance in 2023 with the aid of a structural gravity model. We employ a two-way fixed effects model based on the

difference-in-differences and triple difference-in-differences framework using Sudan's top African export competitors as a synthetic control group. The study results are interesting and somewhat surprising, with diverse regional and policy implications of global relevance, especially for other war-torn and neighboring countries of the developing world.

We find that, on average, agricultural exports in Sudan were higher in 2023 than would have been expected based on the trends of Sudan's agricultural exports and the exports of other African countries, but this is not statistically significant. We cannot ascertain whether this is causally linked to war activities, but our additional analyses show that exports of products mainly produced in SAF-controlled areas increased significantly in 2023, controlling for all trends. These products include sesame, groundnuts, cotton, and other oilseeds. In contrast, exports of products mainly produced in RSF-controlled areas, including animals and sorghum, decreased in 2023.

This outcome clearly shows that the impact of civil war on agricultural trade is not only influenced by location-specific conditions but also product-specific characteristics. Following the onset of the civil war, Sudan's agricultural export performance has been very product-specific, with increased exports of products from northern and eastern Sudan, areas that are controlled by the SAF, in 2023. While these results are positive in part, it is important that farmers benefit from continued agricultural exports during the civil war period, and agricultural export capacity will be essential for postconflict recovery. Therefore, critical infrastructure should be protected by both factions during the conflict. In sum, conflict impacts on trade are highly product- and location-specific, determined primarily by access to trade infrastructure. We see this in Sudan because Port Sudan, Sudan's single most important international export port, and the surrounding areas are controlled by the SAF, while the RSF has no direct access to Port Sudan, which constrains exports from RSF-controlled areas. Saudi Arabia, Sudan's largest trade partner, has helped to establish export infrastructure outside the disputed Khartoum area, primarily in SAF-controlled areas, thereby further strengthening the export capacity of areas under SAF control relative to RSFheld regions.

Our study highlights the critical importance of maintaining trade infrastructure. In particular, the findings suggest a role for development of resilient and efficient trade infrastructure in both war-torn and neighboring countries. This calls for strengthening regional integration agreements that will both support dialogue meant to end civil wars and also support investment in trade policies and rules that favor the development of trade infrastructure needed for postconflict agricultural recovery.

Our findings further show that the Sudanese export economy is resilient to the effects of the war. Access to the international market is essential to provide farmers with decent farm incomes and help them survive economically in the civil war period. In addition, we show that the civil war has only limited impacts on economic activities in some parts of the country—these could support an economic recovery process after the war ends. However, Sudan’s economy is increasingly a “war economy,” and international humanitarian organizations, such as Human Rights Watch and Amnesty International, have reported that both factions bypass the arms embargo to import weapons (HRW 2024; Klomegah 2024). Stable or even increasing export earnings would likely facilitate further imports of weapons. However, currently, we lack information about the extent to which farmers benefit from continued exports and whether the SAF and RSF exploit farmers to increase the export revenue needed to fund weapon purchases. This warrants further research beyond the econometric analysis of trade flow trends discussed here.

There are a few limitations to our study. First, we analyze the civil war’s impact on official exports only in the very short run. In April, at the onset of the civil war, many of the export deals for 2023 were already sealed and many of the shipments for international destinations were likely already at the port facilities. Furthermore, war-induced supply chain disruptions and agricultural labor shortages will have affected the 2023 agricultural season and 2024 exports, not 2023 exports. It is essential to continue monitoring trade flows as data are published. Second, in our analysis, we neglect informal cross-border trade because of the lack of data. It is likely that large shares of intra-African exports, for example, sorghum, have shifted from the formal to informal sector. Hence, we may overestimate the decline of trade in products mainly produced in RSF-controlled areas. Last, while we provide explanations for our findings, more research is required to understand how conflicts disrupt international supply chains and affect exports as well as earnings. This knowledge is needed to design sanction mechanisms that do not harm vulnerable populations, either directly through income losses or indirectly through exploitation in the war economy.

References

- Abiad, A., K.V. Baris, J.A. Bernabe et al. 2018. "The Impact of Trade Conflict on Developing Asia." ADB Economics Working Paper Series No. 586. ADB (Asian Development Bank). <https://www.adb.org/publications/impact-trade-conflict-developing-asia>
- Abushama, H., D. Resnick, K. Siddig, and O.K. Kirui. 2023. "Political and Economic Drivers of Sudan's Armed Conflict: Implications for the Agri-Food System." Sudan SSP Working Paper 15. IFPRI. <https://hdl.handle.net/10568/137896>
- ACLED (Armed Conflict Location & Event Data). 2023. "Sudan Situation Update: November 2023 | RSF Expands Territorial Control as Ceasefire Talks Resume in Jeddah." *ACLED Updates* (blog), November 3. <https://acleddata.com/update/sudan-situation-update-november-2023-rsf-expands-territorial-control-ceasefire-talks-resume>
- Afesorgbor, S.K. 2019. "The Impact of Economic Sanctions on International Trade: How Do Threatened Sanctions Compare with Imposed Sanctions?" *European Journal of Political Economy* 56:11–26. <https://doi.org/10.1016/j.ejpoleco.2018.06.002>
- Alfadul, H., K. Siddig, M. Ahmed, H. Abushama, and O. Kirui. 2024. "Sustainable Livestock Development in Sudan: Challenges, Opportunities, and Policy Priorities." Sudan SSP Working Paper 19. IFPRI. <https://hdl.handle.net/10568/151697>
- Ali, H.E. 2013. "Estimate of the Economic Cost of Armed Conflict: A Case Study from Darfur." *Defence and Peace Economics* 24 (6):503–519. <https://doi.org/10.1080/10242694.2012.723154>
- Asare, J., S. Awad, S. Logan, P. Mathewson, and C. Sacchetto. 2021. *Sudan in the Global Economy: Opportunities for Integration and Inclusive Growth*. IGC (International Growth Centre). <https://www.theigc.org/publications/sudan-global-economy-opportunities-integration-and-inclusive-growth>
- Bacchetta, M., V. Cerra, R. Piermartini, and M. Smeets. 2021. "Trade and Inclusive Growth." IMF Working Papers WP/21/74. IMF (International Monetary Fund). <https://www.elibrary.imf.org/view/journals/001/2021/074/article-A001-en.xml>
- Baier, S.L., and J.H. Bergstrand. 2007. "Do Free Trade Agreements Actually Increase Members' International Trade?" *Journal of International Economics* 71 (1):72–95. <https://doi.org/10.1016/j.jinteco.2006.02.005>
- Benjamin, N. 2023. *Dealing with Informality in Conflict and Fragile Settings*. Technical Report. DCED (Donor Committee for Enterprise Development). <https://www.enterprise-development.org/dealing-with-informality-in-conflict-and-fragile-settings/>
- Bove, V., J. Di Salvatore, and R. Nisticò. 2023. "Economic Sanctions and Trade Flows in the Neighborhood." *The Journal of Law and Economics* 66 (4):671–697. <https://doi.org/10.1086/725678>

- Cali, M., W. Harake, F. Hassan, and C. Struck. 2015. *The Impact of the Syrian Conflict on Lebanese Trade*. World Bank. <https://hdl.handle.net/10986/21914>
- Caramuta, C., A. Grosso, and G. Longo. 2023. "Logistics Chain Responsiveness to War Impacts: A Case Study in North Adriatic Region." *Case Studies on Transport Policy* 14:101086. <https://doi.org/10.1016/j.cstp.2023.101086>
- Collier, P. 1999. "On the Economic Consequences of Civil War." *Oxford Economic Papers* 51 (1):168–183. <https://doi.org/10.1093/oeq/51.1.168>
- Collier, P., and M. Duponchel. 2013. "The Economic Legacy of Civil War." *Journal of Conflict Resolution* 57 (1):65–88. <https://doi.org/10.1177/0022002712464847>
- Collier, P., V.L. Elliott, H. Hegre, A. Hoeffler, M. Reynal-Querol, and N. Sambanis. 2003. *Breaking the Conflict Trap: Civil War and Development Policy*. World Bank. <https://hdl.handle.net/10986/13938>
- Collier, P., and A. Hoeffler. 2004. "Aid, Policy and Growth in Post-Conflict Societies." *European Economic Review* 48 (5):1125–1145. <https://doi.org/10.1016/j.eurocorev.2003.11.005>
- Didier, L. 2019. "The Impact of Conflict on Trade in Services: A Sector-Level Analysis." *Comparative Economic Studies* 62 (1):34–48. <https://doi.org/10.1057/s41294-019-00095-y>
- Doan, N.T., and M.H. Tran. 2023. "Quantifying the Effect of Economic Sanctions on Trade in Cultural Goods." *International Economic Journal* 37 (3):401–423. <https://doi.org/10.1080/10168737.2023.2220300>
- Du, Y., J. Ju, C.D. Ramirez, and X. Yao. 2017. "Bilateral Trade and Shocks in Political Relations: Evidence from China and Some of Its Major Trading Partners, 1990–2013." *Journal of International Economics* 108:211–225. <https://doi.org/10.1016/j.jinteco.2017.07.002>
- Elobaid, A.H., and A. Alhelo. 2023. "Post-Conflict Reconstruction, Stabilization and Growth Agenda for Sudan." ERF Policy Brief No. 122. ERF (Economic Research Forum). <https://erf.org/eg/publications/post-conflict-reconstruction-stabilization-and-growth-agenda-for-sudan-2/>
- Estrada, M.A.R., and E. Koutronas. 2022. "The Impact of the Russian Aggression against Ukraine on the Russia-EU Trade." *Journal of Policy Modeling* 44 (3):599–616. <https://doi.org/10.1016/j.jpolmod.2022.06.004>
- FAO (Food and Agricultural Organization of the United Nations). 2024. "Sudan: FAO Issues Stark Warning over "Deeply Concerning" Scale of Hunger." Press release. March 20. https://www.fao.org/newsroom/detail/sudan-fao-issues-stark-warning-over-deeply-concerning-scale-of-hunger/en?utm_source=chatgpt.com
- Fernandes, G., P. Teixeira, and T.A. Santos. 2023. "The Impact of the Ukraine Conflict in Internal and External Grain Transport Costs." *Transportation Research Interdisciplinary Perspectives* 19:100803. <https://doi.org/10.1016/j.trip.2023.100803>

- Freeman, R., M. Larch, A. Theodorakopoulos, and Y.V. Yotov. 2025. "Unlocking New Methods to Estimate Country-Specific Effects and Trade Elasticities with the Structural Gravity Model." *Journal of Applied Econometrics* 40 (6):669–684. <https://doi.org/10.1002/jae.3133>
- Fuchs, A., and N.-H. Klann. 2013. "Paying a Visit: The Dalai Lama Effect on International Trade." *Journal of International Economics* 91 (1):164–177. <https://doi.org/10.1016/j.jinteco.2013.04.007>
- Gaulier, G., and S. Zignago. 2010. "BACI: International Trade Database at the Product-Level. The 1994-2007 Version." CEPII Working Paper No. 2010–23. CEPII (Centre for Prospective Studies and International Information). <https://www.cepii.fr/CEPII/fr/publications/wp/abstract.asp?NoDoc=2726>
- Gutmann, J., M. Neuenkirch, and F. Neumeier. 2023. "The Economic Effects of International Sanctions: An Event Study." *Journal of Comparative Economics* 51 (4):1214–1231. <https://doi.org/10.1016/j.jce.2023.05.005>
- HDX (Humanitarian Data Exchange). 2024. "The Humanitarian Data Exchange." Accessed December 9, 2024. <https://data.humdata.org/>
- Heilmann, K. 2016. "Does Political Conflict Hurt Trade? Evidence from Consumer Boycotts." *Journal of International Economics* 99:179–191. <https://doi.org/10.1016/j.jinteco.2015.11.008>
- HRW (Human Rights Watch). 2024. "Sudan: Abusive Warring Parties Acquire New Weapons." *Human Rights Watch News* (blog), September 9. <https://www.hrw.org/news/2024/09/09/sudan-abusive-warring-parties-acquire-new-weapons>
- IFPRI. 2024. "Global Spatially-Disaggregated Crop Production Statistics Data for 2020 Version 2.0." Harvard Dataverse. Accessed December 9, 2024. <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/SWPENT>
- Karam, F., and C. Zaki. 2016. "How Did Wars Dampen Trade in the MENA Region?" *Applied Economics* 48 (60):5909–5930. <https://doi.org/10.1080/00036846.2016.1186799>
- Khalifa, A. 2020. "Sudan's Transition: Challenges and Opportunities." *TWI Policy Analysis* (blog), June 1. https://www.washingtoninstitute.org/policy-analysis/sudans-transition-challenges-and-opportunities?utm_source=chatgpt.com
- Kirui, O.K., K. Siddig, H. Abushama, and A.S. Taffesse. 2023. "Armed Conflict and Business Operations in Sudan: Survey Evidence from Agri-Food Processing Firms." Sudan SSP Working Paper 11. IFPRI. <https://hdl.handle.net/10568/140193>
- Klomegah, K.K. 2024. "Weapon Supplies from China, Russia, Turkey, and United Arab Emirates Fuelling Sudanese War." *Modern Diplomacy*, July 28. <https://moderndiplomacy.eu/2024/07/28/weapon-supplies-from-china-russia-turkey-and-united-arab-emirates-fuelling-sudanese-war/>

- Kornher, L., and M. Kalkuhl. 2019. "The Gains of Coordination – When Does Regional Cooperation for Food Security Make Sense?" *Global Food Security* 22:37–45. <https://doi.org/10.1016/j.gfs.2019.09.004>
- Koubi, V. 2017. "War and Economic Growth." In *Peace and Conflict 2012*, ed. J.J. Hewitt, chapter 10. First ed. Routledge. <https://doi.org/10.4324/9781315089997-11>
- Larch, M., J. Luckstead, and Y.V. Yotov. 2024. "Economic Sanctions and Agricultural Trade." *American Journal of Agricultural Economics* 106 (4):1477–1517. <https://doi.org/10.1111/ajae.12473>
- Le Billon, P. 2001. "The Political Ecology of War: Natural Resources and Armed Conflicts." *Political Geography* 20 (5):561–584. [https://doi.org/10.1016/S0962-6298\(01\)00015-4](https://doi.org/10.1016/S0962-6298(01)00015-4)
- Lewis, D., G. Kebede, A. Brown, and P. Mackie. 2019. *Surviving, Managing, Thriving: The Informal Economy in Post-Conflict Cities*. UN-Habitat (United Nations Human Settlements Programme). https://unhabitat.org/sites/default/files/2020/02/1-post-conflict_cities.pdf
- Li, Y., Z. Jian, W. Tian, and L. Zhao. 2021. "How Political Conflicts Distort Bilateral Trade: Firm-Level Evidence from China." *Journal of Economic Behavior & Organization* 183:233–249. <https://doi.org/10.1016/j.jebo.2021.01.003>
- Lin, F., C. Hu, and A. Fuchs. 2019. "How Do Firms Respond to Political Tensions? The Heterogeneity of the Dalai Lama Effect on Trade." *China Economic Review* 54:73–93. <https://doi.org/10.1016/j.chieco.2018.10.009>
- Marano, V., A. Cuervo-Cazurra, and C.C.Y. Kwok. 2013. "The Impact of Conflict Types and Location on Trade." *The International Trade Journal* 27 (3):197–224. <https://doi.org/10.1080/08853908.2013.796835>
- Mwendia, S., B. Dey, M.I. Mohammed, H. Makkar, A. Notenbaert, and M. Peters. 2023. *Role of Cultivated Forages in Sudan 2 Activity Title: Feed the Future Global Supporting Seed Systems for Development Activity*. USAID and CRS (Catholic Relief Services). https://www.researchgate.net/publication/382676529_Role_of_Cultivated_Forages_in_Sudan_2_Activity_Title_Feed_the_Future_Global_Supporting_Seed_Systems_for_Development_Activity
- Nguyen, T.T., and M.H. Do. 2021. "Impact of Economic Sanctions and Counter-Sanctions on the Russian Federation's Trade." *Economic Analysis and Policy* 71:267–278. <https://doi.org/10.1016/j.eap.2021.05.004>
- Nougud, S. 2024. "Sudan's Livestock: \$879m Exports Resilience during War." *Atar*, July 8. <https://atarnetwork.com/wp-content/uploads/2024/07/ATAR-English-Issue-8-Sudans-livestock-879m-exports-resilience-during-war.pdf>
- Osman, M., U. Schulthess, B. Ahmad et al. 2025. *Sorghum Production in Selected States of Sudan during the 2024/25 Growing Season*. CIMMYT (International Maize and Wheat Improvement Center). <https://hdl.handle.net/10883/35569>

- Qureshi, M.S. 2013. "Trade and Thy Neighbor's War." *Journal of Development Economics* 105:178–195. <https://doi.org/10.1016/j.jdeveco.2013.07.009>
- Rauschendorfer, J., and B. Shepherd. 2020. "Regional Economic Spillovers from the South Sudanese Civil War: Evidence from Formal and Informal Cross Border Trade." IGC Working Paper. IGC (International Growth Centre). <https://www.theigc.org/collections/regional-economic-spillovers-south-sudanese-civil-war-evidence-formal-and-informal>
- Resnick, D., H. Abushama, M. Ahmed, O. Kirui, and K. Siddig. 2026. "Under the Gun: Military and Paramilitary Actors in Sudan's Agrifood System." *The Journal of Development Studies*, 1–22. <https://doi.org/10.1080/00220388.2025.2601585>
- Sakyi, D., and S.K. Afesorgbor. 2019. "The Effects of Trade Facilitation on Trade Performance in Africa." *Journal of African Trade* 6 (1):1–15. <https://doi.org/10.2991/jat.k.191129.001>
- Sakyi, D., I. Bonuedi, and E.E. Osei Opoku. 2018. "Trade Facilitation and Social Welfare in Africa." *Journal of African Trade* 5 (1-2):35–53. <https://doi.org/10.1016/j.joat.2018.08.001>
- Santos Silva, J.M.C., and S. Tenreyro. 2006. "The Log of Gravity." *The Review of Economics and Statistics* 88 (4):641–658. <https://doi.org/10.1162/rest.88.4.641>
- Seid, E.H., H. Kebret, and A.I. Abdi. 2021. "The State of the Political Instability and Its Impact on Trade in South Sudan: A Critical Assessment." Financial Working Paper FW-004. AERC (African Economic Research Consortium). <https://publication.aercafricallibrary.org/handle/123456789/2025>
- Siddig, K., M. Raouf, and M.O.M. Ahmed. 2023. "The Economy-Wide Impact of Sudan's Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty." Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>
- SPARC (SPARC-Knowledge Supporting Pastoralism and Agriculture.) 2025. *The War Economy in Darfur: Distorting Trade and Fuelling Conflict*. SPARC. <https://www.sparc-knowledge.org/publications-resources/war-economy-darfur-trade-conflict>
- Spittaels, S., and Y. Weyns. 2014. *Mapping Conflict Motives: The Sudan – South Sudan Border*. IPIS (International Peace Information Service). <https://ipisresearch.be/fr/publication/mapping-conflict-motives-sudan-south-sudan-border/>.
- Sudan, Ministry of Livestock. 2021. *Livestock Statistical Bulletin, Issue No. 29-30*. Ministry of Livestock.
- Taralashvili, T. 2024. "The Impact of Interstate Soft Conflicts on Bilateral Trade Flows Using Structural Gravity Model." *The World Economy* 47 (5):1943–1977. <https://doi.org/10.1111/rwec.13519>
- UNCTAD (United Nations Conference on Trade and Development). 2024. "General Profile: Sudan." UNCTADstat. Last updated December 2, 2025. <https://unctadstat.unctad.org/CountryProfile/GeneralProfile/en-GB/729/index.html>

UNOPS (United Nations Office for Project Services). 2024. "Rehabilitating East Darfur's Gum Arabic Belt." *UNOPS News* (blog). <https://www.unops.org/news-and-stories/stories/rehabilitating-east-darfurs-gum-arabic-belt>

Wahlstedt, E., and H.M. Sulieman. 2024. *Supporting Conflict-Resilient Food Systems in Sudan*. CSF (Conflict Sensitivity Facility). <https://csf-sudan.org/library/supporting-conflict-resilient-food-systems-in-sudan/>

World Bank. 2024a. "Data on Doing Business Indicators, Logistic Performance Indicators, and Tariff Rate." World Development Indicators. Accessed December 9, 2024. <https://databank.worldbank.org/source/world-development-indicators>

World Bank. 2024b. "World Integrated Trade Solution (WITS)." Accessed December 9, 2024. <https://wits.worldbank.org/>

Yotov, Y.V., R. Piermartini, J.-A. Monteiro, and M. Larch. 2018. *An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model*. WTO (World Trade Organization) and UNCTAD. https://www.wto.org/english/res_e/publications_e/advancedguide2016_e.htm

Chapter 6 Appendix

TABLE 6.A1 Average logistic performance indicators (2007–2022)

	ATTC		CQLS		EACPS		ECCP		FSRCE		QTTRI		OVERALL	
	Mean	%Δ	Mean	%Δ	Mean	%Δ	Mean	%Δ	Mean	%Δ	Mean	%Δ	Mean	%Δ
Conflict countries	2.63	11.75	2.58	12.90	2.62	2.90	2.39	4.13	3.04	2.42	2.44	14.23	2.62	7.72
Nonconflict countries	2.99	17.84	2.92	17.42	2.92	13.11	2.78	14.51	3.35	6.49	2.85	19.35	2.97	14.22
All countries	2.89	17.43	2.82	16.16	2.84	11.97	2.67	13.27	3.26	5.47	2.73	19.38	2.87	13.31

Note: Δ denote the percentage of over the sample period; ATTC, CQLS, EACPS, ECCP, FSRCE, QTTRI, and OVERALL represent, respectively, the ability to track and trace consignments, competence and quality of logistics services; ease of arranging competitively priced shipments, efficiency of the customs clearance process, frequency with which shipments reach consignee within the scheduled or expected time, quality of trade and transport-related infrastructure, and overall logistic performance indicators index.

Source: Authors, based on data from World Bank (2024a).

TABLE 6.A2 Average border and transport efficiency indicators (2005–2014) and tariff rate (2014–2021)

	DE		TE		CE		DM		TM		CM		TFR	
	Number	%Δ	Days	%Δ	Cost	%Δ	Number	%Δ	Days	%Δ	Cost	%Δ	Mean	%Δ
Conflict countries	7.18	11.67	32.02	14.83	2774.28	-9.97	8.99	5.95	39.35	26.16	3434.82	2.20	10.27	10.64
Nonconflict countries	6.09	5.36	21.47	-0.81	1675.06	-8.58	7.01	3.75	23.15	4.75	1963.00	-3.02	8.31	61.47
All countries	6.33	4.29	23.82	-3.61	1920.39	-8.38	7.45	2.47	26.76	-1.06	2291.49	-6.58	8.71	131.61

Note: Δ denote the percentage of over the sample period; DE (DM), TE(TM), CE (CM), and TFR refer to the document to export (import), time to export (import), cost to export (import), and tariff rate, respectively.

Source: Authors, based on data from World Bank (2024a).

Product	SAF										Per capita production
	Kassala	Northern	White Nile	River Nile	Red Sea	Aj Jazirah	Sennar	Gedaref	Blue Nile		
Population	2,718,540	1,446,861	3,392,274	1,862,303	2,035,582	5,124,749	2,532,326	3,091,393	813,930	23,017,958	
10229	0.91	0.27	3.77	0.11	0.15	2.67	1.7	1.12	2.17	0.55	
10290											
10410	RSF	1.03	2.67	1.08	0.44	2.59	1.44	2.24	4.09	0.76	
10613	RSF	0.72	0.05	0.04	0.12	0.13	0.12	0.36	0.01	0.08	
20110											
20120		0.27	3.77	0.11	0.15	2.67	1.7	1.12	2.17	0.55	
20410											
20421	RSF	1.03	2.67	1.08	0.44	2.59	1.44	2.24	4.09	0.76	
71320											
71360		8,868.6	7,142	8	972	23,564.6	7,217	1,954.2	n/a	2,163	
100790	RSF	160,217.2	143,323.1	148,908	136,185.9	41,193.9	110,545.2	23,473	80,634.4	171,495.2	12,806
120242	SAF	55,297.1	99,485	67,692.6	n/a	n/a	1,441,842	23,561	231,634.5	3,734.2	83,554
120740	SAF	4,937.2	1970.6	166,638.8	1894.4	n/a	3,504	140,217	309,528.4	95,950.7	31,481
120770	SAF	232,180.7	n/a	199,953.6	n/a	2,529.5	719,681.4	206,215	16,624.8	n/a	59,830
121410	SAF	Most production in Central regions and Nile states									
121490		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
130120		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
150810	SAF	55,297.1	99,485	67,692.6	n/a	1,441,842	23,561.9	231,634.5	3,734.2	83,554	
230230		Production in both RSF and SAF areas									
520100	SAF	437,47.6	37,452.9	11,509.1	n/a	10,357.1	142,678	29,347.4	431,78.8	n/a	13,827

Note: n/a = no data were available for these states. For rows with text, no data were available for any state.

Source: Authors, based on data sources reported in Table 6.4

ECONOMYWIDE IMPACT OF SUDAN'S CONFLICT AND PATHWAYS TO RECOVERY

Khalid Siddig, Zuhair Elnour, and James Thurlow

Massive human displacement and economic devastation have resulted from Sudan's ongoing conflict, which erupted on April 15, 2023, between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF). According to the United Nations High Commissioner for Refugees, as of February 2, 2026, nearly 12 million people were internally displaced in Sudan, and 4.5 million had sought refuge in neighboring countries (UNHCR 2026). Public services, including health, education, and sanitation, have collapsed in many regions, compounding the humanitarian crisis and further destabilizing the socioeconomic fabric of the country.

The conflict has also devastated Sudan's industrial base, particularly in Khartoum and surrounding areas, where entire industrial zones have been looted, destroyed, or rendered inoperable. Survey evidence from agrifood processing firms indicates widespread closures, labor disruptions, and a collapse in supply chains, with more than 90 percent of firms halting operations in the early months of the conflict (Kirui, Siddig, et al. 2023a; 2023b). Educational and health facilities have been systematically damaged or occupied by armed groups, leading to prolonged closures and denying essential services to millions.

In addition, agricultural production has been severely disrupted. Evidence from a nationwide survey of smallholder farmers reveals that insecurity, input shortages, and market access constraints have sharply reduced farming activity and yields across nearly all states in Sudan (Kirui, Siddig, Ahmed, et al. 2023). This destruction has not only deepened the immediate humanitarian crisis but also severely undermined Sudan's long-term development prospects.

Urban populations have also experienced severe socioeconomic distress. Evidence from a national household survey documents rising unemployment, collapsing consumption, and growing food insecurity among urban households, driven by displacement, declining incomes, and disruption of public services (IFPRI and UNDP 2024a; 2024b).

Projections by major international financial institutions point to severe contractions in Sudan's gross domestic product (GDP) (Siddig and Basheer 2024). In October 2023, the International Monetary Fund (IMF) projected that Sudan's GDP would shrink by 18 percent in 2023, with a modest recovery of 0.6 percent anticipated in 2024 (IMF 2023a). However, by October 2024, the IMF revised its projections, estimating a sharper decline of 20 percent in 2024 (IMF 2023b). Similarly, the World Bank's late 2023 forecast anticipated a 12 percent contraction in 2023 and a further 3.7 percent decrease in 2024 (World Bank 2023). Their revised estimates of October 2024 were even more alarming, projecting GDP declines of 20 percent in 2023 and 15 percent in 2024 (World Bank 2024).

Other assessments indicated even steeper losses, suggesting GDP contractions of more than 29 percent (Sudan, CBoS 2024) and 46 percent in 2023 (Ahmed et al. 2026; Siddig et al. 2023). Reinforcing these grim assessments, Sudan's Minister of Finance reported in November 2023 that the war had resulted in economic losses exceeding US\$26 billion, more than half of the nation's total GDP in 2022 (Sudan Akhbar 2023).

While existing estimates highlight the immediate macroeconomic costs of violent conflict (Ahmed et al. 2026), the longer-term effects on livelihoods, poverty, and development remain less understood. For example, de Groot and colleagues (2022) estimated that, in the absence of violent conflict since 1970, global GDP in 2014 would have been 12 percent higher on average, underscoring the enduring economic burdens that civil wars impose by eroding the so-called "peace dividend." Although Sudan has endured repeated cycles of violent conflict, economywide analyses of their impacts are almost nonexistent. This scarcity of research highlights a critical gap, which the present study begins to address through a comprehensive, data-driven assessment.

Data limitations pose a significant challenge for economic analysis in Sudan. Official statistics are frequently outdated, incomplete, or inconsistent, reflecting structural weaknesses in the national statistical system (World Bank 2021; UNDP 2019; IMF 2020). These shortcomings are intensified in contexts of conflict and fragility, where data collection is disrupted and much economic activity shifts into informal channels (Jerven 2013). Sudan's long civil war, which culminated in South Sudan's secession, and recurrent violence in Darfur have undermined growth, weakened markets, and eroded state capacity (World Bank 2009; World Bank 2025). In addition, years of international sanctions, the extensive involvement of military and paramilitary actors in commercial life, and the persistence of entrenched institutions have further

limited transparency and the reliability of official statistics. Remittances illustrate these difficulties well: although they provide a vital source of household income and foreign exchange, much of this flow bypasses formal systems and remains poorly measured. Taken together, these historical and structural factors form the context for the analysis presented in this chapter.

Given these constraints on Sudan's statistical system, the quality and consistency of available data remain limited, with challenges likely affecting all sectors of the economy. Consequently, while the model is well suited to capture broad economywide trends and trade-offs, sector-specific results should be interpreted with caution, since variations in data quality may influence the robustness of scenario outcomes. To mitigate these limitations, we cross-checked our sources and designed the scenarios to reflect a wide range of possible outcomes.

In this context, understanding the economywide impact of the ongoing conflict and potential recovery pathways is critical for guiding policy responses. As emphasized by Siddig and Basheer (2024), the lack of comprehensive, data-driven analysis hampers efforts to design effective responses to Sudan's crisis. Rigorous economic assessments are essential to inform the design of humanitarian and development strategies, both during and after conflict.

This chapter applies a dynamic computable general equilibrium (CGE) model, the Rural Investment and Policy Analysis (RIAPA) model, to quantify the economic costs of the conflict and assess the effectiveness of various intervention scenarios. The findings build on a growing body of evidence on the conflict's impact on food systems, household welfare, and macroeconomic stability. Notable recent contributions include projections of agricultural losses, conflict-induced poverty dynamics, and analysis using satellite data (Siddig et al. 2024; IFPRI and UNDP 2024a; 2024b; Guo et al. 2024; Siddig et al. 2023). The chapter is structured as follows: the second section outlines the analytical framework, including the design of simulation scenarios and data sources. The third section presents, discusses, and analyzes the results from the conflict and recovery scenarios. The final section concludes with reflections on Sudan's future trajectory and the policy implications of the findings.

Description of modeling approach and scenario design

We apply an integrated economywide modeling approach to assess the socio-economic impacts of Sudan's conflict and explore potential recovery pathways

through 2030. Our analysis focuses on three main objectives: (1) quantifying the economic impacts of the conflict, (2) evaluating different recovery strategies, and (3) examining how these interventions affect the economy, poverty, inequality, and undernourishment.

Modeling framework

For this analysis, we used the RIAPA model developed by IFPRI. RIAPA is a single-country, recursive dynamic CGE model tailored to evaluate the economywide impacts of public investments and policies on inclusive and sustainable growth (Thurlow 2008). It is based on the standard CGE modeling approach but adds dynamic features that allow for the simulation of medium- to long-term structural change.

Similar to other CGE models, RIAPA tracks the interlinkages between sectors, labor markets, households, and the government. Producers are assumed to maximize profits based on nested production technologies and available production factors, while consumers maximize utility based on income and preferences. The model allows for endogenous adjustments in wages and commodity prices to equilibrate factor and product markets.

One of the model's key strengths is its ability to link macroeconomic results to micro-level household outcomes, such as poverty and nutrition, through microsimulation modules. These modules are based on nationally representative household survey data. The model's integration with IFPRI's Nexus Social Accounting Matrix (SAM) database enables detailed disaggregation of agricultural and food systems, providing rich insight into sectoral impacts and spillovers (IFPRI 2024; Siddig et al. 2024).

RIAPA offers three distinctive advantages that make it particularly valuable for analyzing the economywide impacts of policies, investments, and external shocks. First, the model provides a detailed representation of the agrifood system and its linkages to the economy within the Nexus SAMs. It enables the assessment of direct and spillover effects across sectors and interaction with the domestic economy and global markets. Second, RIAPA identifies and navigates trade-offs associated with different policy and investment choices, recognizing that interventions often produce uneven outcomes across sectors and population groups. By incorporating structural differences between industries and patterns of household engagement, the model highlights how competition over scarce resources and varying sectoral characteristics can create winners and losers. Finally, RIAPA links macroeconomic outcomes to household-level impacts through integrated microsimulation modules, offering insights into poverty changes and diet quality.

Data sources

RIAPA is calibrated to the 2021 Nexus SAM for Sudan (IFPRI 2024). This SAM provides a comprehensive economywide database that captures production, trade, and income flows across approximately 55 sectors of the Sudanese economy. It also includes detailed disaggregation of households, labor, and agrifood systems, offering a robust foundation for economywide analysis relevant to policy and investment planning.

In defining the baseline simulation, key macroeconomic data, including GDP contraction estimates for 2023–2025, are drawn from the most recent IMF projections. Total factor productivity (TFP) growth in various sectors is adjusted so that overall GDP growth equals the target values. Additional behavioral and distributional insights are drawn from recent household-, farmer-, and firm-level surveys. These include the 2023/24 Rural Household Survey (IFPRI and UNDP 2024a), 2024 Urban Household Survey (IFPRI and UNDP 2024b), 2023 Farmers' Survey (Kirui, Siddig, Ahmed, et al. 2023), and 2023 Agro-industry Survey (Resnick et al. 2025; Kirui, Siddig, et al. 2023a), which together provide a detailed picture of the evolving socio-economic landscape, consumption dynamics, coping strategies, and business constraints in Sudan amid conflict. Nevertheless, given Sudan's rapidly evolving crisis, conditions may have deteriorated further by the time of publication, and the results presented here may therefore differ from future outcomes.

Scenario design

We simulate six scenarios grouped into three categories to reflect Sudan's changing context and possible recovery pathways. These include a counterfactual preconflict baseline, a conflict scenario, and four intervention simulations. Table 7.1 summarizes key assumptions, while the accompanying text elaborates on the logic and parameters used.

PRECONFLICT (BASE) SCENARIO

This scenario projects Sudan's economic trajectory as if the 2023 conflict had not occurred. It assumes continued economic trends from 2022 and serves as a reference point to estimate the cost of the conflict and assess the potential of recovery interventions.

CONFLICT SCENARIO

This scenario reflects the ongoing conflict and its economic disruption. It incorporates revised GDP growth estimates provided by the IMF: –18.3 percent for 2023, –20 percent for 2024, and –10 percent for 2025. The 10 percent

TABLE 7.1 Summary of key scenario assumptions

Scenario	GDP Growth	Agricultural TFP	Foreign Inflows	Intervention Focus
Preconflict (Baseline)	IMF 2023 + WB trends	Maintained at preconflict levels	None	Continuation of preconflict trajectory
Conflict	IMF 2024 (–18.3%, –20%, –10%)	Declines with GDP	None	Reflects prolonged conflict
Agricultural Recovery	Same as Conflict	Recovers to 2022 level by 2028	None	Agricultural productivity
Working Capital	Same as Conflict	Same as Agricultural Recovery	+US\$1B in foreign savings	Investment boost to private sector
Cash Transfers	Same as Conflict	Same as Agricultural Recovery	+US\$1B in remittances	Household-level income support
Combined Scenario	Same as Conflict	Same as Agricultural Recovery	+US\$750M foreign savings, +US\$250M remittances	Mix of capital and cash transfers

Source: Authors.

Note: GDP = gross domestic product; IMF = International Monetary Fund; TFP = total factor productivity; WB = World Bank. All recovery interventions assume disbursement begins in 2026 and build on the conflict scenario trajectory through 2025.

contraction in GDP in 2025 assumes that the conflict persists through the end of 2025, resulting in widespread economic, sectoral, and welfare losses. It assumes the continuation of conflict-related disruption through 2025, resulting in significant economic, sectoral, and welfare losses.

Starting in 2026, four alternative recovery interventions simulate the impact of injecting US\$1 billion (approximately 3.3 percent of 2022 GDP) into the economy. Each follows the conflict scenario trajectory until 2025, after which interventions diverge in design and focus.

AGRICULTURAL RECOVERY SCENARIO

This focuses on reviving agricultural TFP to its preconflict (2022) levels by 2028.

WORKING CAPITAL INJECTION SCENARIO

The scenario assumes the full US\$1 billion is directed to support investment and capital flows to the private sector to stimulate economic activity, in addition to reviving the agriculture sector. The total amount is dispersed as follows: 20 percent is allocated in 2026, 40 percent in 2027, and 40 percent in 2028. It assumes an additional US\$1 billion in foreign savings.

CASH TRANSFER SCENARIO

This scenario distributes US\$1 billion as targeted cash assistance to vulnerable households, aiming to alleviate poverty and food insecurity in addition to

reviving the agriculture sector. Half of the total amount of US\$1 billion is dispersed in 2026 and the other half in 2027. It assumes a US\$1 billion increase in remittances.

COMBINED SCENARIO

This integrates the three previous interventions—agriculture, working capital, and cash transfers—by allocating US\$1 billion across working capital and cash transfers to explore synergies and trade-offs. The total amount of US\$1 billion is dispersed as follows: 25 percent is allocated to cash transfers, and 75 percent is allocated to working capital. Both the amounts allocated to cash transfers and working capital are dispersed across the years following the approach used in each scenario.

The four simulated interventions described above are designed to represent the impact of mobilizing US\$1 billion in external support—not as a full reconstruction package, but as a prioritization exercise within a broader recovery framework. Total reconstruction needs are expected to reach up to US\$200 billion, with more than 60 percent of the country's infrastructure being damaged (Fathi 2025), underscoring the scale of effort required beyond the initial recovery phase.

Results and discussion

This section presents the core findings of the economywide modeling exercise. It is organized into two main components. First, we present the macroeconomic and welfare effects of the ongoing conflict relative to a preconflict baseline, highlighting the extent of economic contraction, sectoral collapse, rising poverty, food insecurity, and consumption losses. These results are crucial to understanding the depth of the crisis and the scale of the challenge facing recovery efforts. Next, we explore the potential mitigation effects of key interventions, including agricultural revitalization, infrastructure investment, and social protection, relative to a continued conflict scenario. This allows for an assessment of the relative contribution of targeted interventions within a constrained fiscal and institutional context.

Economic impact of the conflict relative to the preconflict baseline

This section presents the economywide impacts of the conflict scenario compared to a counterfactual preconflict baseline. The analysis draws on projections that simulate Sudan's trajectory in the absence of conflict and contrasts it with

observed and expected outcomes under continued violence through 2025. The results highlight the extensive macroeconomic and welfare losses attributable to the conflict, including contraction in GDP, sectoral disruption, increased poverty and food insecurity, and deep declines in household consumption.

ECONOMIC GROWTH TRAJECTORIES: PRECONFLICT BASE VS. CONFLICT SCENARIO

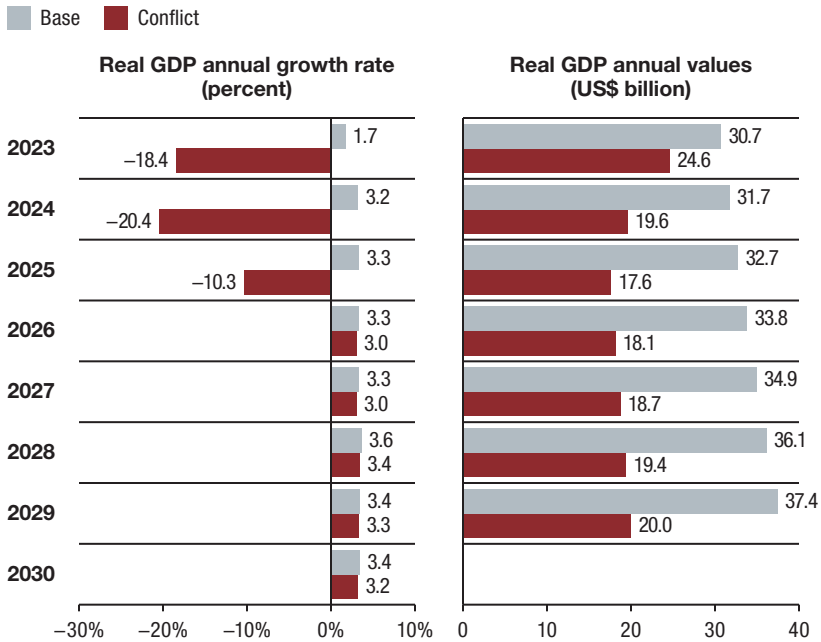
Figure 7.1 compares Sudan's historical and projected GDP growth and output levels under two scenarios: a baseline preconflict trajectory and an alternative reflecting the impact of the ongoing conflict. The contrast is stark: while the base case indicates stable growth averaging around 3.3 percent annually post-2024, the conflict scenario shows a severe contraction in the immediate years following the outbreak of violence. GDP shrinks by 18.4 percent in 2023, plunges further by 20.4 percent in 2024, and contracts again by 10.3 percent in 2025. Comparing the projected period of 2023–2025 with Sudan's past downturns, including contractions by 6.2 percent and 17 percent in the mid-1980s and 2012, respectively (World Bank 2025), the current contraction appears far more severe and ranks among the most serious economic crises in the country's recent history. The economic devastation is equally visible in real GDP values. Under the conflict scenario, GDP falls from US\$24.6 billion in 2023 to a low of \$17.6 billion in 2025, a cumulative decline of nearly 30 percent relative to the baseline.¹ Even as the conflict scenario assumes some stabilization post-2026, the economic recovery remains shallow and protracted. By 2029, the conflict-affected economy only regains \$20 billion, still significantly below the \$37.4 billion baseline projection for that year. These trends illustrate not only the scale of output losses but also the long-term scarring effects of conflict on capital accumulation, investor confidence, and institutional capacity.

These projections are based on preconflict estimates by the IMF, published in April 2023 (IMF 2023a), as well as revised projections from October 2024 (IMF 2023b) that capture the impact of the conflict on GDP in 2023 and 2024. This study assumed the conflict would persist through the end of 2025, with GDP projected to decline by 10.3 percent in that year alone. Thereafter, we assume slightly lower annual real GDP growth than in the IMF projections.²

Figure 7.2 shows annual growth rates for agriculture, industry, and services between 2023 and 2030 in the conflict scenario. All sectors experience sharp contractions in the initial years of the conflict, with agriculture suffering the deepest decline, contracting by 25 percent in 2023 and 19.5 percent

1 All dollars are US dollars.

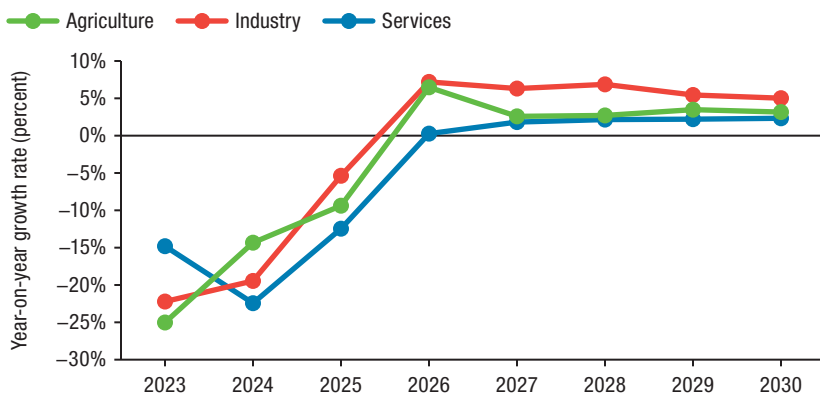
2 Siddig et al. (2024) presents similar simulations through 2028.

FIGURE 7.1 Annual real GDP growth rates and values, preconflict (base) and conflict scenarios, 2023–2030

Source: IMF (2023a); (2023b) and authors' estimates.

in 2024. In this simulation, the negative productivity shock to agriculture reflects the compounded effects of insecurity, displacement, disruptions to seasonal planting cycles, and the breakdown of rural markets. Industry contracts by 22.2 percent in 2023 and 22.4 percent in 2024, driven by damage to industrial infrastructure, reduced energy supply, and curtailed manufacturing. The services sector, which is often more resilient in conflict-affected settings, also records significant downturns of 14.8 percent in 2023 and 22.4 percent in 2024, indicating the systemic reach of the crisis.

Recovery across all three sectors is gradual and uneven. Agriculture and industry register positive growth beginning in 2026, with agriculture reaching 6.5 percent and industry 7.2 percent, reflecting potential rebound effects, localized stabilization, and adaptive strategies by producers. Services begin to recover more slowly but show consistent positive growth from 2026 onward. However, despite these gains, none of the sectors fully return to their preconflict trajectories by 2030.

FIGURE 7.2 Annual GDP growth rates for agriculture, industry, and services, conflict scenario, 2023–2030

Source: RIAPA model simulations for Sudan.

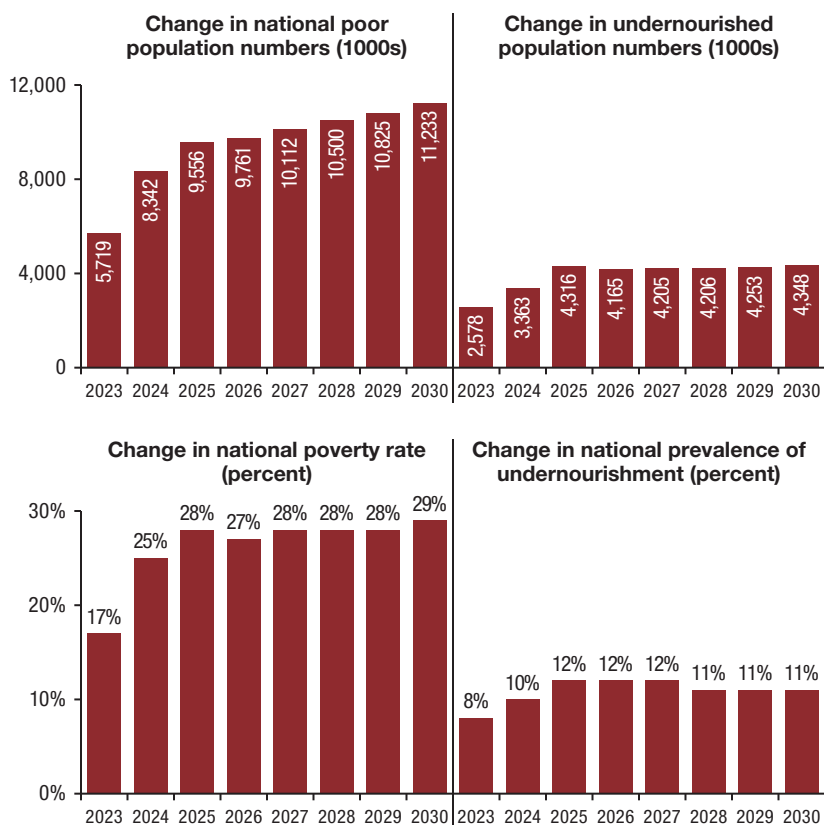
POVERTY AND FOOD INSECURITY

Figure 7.3 highlights the devastating effects of the conflict on poverty and food insecurity in Sudan. National poverty numbers rise sharply from 5.7 million in 2023 to more than 11.2 million by 2030, with the poverty rate increasing by 12 percentage points in 2023 alone and stabilizing at around 28–29 percent above preconflict levels throughout the analysis period. These statistics underscore the immediate and persistent deterioration in household welfare triggered by the conflict.

In terms of food insecurity, our estimate of 29 million people in 2024 is higher than the World Food Programme’s figure of 24.5 million (IPC 2024). This difference may partly reflect variations in data sources, methodological approaches, and classification criteria.

Undernourishment also increases significantly. The number of undernourished individuals grows from 2.6 million in 2023 to 4.3 million in 2030. The national prevalence of undernourishment rises by 3–4 percentage points during the same period, peaking at 12 percent in the mid-2020s and remaining above 11 percent through 2030. These outcomes reflect disruptions to food production and distribution, inflationary pressures, and diminished household purchasing power.

The number of poor and undernourished people increases, with a 57 percent increase in poverty and 68 percent of the increase in undernourishment occurring among rural populations. This reflects both the direct impact

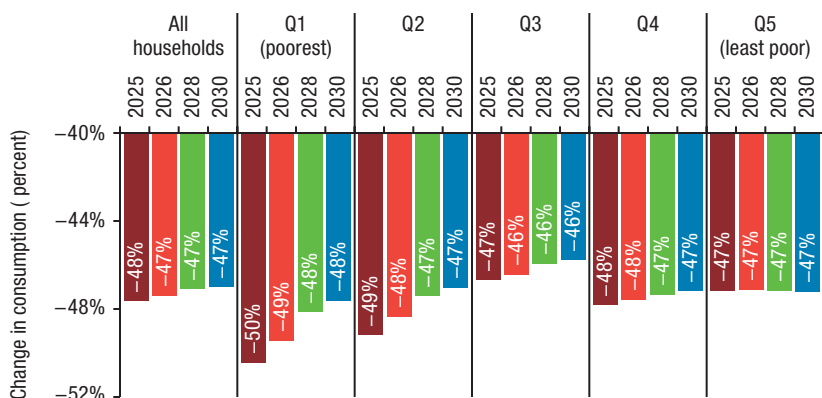
FIGURE 7.3 Change in poor and undernourished population, conflict scenario, 2023–2030

Source: Authors' model simulations.

of conflict on agricultural livelihoods and the more limited access to food, income-generating opportunities, and humanitarian support in rural settings. Nevertheless, the urban impact remains substantial, with 43 percent of newly poor and 32 percent of newly undernourished individuals residing in cities and towns.

HOUSEHOLD CONSUMPTION LOSSES

As shown in Figure 7.4, household consumption is lower for all income groups. By 2025, per capita consumption falls by 48 percent on average, with the poorest quintile experiencing a 50 percent decline relative to the baseline. While the scale

FIGURE 7.4 Percent change in per capita consumption relative to baseline, conflict scenario, selected years (2025–2030)

Source: Authors' model simulations.

of decline remains similar across all quintiles, the welfare impact is more severe for the poorest households, who are less resilient and have fewer coping mechanisms (IFPRI and UNDP 2024a; 2024b). These effects persist through 2030, with only marginal improvement over time. The uniformity in the magnitude of decline across income groups underscores the systemic nature of the shock, while the equity implications reinforce the need for targeted social protection.

Together, these trends reflect not only increased vulnerability but also the erosion of development gains achieved prior to the conflict (UNDP 2022). Thus, the simulation results in Figures 7.2, 7.3, and 7.4 indicate that without a rapid cessation of hostilities and targeted interventions, poverty, food insecurity, and consumption poverty will continue to escalate. The findings align with other studies demonstrating that conflict impairs livelihoods across both rural and urban populations and disproportionately affects the poor, women, and displaced groups (IFPRI and UNDP 2024a; 2024b; Siddig et al. 2024).

Impact of recovery and intervention scenarios relative to conflict

CHANGES IN GROSS DOMESTIC PRODUCT

Table 7.2 presents annual real GDP growth rates and values from 2025 to 2030 across conflict and intervention scenarios. All intervention scenarios prevent further contraction in 2026, reversing the 10.3 percent decline projected under the conflict baseline. The agriculture-focused scenario lifts

TABLE 7.2 Annual real GDP growth rates (%) and values (US\$ billion), conflict and intervention scenarios, 2025–2030

	Base	Conflict	Agriculture	Working Capital	Cash Transfers	Combination
Real GDP Growth Rates (%)						
2025	3.3	-10.3	-10.3	-10.3	-10.3	-10.3
2026	3.3	3.0	5.6	6.3	7.2	6.5
2027	3.3	3.0	4.5	5.5	4.7	4.9
2028	3.6	3.4	5.2	5.7	4.3	5.2
2029	3.4	3.3	3.9	3.1	3.8	3.3
2030	3.4	3.2	3.7	3.7	3.7	3.7
Real GDP (US\$ billions)						
2025	32.7	17.6	17.6	17.6	17.6	17.6
2026	33.8	18.1	18.6	18.7	18.9	18.8
2027	34.9	18.7	19.4	19.8	19.8	19.7
2028	36.1	19.4	20.5	20.9	20.6	20.7
2029	37.4	20.0	21.3	21.5	21.4	21.4
2030	38.6	20.7	22.1	22.4	22.2	22.2

Source: Authors' model simulations.

GDP growth to 5.6 percent, while working capital and combination scenarios achieve 5.3 percent and 6.5 percent, respectively. The cash transfer scenario delivers the strongest rebound at 7.2 percent.

The differences are also evident in GDP levels. By 2026, GDP under the combination scenario reaches \$20.6 billion compared to \$18.1 billion under the conflict case, with 14 percent improvement. Gains remain stable through 2030, with GDP under the combination scenario estimated at \$22.2 billion, well above the \$20 billion projected under continued conflict. The agricultural, cash transfer, and combination scenarios all contribute meaningful gains, though less than the working capital scenario, underscoring the sustained value of long-term investment.

When comparing the four interventions, the cash transfer scenario delivers the strongest immediate recovery. In 2026, GDP growth under the cash transfer scenario reaches 7.2 percent, outperforming the working capital, agriculture, and combination scenarios. The working capital intervention also drives significant medium-term recovery, while the agriculture intervention shows a more moderate but still positive rebound.

TABLE 7.3 Average annual growth rates (%) of total and sectoral GDP, conflict and intervention scenarios, 2022–2030

Indicators	Base	Conflict	Agriculture	Working Capital	Cash Transfers	Combination
Total GDP	2.5	-4.4	-3.7	-3.6	-3.7	-3.7
Agriculture GDP	2.3	-4.1	-1.6	-1.6	-1.6	-1.7
Industry GDP	2.6	-2.6	-2.4	-2.2	-2.4	-2.3
Services GDP	2.5	-5.3	-5.1	-4.9	-5.0	-5.0

Source: Authors' model simulations.

By 2027, the combination scenario yields the highest GDP growth among the interventions, reflecting the cumulative benefits of a multipronged strategy. Although cash transfers initially provide the strongest boost, over time the combination of interventions sustains stronger and more balanced growth. This highlights the differing comparative advantages of interventions across periods: cash transfers stimulate immediate consumption and demand, working capital strengthens private sector activity in the medium term, and agriculture reinforces long-term productivity and resilience.

Table 7.3 further shows the average annual growth rates for total and sectoral GDP between 2022 and 2030 under the conflict and intervention scenarios. Under the conflict scenario, the economy contracts sharply, with an average annual GDP decline of 4.4 percent. Each of the interventions improves this outlook, with the combination scenario raising the average annual GDP growth rate to -3.7 percent, the same as that achieved individually by the agriculture, working capital, and cash transfer interventions.

At the sectoral level, agriculture experiences the greatest relative improvement, shifting from -4.1 percent average annual growth under the conflict scenario to -1.6 percent under all intervention strategies. Industrial GDP sees a modest recovery from -1.2 percent under conflict to roughly -0.5 percent across interventions, while services remain the most affected, averaging a decline of around -5 percent regardless of intervention type.

Comparing the four interventions across sectors, agriculture GDP responds most positively under all scenarios, demonstrating the sector's sensitivity to both direct support and spillover effects. Working capital and cash transfers generate modest gains in industry GDP, suggesting that enterprise support and liquidity injections can stimulate production and trade, though not dramatically. Services remain persistently weak, with limited differentiation across interventions, reflecting the sector's structural dependence on

TABLE 7.4 Change in number of poor and undernourished people, conflict and intervention scenarios, 2025–2030

	Conflict	Agriculture	Working Capital	Cash Transfers	Combination
Change in national poor population (thousands)					
2025	9,556	9,556	9,556	9,556	9,556
2026	9,761	9,342	9,252	9,236	9,258
2027	10,112	9,370	8,996	9,155	9,078
2028	10,500	9,257	8,925	9,207	9,068
2029	10,825	9,490	9,349	9,388	9,449
2030	11,233	9,705	9,600	9,641	9,700
Change in national undernourished population (thousands)					
2025	4,316	4,316	4,316	4,316	4,316
2026	4,165	3,736	3,613	3,342	3,559
2027	4,205	3,490	3,220	3,039	3,335
2028	4,206	3,192	2,971	3,069	3,195
2029	4,253	3,157	3,098	3,086	3,238
2030	4,348	3,171	3,114	3,062	3,249

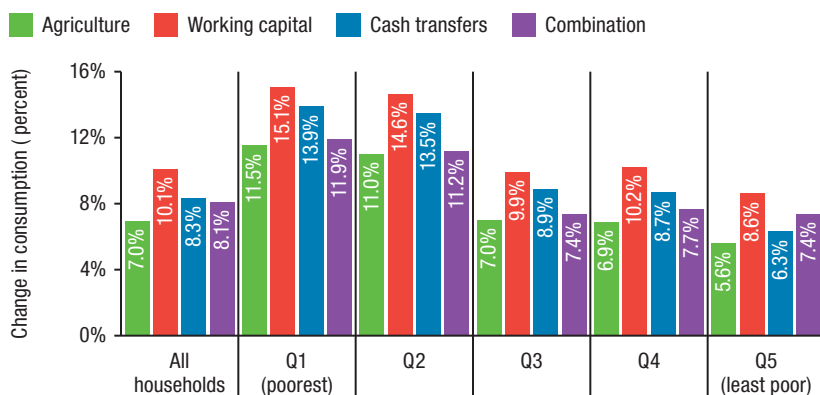
Source: Authors' model simulations.

broader macroeconomic stability and institutional functioning. The combination scenario offers slight improvements in all sectors, but especially in agriculture, reinforcing the value of integrated support for rebuilding Sudan's productive capacity.

POVERTY AND FOOD INSECURITY

Table 7.4 presents the effects of the intervention scenarios on national poverty and undernourishment between 2025 and 2030. Compared to the conflict scenario, all interventions reduce the number of poor and undernourished people, but to varying degrees. The working capital and cash transfer scenarios show the most immediate impact on poverty reduction, especially from 2026 onward. By 2030, the cash transfer scenario reduces the number of poor by nearly 1.6 million compared to the conflict baseline. Agriculture interventions yield consistent but slightly lower improvements in poverty, while the working capital scenario leads to the lowest poverty numbers by 2030.

In terms of undernourishment, the cash transfer scenario shows the most pronounced benefits across the simulation period, with the number of

FIGURE 7.5 Change in per capita consumption (%), intervention relative to conflict, 2028

Source: Authors' model simulations.

undernourished people falling below 3.1 million by 2030—compared to more than 4.3 million under the conflict scenario. The agriculture, working capital, and combination scenarios show relatively smaller but still positive impacts, especially from 2026 onward.

HOUSEHOLD CONSUMPTION IN THE CONFLICT AND INTERVENTION SCENARIOS

Figure 7.5 shows the change in per capita household consumption across intervention scenarios relative to the conflict scenario in 2028, the last year of interventions. Across all households, working capital and cash transfers generate the largest improvements in consumption, with increases of 10.1 percent and 8.3 percent, respectively. Agriculture support yields a smaller gain of 7 percent, while the combination scenario delivers an 8.1 percent improvement.

The greatest relative gains are observed among the poorest quintile (Q1), for whom working capital support and cash transfers increase consumption by 15.1 percent and 13.9 percent, respectively. Even the agriculture-only intervention achieves a strong 11.5 percent gain for Q1, highlighting the pro-poor potential of all three strategies. Among wealthier quintiles (Q4 and Q5), gains are more modest but remain positive, with increases ranging between 6 percent and 10 percent. Notably, the combination scenario yields more balanced improvements across all groups, indicating that integrated approaches provide more equitable consumption recovery.

These distributional effects confirm that targeted interventions not only lift aggregate consumption but can also reduce inequality in postconflict recovery outcomes. This reinforces the importance of tailoring policies to address both overall welfare and distributional justice.

Taken together, these findings confirm that swift and well-targeted interventions can substantially accelerate recovery and prevent long-term economic stagnation. The comparative analysis of intervention strategies underscores that while each approach offers specific strengths, the effectiveness of most economic variables is amplified when delivered in combination. Cash transfers offer rapid relief to households; working capital support catalyzes private sector activity; and agricultural revitalization lays a foundation for sustainable food system recovery. The combination scenario consistently delivers the highest aggregate and distributional benefits, making a compelling case for integrated, multisectoral recovery strategies tailored to Sudan's evolving postconflict context.

Conclusion and policy implications

This chapter set out to analyze the macroeconomic and welfare consequences of the ongoing conflict in Sudan and identify potential recovery pathways. To achieve this, it employed a recursive dynamic CGE model calibrated to Sudan's 2021 SAM, simulating three main trajectories: a preconflict baseline, a conflict scenario assuming the continuation of violence through 2025, and four targeted intervention scenarios focused on agricultural revitalization, working capital support, cash transfers, and a combined package.

The analysis clearly shows that the conflict has caused significant and prolonged macroeconomic contraction, sectoral disruptions, sharp increases in poverty and food insecurity, and deep declines in household consumption. These impacts are widespread across rural and urban areas and disproportionately affect vulnerable groups.

At the same time, the modeling demonstrates that a carefully designed and well-sequenced recovery strategy—focused on agriculture, private sector revitalization, and household-level support—can meaningfully reverse some of the damage. While no single intervention is sufficient on its own, a combined approach delivers broad-based improvements across macroeconomic and welfare indicators. Such findings support a policy agenda that is coordinated, inclusive, and responsive to immediate needs while laying the foundation for long-term resilience.

Based on our modeling results, we suggest the following policy recommendations.

Prioritize integrated recovery packages: A combined investment approach, spanning agriculture, enterprise revitalization, and household income support, delivers the most substantial and equitable impacts. Policymakers and development partners should prioritize bundling interventions rather than deploying them in isolation.

Frontload cash transfers and working capital: Cash transfers and working capital support yield immediate improvements in GDP and welfare outcomes. These should be prioritized early in the recovery phase to stabilize consumption and restart private sector activity.

Invest in agriculture for long-term resilience: While agriculture's short-term gains are moderate, its long-term growth potential and role in food security and employment make it a strategic priority. Investments in seeds, extension, input access, and postharvest systems should be expanded.

Target the poorest and most affected groups: All interventions significantly benefit the poorest households. Recovery programs should maintain a clear pro-poor orientation, with mechanisms to reach conflict-affected, displaced, and rural populations.

Expand fiscal space through donor support: The interventions modeled assume US\$1 billion in support, a small fraction of Sudan's overall recovery needs. Development partners should coordinate to expand financial support, recognizing that full recovery will require sustained multi-year investment.

Monitor and adjust based on data: As conditions evolve, recovery efforts should be continually informed by real-time data on prices, food access, and household welfare. Sudan's data systems, including those used in this analysis, should be strengthened to support adaptive policymaking.

These recommendations aim to guide urgent and coordinated recovery efforts while laying the groundwork for inclusive and sustained economic transformation in Sudan. As Sudan hopefully moves toward stabilization and sustained economic growth, investing in scalable, evidence-informed interventions will be critical to reversing welfare losses and supporting inclusive recovery.

References

- Ahmed, M., M. Raouf, and K. Siddig. 2026. "What Are the Economic and Poverty Implications for Sudan If the Conflict Continues through 2025?" *The Journal of Development Studies* 62 (1):106–127. <https://doi.org/10.1080/00220388.2025.2510642>
- Sudan, CBoS (Central Bank of Sudan). 2024. *National Accounts Data*. CBoS.
- de Groot, O.J., C. Bozzoli, A. Alamir, and T. Brück. 2022. "The Global Economic Burden of Violent Conflict." *Journal of Peace Research* 59 (2):259–276. <https://doi.org/10.1177/00223433211046823>
- Fathi, H.M. 2025. "Two Years of War and the Possibility of Reconstruction." *Sudan Horizon*, April 15. <https://sudanhorizon.com/two-years-of-war-and-the-possibility-of-reconstruction/>
- Guo, Z., H. Abushama, K. Siddig, O.K. Kirui, K. Abay, and L. You. 2024. "Monitoring Indicators of Economic Activities in Sudan Amidst Ongoing Conflict Using Satellite Data." *Defence and Peace Economics* 35 (8):992–1008. <https://doi.org/10.1080/10242694.2023.2290474>
- IFPRI (International Food Policy Research Institute). 2024. "2021 Social Accounting Matrix for Sudan." *Harvard Dataverse*, December 14. <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/IKW7UT>
- IFPRI and UNDP (United Nations Development Programme). 2024a. *Livelihoods in Sudan Amid Armed Conflict: Evidence from a National Rural Household Survey*. IFPRI and UNDP. <https://www.undp.org/sudan/publications/livelihoods-sudan-amid-armed-conflict>
- IFPRI and UNDP. 2024b. *The Socio-Economic Impact of Armed Conflict on Sudanese Urban Households*. IFPRI. <https://hdl.handle.net/10568/159599>
- IMF (International Monetary Fund). 2020. *Sudan: Staff Report for the 2019 Article IV Consultation*. IMF. <https://www.imf.org/en/publications/cr/issues/2020/03/10/sudan-2019-article-iv-consultation-press-release-staff-report-and-statement-by-the-executive-49254>
- IMF. 2023a. *World Economic Outlook, April 2023: A Rocky Recovery*. IMF. <https://www.imf.org/en/publications/weo/issues/2023/04/11/world-economic-outlook-april-2023>
- IMF. 2023b. *World Economic Outlook, October 2023: Navigating Global Divergences*. IMF. <https://www.imf.org/en/publications/weo/issues/2023/10/10/world-economic-outlook-october-2023>
- IPC (Integrated Food Security Phase Classification). 2024. *Sudan: Acute Food Insecurity Situation - Updated Projections and FRC Conclusions for October 2024 to May 2025*. IPC. <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1159433/>
- Jerven, M. 2013. *Poor Numbers: How We Are Misled by African Development Statistics and What to Do About It*. Cornell University Press. <https://www.cornellpress.cornell.edu/book/9780801478604/poor-numbers/#bookTabs=4>

- Kirui, O.K., K. Siddig, H. Abushama, and A.S. Taffesse. 2023a. "Armed Conflict and Business Operations in Sudan: Survey Evidence from Agri-Food Processing Firms." Sudan SSP Working Paper 11. IFPRI. <https://hdl.handle.net/10568/140193>
- Kirui, O.K., K. Siddig, H. Abushama, and A.S. Taffesse. 2023b. "Sudan's Ongoing Conflict Disrupts Agrifood Processing and Aggravates Unemployment." *IFPRI Blog* (blog). December 15. <https://www.ifpri.org/blog/sudans-ongoing-conflict-disrupts-agrifood-processing-and-aggravates-unemployment/>
- Kirui, O.K., K. Siddig, M. Ahmed, H. Abushama, and A.S. Taffesse. 2023. "Impact of the Ongoing Conflict on Smallholder Farmers in Sudan: Evidence from a Nationwide Survey." Sudan SSP Working Paper 17. IFPRI. <https://hdl.handle.net/10568/140241>
- Resnick, D., H. Abushama, M. Ahmed, O.K. Kirui, and K. Siddig. 2025. "Under the Gun: Military and Paramilitary Actors in Sudan's Agri-Food System." IFPRI Discussion Paper 02328. IFPRI. <https://hdl.handle.net/10568/173517>
- Siddig, K., and M. Basheer. 2024. "We Need to Know the Economic Impacts of Sudan's Ongoing Conflict." *Nature Human Behaviour* 8 (6):1003–1004. <https://doi.org/10.1038/s41562-024-01883-y>
- Siddig, K., M. Raouf, and M.O.M. Ahmed. 2023. "The Economy-Wide Impact of Sudan's Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty." Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>
- Siddig, K., J. Thurlow, M. Ahmed, J. Randriamamonjy, and M. Raouf. 2024. "Impact of Ongoing Conflict and Pathways to Recovery in Sudan: Agricultural Bounce-Back, Infrastructural Investment, and Social Protection." Sudan SSP Working Paper 21. IFPRI. <https://hdl.handle.net/10568/168104>
- Sudan Akhbar. 2023. "Finance Minister Reveals Shocking Figure for Sudan's Losses Due to War." *Sudan Akhbar*, November 26. <https://www.sudanakhbar.com/1455725>
- Thurlow, J. 2008. *A Recursive Dynamic CGE Model and Microsimulation Poverty Module for South Africa*. IFPRI. <https://hdl.handle.net/10568/180877>
- UNDP (United Nations Development Programme). 2019. *Human Development Report 2019: Beyond Income, Beyond Averages, Beyond Today: Inequalities in Human Development in the 21st Century*. UNDP. <https://digitallibrary.un.org/record/3846848?ln=en&v=pdf>
- UNDP. 2022. *Human Development Report 2021/2022: Uncertain Times, Unsettled Lives: Shaping Our Future in a Transforming World*. UNDP. <https://digitallibrary.un.org/record/3986309?ln=en&v=pdf>
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>

- World Bank. 2009. *Sudan - The Road toward Sustainable and Broad-Based Growth*. World Bank. <https://hdl.handle.net/10986/3183>
- World Bank. 2021. *Concept Project Information Document (PID) - Sudan Data and Statistics Strengthening Project - P177123*. World Bank. <https://documentos.bancomundial.org/es/publication/documents-reports/documentdetail/319991626455970673>
- World Bank. 2023. *Sudan Economic Update: Missed Opportunities Amidst Deepening Fragility*. World Bank. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099540409212319137>
- World Bank. 2024. "World Development Indicators." Updates of October 2024. <https://databank.worldbank.org/home>
- World Bank. 2025. *Sudan Economic Update, May 2025: The Economic and Social Consequences of the Conflict - Charting a Path to Recovery*. World Bank. <https://hdl.handle.net/10986/43314>

FOOD CONSUMPTION PATTERNS AND DIETARY DIVERSITY AMID CONFLICT

Fredrik Svensson and Oliver K. Kirui

Sudan is currently experiencing one of the most severe food security crises globally. According to the Integrated Food Security Phase Classification (IPC) more than 21.2 million people—45 percent of the population—are acutely food insecure (IPC Phase 3 or above), with more than 146,000 people facing catastrophic levels of food insecurity (IPC Phase 5) as of February 2026 (IPC 2025). As of September 2025, El-Fasher (North Darfur) and the besieged town of Kadugli (South Kordofan) were classified as experiencing famine (IPC Phase 5) with reasonable evidence. These conditions were expected to persist through January 2026. The crisis has also led to the acute malnutrition of 4.7 million children under five and pregnant and breastfeeding women and girls (IPC 2024a).

This alarming situation is largely driven by the ongoing armed conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF). The conflict has caused widespread displacement, disrupted markets and supply chains, damaged agricultural livelihoods, and severely limited humanitarian access. An estimated 7 million people have been displaced internally, with an additional 4.5 million having fled to neighboring countries (UNHCR 2026). Insecurity and restricted movement have negatively affected agricultural activities in key food-producing states such as Aj Jazirah, Sennar, Darfur, and Kordofan, exacerbating the crisis (UNFPA 2024).

In conflict contexts like Sudan, understanding food security dynamics requires more than macroeconomic or supply-side analyses. Household-level data on food consumption and nutrition are vital to assess not just food availability but also actual access and dietary quality at the individual and community levels (FSIN 2022; UNOCHA 2022). Indicators such as the Food Consumption Score (FCS), Minimum Dietary Diversity for Women (MDD-W), and nutrition-based proxies such as mid-upper arm circumference (MUAC) allow humanitarian actors to detect early signs of deterioration in food access and to target interventions more effectively (WFP 2008; FAO and

FHI 360 2016; UNICEF 2017). These indicators are especially crucial when formal monitoring systems are degraded or absent due to conflict (IPC 2021a; FEWS NET 2026).

In this chapter, we analyze trends in household food consumption, dietary diversity, and nutrition in Sudan before and during the current conflict, using data from the World Food Programme's (WFP's) Comprehensive Food Security and Vulnerability Assessments (CFSVA) conducted in early 2023 and early 2024, respectively. With this analysis, we aim to document the evolving impact of conflict on food security and nutrition and to inform evidence-based humanitarian and policy responses.

Among our key findings, the study shows a worsening across key food security indicators between 2023, prior to the eruption of conflict, and 2024, during the conflict. The prevalence of inadequate food consumption increased from 22 percent in 2022 to 33 percent in 2024. Conflict-affected states, such as East Darfur and South Kordofan, experienced the largest increases. The vast majority of women (84 percent) did not meet the minimum acceptable diet (MAD) threshold in 2024, which is an increase of 5 percentage points compared to 2023 (79 percent). Moreover, the consistent consumption of foods rich in vitamin A, protein, and heme iron decreased between 2023 and 2024, with an increase in the share of households never consuming these foods. These findings highlight the detrimental impact of conflict, macroeconomic deterioration, and disruption of livelihoods on the food security situation among populations in Sudan.

Methodology

Conceptual framework

This study is grounded in the understanding that armed conflict profoundly disrupts food systems, affecting every link in the chain—from production and markets to household access and individual consumption. In the case of Sudan, the ongoing conflict has not only displaced millions but has also destabilized agricultural livelihoods, damaged infrastructure, inflated food prices, and restricted humanitarian access, leading to a dramatic erosion in household food security in parts of the country (UNFPA 2024; IPC 2024b).

The conceptual framework guiding this analysis draws from the Food and Nutrition Security Framework and humanitarian food security models that emphasize four core pillars: food availability, access, utilization, and stability

(IPC 2021b). These pillars are used to understand how conflict-induced shocks affect both the supply and demand dimensions of food security, with a particular emphasis on access and utilization, which are often most severely impacted during crises (Maxwell et al. 2014).

A central premise of this framework is that household-level food consumption and dietary quality serve as effective proxies for understanding the real-time impacts of conflict on food security. These micro-level indicators offer granular and actionable insights into the severity and extent of food insecurity. This is especially critical in Sudan, where conflict dynamics vary widely by region and over time (FEWS NET 2026; UNOCHA 2022).

To operationalize this framework, the study employs three key indicators that capture different dimensions of food access and dietary quality. The FCS is used to measure household-level dietary diversity and food frequency, serving as a proxy for food access (WFP 2024b). The MDD-W assesses the micronutrient adequacy of diets among women of reproductive age, providing critical insight into gendered nutritional vulnerabilities (FAO and FHI 360 2016). Complementing these, the Food Consumption Score–Nutrition (FCS-N) disaggregates food consumption data to evaluate the frequency of intake of nutrient-rich food groups—specifically protein-, vitamin A-, and iron-rich foods—highlighting potential deficiencies in essential micronutrients (WFP 2024b).

Together, these indicators allow for a multidimensional analysis of food security and nutrition, extending beyond caloric sufficiency to assess dietary quality, vulnerability to malnutrition, and risk of micronutrient deficiencies. This framework also incorporates a temporal dimension, comparing preconflict and postconflict data (2023 versus 2024) to capture the evolving impact of violence and displacement on household consumption behaviors and nutritional outcomes.

Ultimately, this conceptual approach enables the study to move beyond macroeconomic or supply-side analyses and focus instead on the lived experiences of households and individuals, particularly women, under conditions of severe fragility. By anchoring the research in indicators that are globally recognized, field-tested, and context-relevant, the framework aims to provide evidence that is both analytically rigorous and programmatically useful for humanitarian planning, policy design, and targeted food and nutrition interventions in Sudan and comparable conflict-affected settings.

Measuring food consumption and dietary quality

Food Consumption Score

The FCS is a widely used proxy indicator developed by the WFP to assess household-level dietary diversity and food frequency. During food security assessments, enumerators ask respondents about the number of days in the past seven days that their household consumed specific food items. These items are grouped into eight standard food groups: staples, pulses, vegetables, fruits, meat and fish, milk, sugar, and oil.

Each food group is assigned a weight based on its relative nutritional value (for example, meat and dairy receive higher weights due to protein and micro-nutrient content). The weekly frequency reported for each food group is multiplied by its weight, and the values are summed to derive the FCS. Based on the total score, households are classified into three categories:

- Poor consumption: $FCS \leq 21$
- Borderline consumption: $21.5 \leq FCS \leq 35$
- Acceptable consumption: $FCS > 35$

While the FCS is simple to calculate and widely used for rapid assessments, offering a useful snapshot of food access and diversity, it does not account for portion size or intra-household food distribution and may overestimate dietary adequacy if small amounts of a food are consumed frequently (WFP 2008; FAO and WFP 2011).

Minimum Dietary Diversity for Women

The MDD-W is a globally recognized indicator that assesses the micronutrient adequacy of diets among women of reproductive age (15–49 years). It measures whether a woman has consumed at least 5 out of 10 specified food groups in the previous 24 hours. These food groups include grains, dairy, eggs, meat and fish, dark leafy greens, vitamin A-rich fruits and vegetables, legumes, nuts and seeds, and other fruits and vegetables.

The MDD-W is a critical indicator of women's access to a diverse and nutritious diet, which has strong implications for maternal and child health. It is particularly valuable in emergency contexts, where women are disproportionately affected by food insecurity and are key decision-makers in household food preparation (FAO and FHI 360 2016).

Food Consumption Score–Nutrition

The FCS-N is an extension of the FCS that disaggregates dietary data to assess the frequency of consumption of key micronutrient-rich food groups: protein-rich foods, vitamin A-rich foods, and iron-rich foods. This indicator helps to identify not just how diverse the diet is, but whether it includes critical nutrients essential for child growth, immunity, and development.

Protein-rich foods: meat, fish, dairy, legumes

Vitamin A-rich foods: orange vegetables, liver, dark green leafy vegetables

Iron-rich foods: red meat, organ meat

The FCS-N is especially useful for assessing the risk of micronutrient deficiencies and guiding nutrition-sensitive programming in food-insecure populations (WFP 2025).

Data

This chapter draws on primary data from the CFSVA conducted in Sudan by WFP (WFP 2024a). The CFSVA is an annual nationwide face-to-face assessment designed to evaluate household food access, consumption patterns, nutrition, and vulnerability.

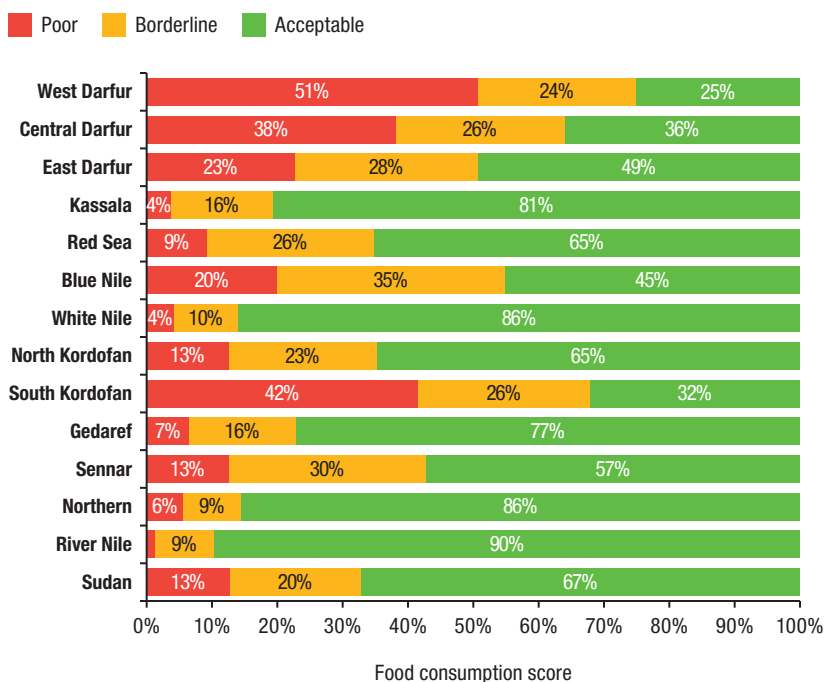
Primary data from the first quarters of 2023 and 2024 offer a comparative look at food security trends before and during the conflict. However, the 2024 survey round faced operational constraints: due to insecurity and limited access, data could not be collected in severely affected states including North and South Darfur, West Kordofan, Khartoum, and Al Jazira.

It is important to note that the data were collected during the postharvest season, which is when food security typically improves as food availability, even in conflict-affected areas, increases. The extent of deterioration in food access is therefore not fully captured. Moreover, as the conflict has evolved since data collection, these findings provide a snapshot rather than a comprehensive view of current conditions.

Results and discussion

National trends in food consumption

In the first quarter of 2024, 67 percent of Sudan's resident households had acceptable levels of food consumption (Figure 8.1), while 20 percent had borderline food consumption, and 13 percent had poor food consumption,

FIGURE 8.1 Food consumption by state, Sudan, 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

meaning that a total of 33 percent had inadequate food consumption. This is a worsening of 11 percentage points compared to 2023, when 22 percent of households in the assessed states had inadequate food consumption.¹ West Darfur had the highest prevalence of households with poor food consumption (51 percent), followed by South Kordofan (42 percent), and Central Darfur (38 percent). Similar deteriorations in food consumption have been documented in other conflict-affected regions. For example, in northern Nigeria, conflict-induced shocks have significantly worsened household food security and reduced dietary diversity (Olanrewaju and Balana 2023). Likewise, in Chad and Mali, increases in inadequate food consumption have been reported following conflict escalation (FAO and WFP 2023). These parallels reinforce

1 In 2023, 73 percent of resident households had acceptable food consumption, 21 percent had borderline food consumption, and 7 percent had poor food consumption.

the finding that conflict consistently drives reductions in household dietary quality across the Sahel region.

The prevalence of inadequate food consumption—that is, households reporting either poor or borderline food consumption and primarily consuming food from only few food groups—increased across the country, with at least one-third of households not consuming nutritionally adequate diets in 2024, which results in malnutrition, particularly among the most vulnerable population groups (children under five and pregnant and lactating women). While the level of food insecurity was high before the war, it has increased since the war began. The prevalence of inadequate food consumption significantly increased in South Kordofan, Sennar, and East Darfur, which are states that have been impacted by conflict, where food prices have increased, and where the functionality of markets has been disrupted (Figure 8.2).

Gender disparities in food consumption

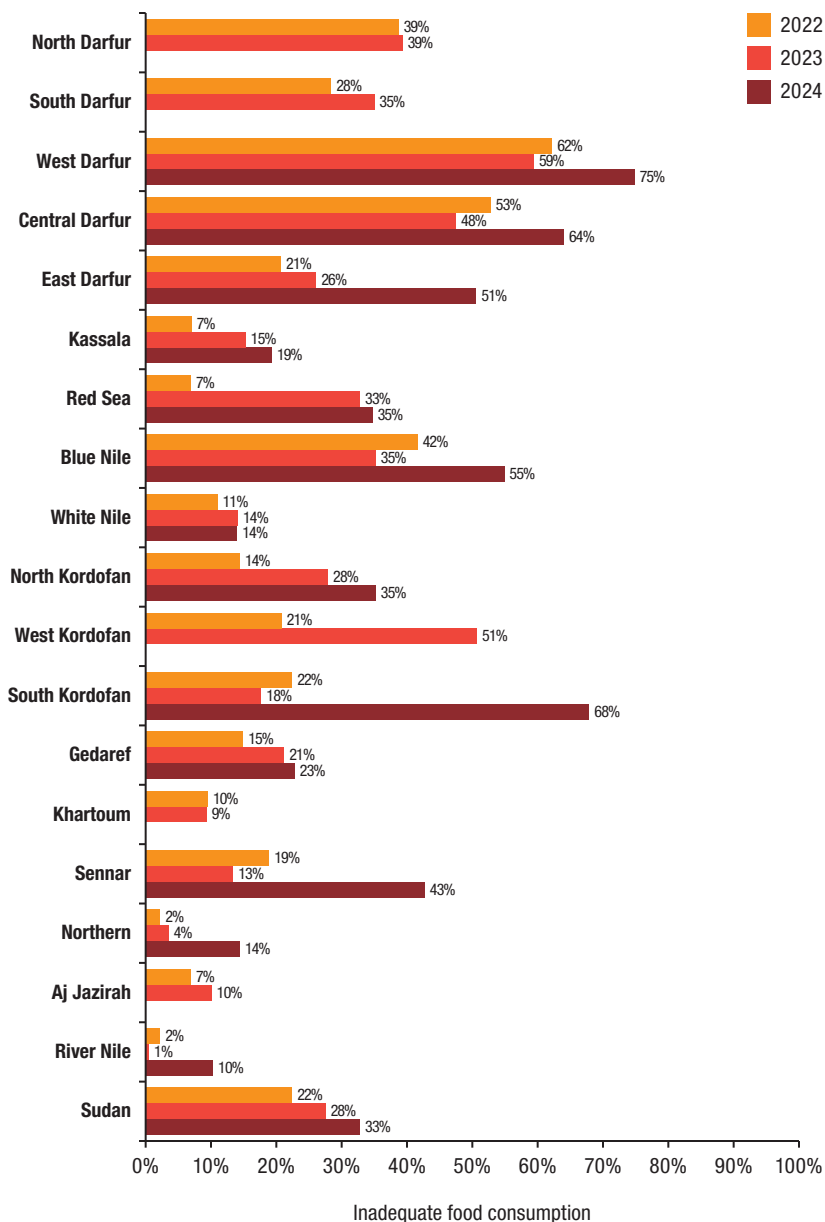
A trend observed every year is that female-headed households have poorer food intake than male-headed households. Among female-headed households, in 2024, 48 percent had inadequate food consumption, up from 37 percent in 2023, while the share was 30 percent for male-headed households, up from 25 percent in 2023. WFP and other humanitarian entities use this information to target specific types of households for assistance. As female-headed households manifest worse food security outcomes, they are often prioritized for assistance. This gender gap is consistent with findings from rural Burkina Faso, where women’s dietary diversity remains persistently low due to limited access to productive resources and markets (JRC 2025). It also mirrors evidence from conflict-affected northern Nigeria, where female-headed households face higher risks of food insecurity due to displacement and livelihood disruption (FAO and WFP 2023).

Women’s dietary diversity: MDD-W results

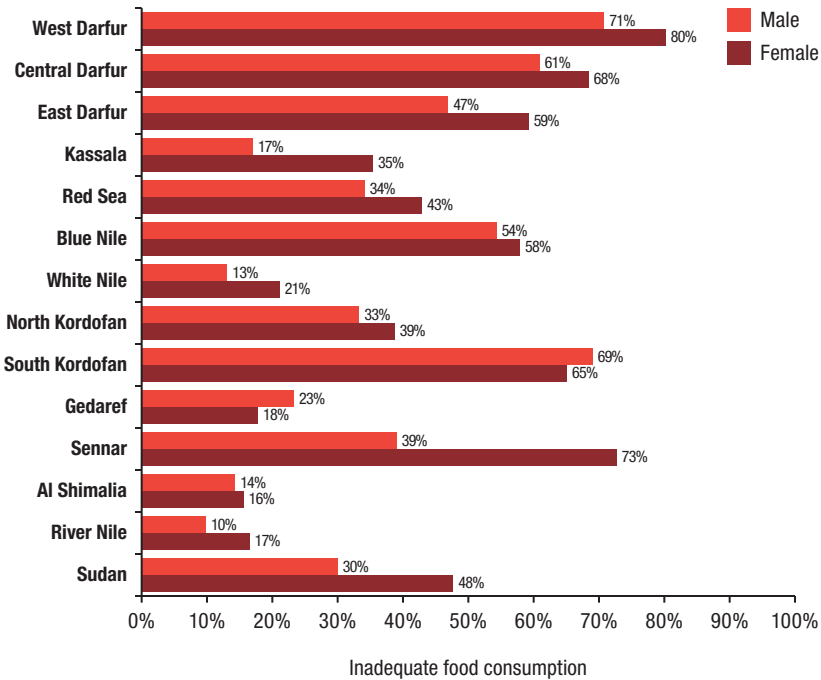
Another important indicator is the MDD-W, which indicates whether women ages 15 to 49 consumed at least 5 out of 10 defined food groups² the previous day or night.³ This proxy indicator reflects the micronutrient adequacy of women’s diets. The results showed that in all states, most women did not

2 These food groups are grains, white roots and tubers, and plantains; pulses (beans, peas, and lentils); nuts and seeds; dairy; meat, poultry and fish; eggs; dark green leafy vegetables; other vitamin A-rich fruits and vegetables; other vegetables; and other fruits.

3 Food and Agriculture Organization, link: <http://www.fao.org/3/a-i5486e.pdf>

FIGURE 8.2 Prevalence of inadequate food consumption by state, Sudan, 2022, 2023, and 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

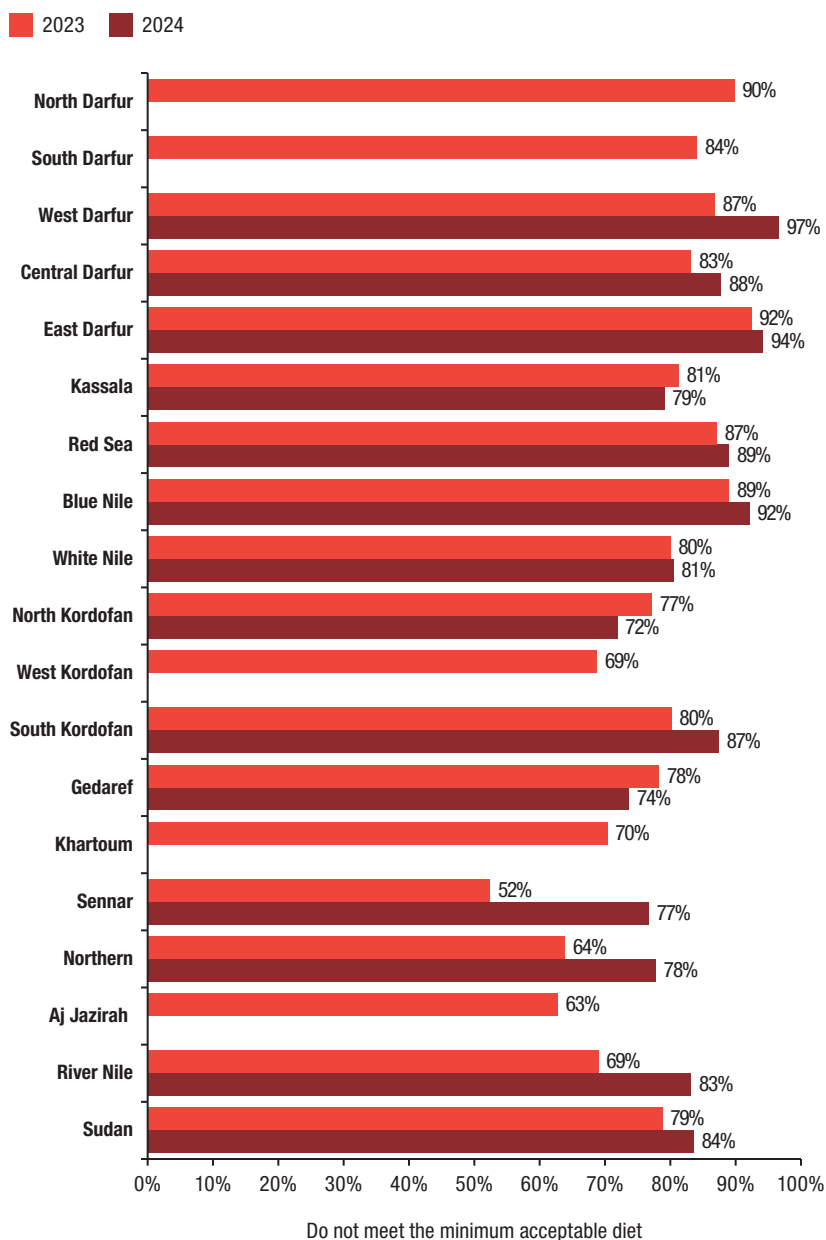
FIGURE 8.3 Prevalence of inadequate food consumption by gender of household head, Sudan, 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

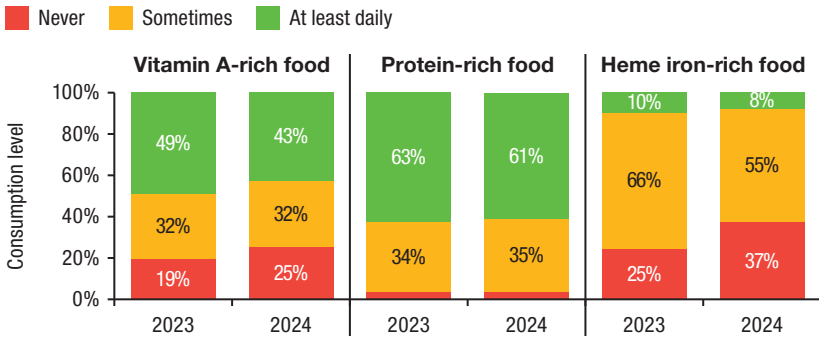
meet the MAD threshold, which indicates intrahousehold disparity between male and female members in terms of food intake (Figure 8.4). As of 2024, 84 percent of women did not meet MAD, an increase of 5 percentage points compared to 2023 (79 percent); this highlights the importance of targeting women for both food and nutrition assistance.

Micronutrient consumption and FCS-N

The FCS-N measures consumption of food rich in protein, iron, and vitamin A at the household level. Protein plays a key role in child growth and is crucial for the prevention of both wasting and stunting, which occurs largely within a child's first 1,000 days. Iron deficiency is one of the main causes of anemia. Vitamin A deficiency, if not tackled before the age of five, can increase child mortality and susceptibility to infectious diseases, such as measles and malaria.

FIGURE 8.4 Minimum Dietary Diversity for Women by state, Sudan, 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

FIGURE 8.5 Food Consumption Scores, all Sudan, 2023 and 2024

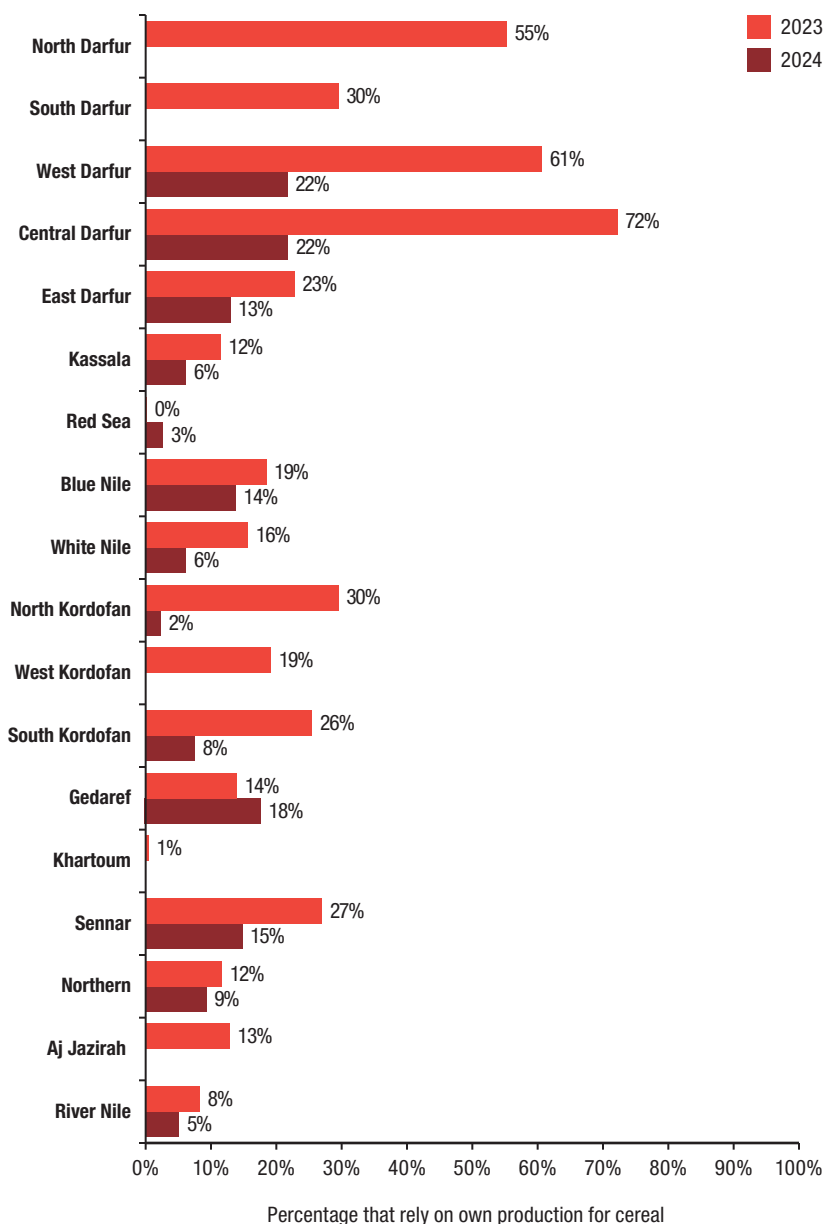
Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

The FCS-N results indicate low consumption of vitamin A-rich foods, as after the war began, 25 percent of households were not consuming these foods (Figure 8.5). Furthermore, 37 percent of resident households reported never consuming foods rich in heme iron, a significant increase in malnourishment compared to before the onset of the war.⁴ Comparable micronutrient deficiencies have been reported in other conflict settings. In Nigeria, the combination of conflict and food price shocks reduced calorie intake and worsened wasting among children (Akerle et al. 2024). Similarly, studies in Gaza have linked conflict-related market disruptions with reduced intake of vitamin A- and iron-rich foods (FAO 2024).

Decline in household food production

Moreover, households' ability to produce their own food has decreased, particularly in conflict-affected states in the Darfur region (Figure 8.6). Households' own production of cereals decreased while market reliance increased, reflecting the disruption of agricultural activities in many areas. Some households that rely on farming or crop production were displaced during the planting or cultivation season; the prices of agricultural inputs increased or the inputs became inaccessible; and rainfall in the 2024 season was below average. Information about households' food production can inform resilience activities to support farmers in increasing their output.

⁴ According to the 2023 CFSVA, 19 percent never consumed food rich in vitamin A, 4 percent never consumed food rich in protein, and 25 percent never consumed food rich in heme iron.

FIGURE 8.6 Percentage of households that rely on own production for their household cereal consumption by state, Sudan, 2023 and 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

TABLE 8.1 Prevalence of acute malnutrition in children under five years of age, Sudan, based on mid-upper arm circumference

	All n = 8,730	Boys n = 4,545	Girls n = 4,185
Prevalence of GAM	(1,665) 19.1% (18.3–19.9 95% C.I.)	(867) 19.1% (18.0–20.2 95% C.I.)	(798) 19.1% (17.9–20.3 95% C.I.)
Prevalence of MAM	(960) 11.0% (10.4–11.7 95% C.I.)	(495) 10.9% (10.0–11.8 95% C.I.)	(465) 11.1% (10.2–12.1 95% C.I.)
Prevalence of SAM	(705) 8.1% (7.5–8.7 95% C.I.)	(372) 8.2% (7.4–9.0 95% C.I.)	(333) 8.0% (7.2–8.8 95% C.I.)

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

Note: GAM = global acute malnutrition; MAM = moderate acute malnutrition; SAM = severe acute malnutrition. Mid-upper arm circumference is a simple measure of arm size used to assess acute malnutrition.

Nutritional status of women and children

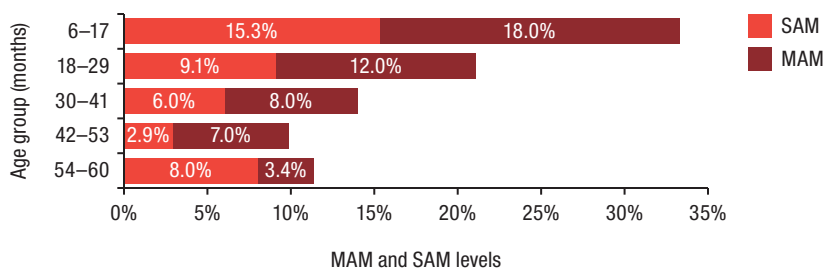
The CFSVA also assesses the nutritional status of children and women of reproductive age. A total of 8,530 children under age five and 1,886 women of reproductive age were screened for MUAC and interviewed for nutrition indicators. Mothers/caregivers of the children were also interviewed about complementary feeding practices. The screening indicated that wasting among children 6 to 59 months remains at a critical level. Comparable proxy global acute malnutrition (GAM) rates that exceed the World Health Organization (WHO) emergency threshold have also been recorded in northern Nigeria and parts of Chad (IPC 2024a; WFP 2023), underscoring that Sudan's levels are in line with patterns observed in other places facing protracted conflict.

As shown in Table 8.1, overall proxy GAM was 19 percent, of which proxy moderate acute malnutrition was 11 percent and proxy severe acute malnutrition was 8 percent. These wasting rates exceed the WHO emergency threshold of 15 percent (WHO and UNICEF 2025). Levels of wasting were similar for boys and girls.

Across the age groups, the youngest children (6–17 months) show higher rates of proxy GAM than children of 18 to 29 months (Figure 8.7). Inadequate feeding practices are typically one of the major causes of malnutrition during the first two years of life. The figure also shows that the proxy GAM for this sample decreases with age.

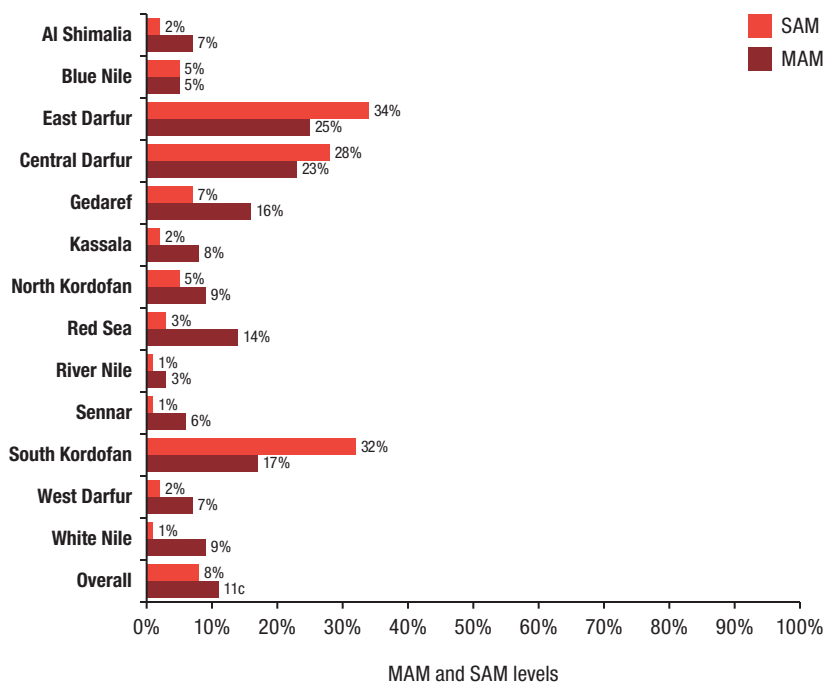
There were, however, variations across assessed states, with the proxy GAM ranging from 4 percent to 59 percent (Figure 8.8). Five of the 13 states had a proxy GAM above 15 percent.

The CFSVA also used MUAC to assess women's nutritional status, finding that 26 percent of pregnant or lactating women were acutely malnourished

FIGURE 8.7 Proxy measures of wasting in children under five, by age, Sudan, 2024

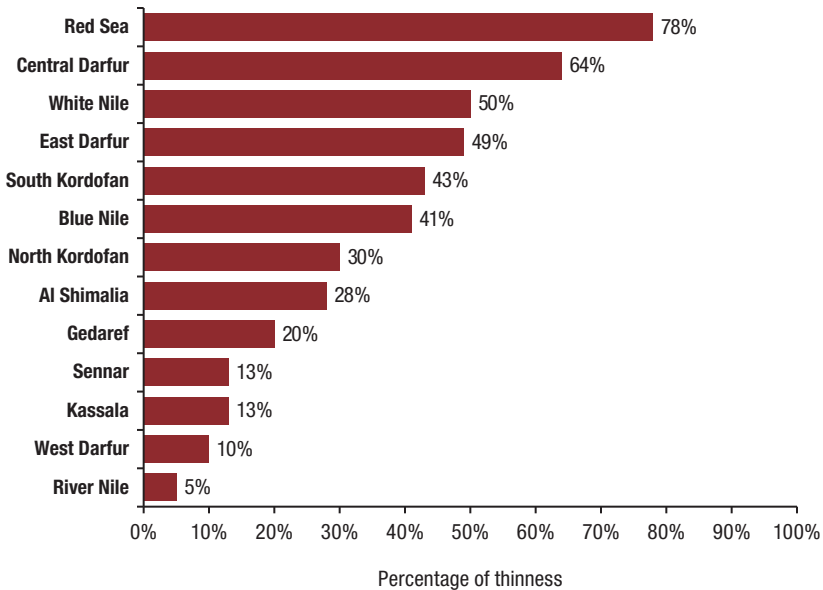
Source: Authors' calculations based on 2024 CFSVA data (WFP 2024a).

Note: MAM = moderate acute malnutrition; SAM = severe acute malnutrition. Age is measured in months.

FIGURE 8.8 Proxy severe and moderate acute malnutrition levels by state, Sudan, 2023–2024

Source: Authors' calculations based on 2024 CFSVA data (WFP 2024a).

Note: MAM = moderate acute malnutrition; SAM = severe acute malnutrition. MAM and SAM were measured through mid-upper arm circumference.

FIGURE 8.9 Proxy thinness of women, Sudan, 2024

Source: Authors' calculations based on 2024 CFSVA data (WFP 2024a).

Note: Proxy thinness is determined through a mid-upper arm circumference of <230 mm.

(Figure 8.9). The largest proportion was found in Red Sea state (78 percent), while the smallest (5 percent) was reported in River Nile state.

Complementary feeding practices

Complementary feeding involves providing infants with other foods in addition to breastmilk from the age of six months, as breastmilk alone is insufficient to meet their increasing nutritional needs. For complementary foods to meet nutrient requirements, they should comprise a variety of food groups, given at the right amount and frequency for the child's age. Inadequacy in any of these factors means that nutrient needs are not met, ultimately resulting in malnutrition. In addition to care practices, food security is a key factor for achieving adequate complementary feeding.

The assessment indicated that 80 percent of children ages 6 to 23 months are breastfeeding, but only 37 percent met the threshold for MDD, consuming at least five of eight food groups (Table 8.2). Moreover, only 19.7 percent of children ages 6 to 23 months met the recommended minimum meal

TABLE 8.2 Minimum acceptable diet and subcomponents, disaggregated by age group, Sudan, 2024

Age category	Breastfed (percent)	Minimum meal frequency (percent)	Minimum dietary diversity (percent)	Minimum acceptable diet (percent)
6–11 months	93.0	24.2	28.8	10.4
12–17 months	85.7	15.5	40.3	8.7
18–23 months	62.8	19.1	42.6	11.2
Overall	80.7	19.7	37.1	10.1

Source: Authors' calculations based on 2024 CFSVA data (WFP 2024a).

frequency for other foods in addition to breastmilk. Using MAD as the standard, 10 percent of children 6 to 23 months were deemed malnourished.

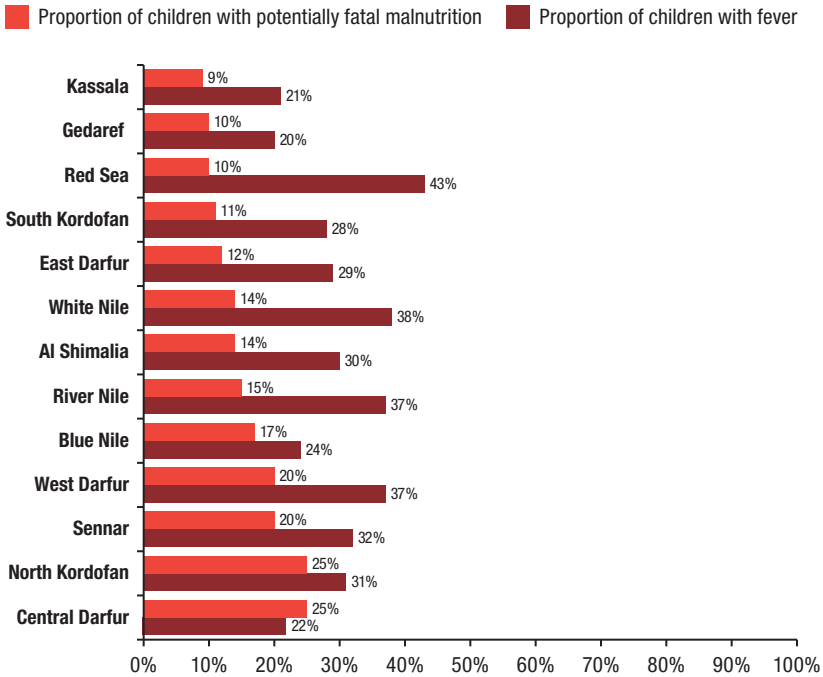
Variation is also observed across the different age groups and states, specifically in children ages 12 to 17 months, which indicates potentially fatal malnutrition—painting a bleak picture for young children if malnutrition is not addressed. Around 14 percent of children had some kind of illness in the two weeks preceding the survey (Figure 8.10). The proportion of children who had experienced a fever in the prior two weeks ranged from 20 percent in Gedaref to 42 percent in Red Sea (Figure 8.10).

Information on household food consumption, dietary diversity, and nutrition status is used to inform the responses of WFP and other humanitarian actors. The CFSVA data remain the cornerstone of WFP's prioritization of geographic areas and populations for assistance. Assistance provided by WFP and other partners makes an important difference for communities. For instance, humanitarian assistance helped to reduce the risk of famine in six areas in Central Darfur and two areas in West Darfur, where nearly 1 million people received regular WFP food or cash aid during 2024.

Conclusions and policy implications

This chapter assesses the impacts of Sudan's ongoing conflict on household food consumption patterns, dietary diversity, and nutrition outcomes. By analyzing data from the WFP's CFSVA for 2023 and 2024, the chapter provides a granular, evidence-based understanding of how conflict has reshaped food security dynamics across the country—especially for vulnerable groups such as women and children.

The data from the 2023 and 2024 CFSVA surveys highlight a significant deterioration in food consumption and dietary quality in Sudan since the outbreak of conflict. By early 2024, one in three households had inadequate

FIGURE 8.10 Proportion of children with potentially fatal malnutrition and fever in the last two weeks, Sudan, 2024

Source: Authors' calculations based on 2023–2024 CFSVA data (WFP 2024a).

food consumption, an 11 percentage point increase from the previous year. The worst conditions were observed in conflict-affected states such as West Darfur, South Kordofan, and Central Darfur. Gender disparities were pronounced, with 48 percent of female-headed households food insecure, compared with 30 percent among male-headed households. Women also experienced worsening dietary diversity: 84 percent of women of reproductive age failed to meet the MDD threshold in 2024, up from 79 percent in 2023. Micronutrient consumption declined across the board. A quarter of households did not consume any vitamin A-rich foods, and 37 percent reported no intake of iron-rich foods.

Child nutrition outcomes are alarming. The proxy GAM rate among children under five stood at 19 percent, exceeding the WHO emergency threshold. The state of women's nutrition was similarly dire, with 26 percent of pregnant or lactating women acutely malnourished. Complementary

feeding practices remain inadequate, and only 10 percent of children ages 6–23 months meet MAD.

While seasonal and geographic disparities exist, the convergence of conflict, displacement, economic decline, and inadequate humanitarian access has led to widespread undernutrition, dietary monotony, and deteriorating child health. The assessment underscores the urgent need to prioritize not just food quantity, but dietary quality, particularly for women and young children.

Policy and programmatic recommendations

To address the escalating food insecurity and malnutrition in Sudan, immediate and well-targeted humanitarian interventions are essential. Within these interventions, priority should be given to vulnerable populations, especially female-headed households, pregnant and lactating women, and children under age five, who face the most severe nutritional deficits. Strengthening nutritional screening and supplementation programs can help identify at-risk individuals early and reduce mortality and morbidity associated with severe acute malnutrition.

Alongside emergency assistance, there is a critical need to invest in recovery and resilience-building efforts. Agricultural production must be restored in relatively stable areas through the provision of seeds, tools, and inputs, as well as support to smallholder farmers affected by displacement and market disruption. Restoring local food production is essential to reduce market dependence and stabilize food access over the medium term. Livelihoods programming should also include support to informal markets and income-generating activities, particularly those led by women, to help households rebuild purchasing power and diversify food sources.

Finally, nutrition-sensitive programming should be mainstreamed across sectors. Health, water, sanitation, and education services must be linked to food security initiatives to address the underlying drivers of malnutrition. Complementary feeding programs, promotion of diverse diets, and community-based nutrition education are crucial, particularly for young children and women. Equally important is improved coordination among humanitarian actors, local authorities, and international donors to ensure access to conflict-affected populations and to scale assistance efficiently and equitably. Peacebuilding efforts that enhance stability and enable humanitarian access are vital to creating a sustainable pathway out of Sudan's food crisis.

Limitations and suggestions for future research

This analysis is primarily descriptive and relies on secondary survey data, which limit causal interpretation. Conflict was treated as an external, given factor, without controlling for other potential drivers of food insecurity such as climatic shocks, economic instability, or governance challenges. Moreover, the study did not disaggregate food security outcomes between more and less conflict-prone areas, which could provide deeper insights into the spatial heterogeneity of impacts. Future research should employ econometric or spatial analysis methods to isolate the effects of conflict from other determinants of food insecurity and explore how varying levels and types of conflict influence nutrition and livelihoods over time. Longitudinal data and mixed-methods approaches could also strengthen understanding of household adaptation and resilience in Sudan's situation and similar protracted crises.

References

- Akerlele, D., O. Fadare, A. Ogunniyi, O. Adeyemi, and M. Rufai. 2024. "Effects of Food Price Changes on Child Undernutrition Among Agricultural Households in Nigeria." *World Development Sustainability* 4:100158. <https://doi.org/10.1016/j.wds.2024.100158>
- FAO (Food and Agricultural Organization of the United Nations). 2024. "GIEWS Update – Palestine, Population of the Gaza Strip at Risk Due to Conflict." FAO Global Information and Early Warning System (GIEWS). <https://openknowledge.fao.org/server/api/core/bitstreams/ca4d5997-653e-4fe1-8e1b-002d1bfc627/content#:~:text=Food%20security%20in%20the%20Gaza,been%20estimated%20at%2026%20percent>
- FAO and FHI 360. 2016. *Minimum Dietary Diversity for Women: A Guide for Measurement*. <https://openknowledge.fao.org/handle/20.500.14283/i5486e>
- FAO and WFP (World Food Programme) WFP. 2011. *Guidelines for Measuring Household and Individual Dietary Diversity*. <https://www.fao.org/agrifood-economics/publications/detail/en/c/122321/>
- FAO and WFP. 2023. *Monitoring Food Security in Food Crisis Countries and Territories with Conflict Situations*. FAO and WFP. <https://openknowledge.fao.org/handle/20.500.14283/cc5722en>
- FEWS NET (Famine Early Warning Systems Network). 2026. "Sudan | Latest Food Security Analysis." Accessed February 17, 2026. <https://fews.net/east-africa/sudan>
- FSIN (Food Security Information Network). 2022. "Sudan." In *Global Report on Food Crises 2022*, 195–199. FSIN. <https://www.fightfoodcrises.net/global-report-food-crises>

- IPC (Integrated Food Security Phase Classification). 2021a. *Sudan: Acute Food Insecurity Situation September 2021 – March 2022*. IPC. <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1154254/>
- IPC. 2021b. *Technical Manual Version 3.1: Evidence and Standards for Better Food Security and Nutrition Decisions*. IPC. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/manual/IPC_Technical_Manual_3_Final.pdf
- IPC. 2024a. *Sudan: Acute Food Insecurity Situation, October 2023 – February 2024 and Projection for March – May 2024*. IPC. <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1154254/>
- IPC. 2024b. *Sudan: Acute Food Insecurity Snapshot – Mid 2024*. IPC. <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1159791/>
- IPC. 2025. *Sudan: Acute Food Insecurity Situation September 2025 – May 2026. Integrated Food Security Phase Classification*. <https://reliefweb.int/report/sudan/sudan-ipc-acute-food-insecurity-analysis-september-2025-may-2026-issued-november-2025>
- JRC (European Commission Joint Research Centre). 2025. *Gender Equality and Food Systems - A Knowledge Review*. Science for Policy Brief No. JRC140233. Knowledge4Policy. <https://publications.jrc.ec.europa.eu/repository/handle/JRC140233>
- Maxwell, D., P. Hailey, and L. Spainhour Baker. 2014. *Alternatives for Monitoring Food Security in Real Time in Somalia*. Feinstein International Center, Tufts University. <https://fic.tufts.edu/assets/Alternatives-for-Monitoring-Food-Security-in-Real-Time-in-Somalia.pdf>
- Olanrewaju, O., and B.B. Balana. 2023. "Conflict-Induced Shocks and Household Food Security in Nigeria." *Sustainability* 15(6):1–15. <https://ideas.repec.org/a/gam/jsusta/v15y2023i6p5057-d1095691.html>
- UNFPA (United Nations Population Fund). 2024. *Sudan Emergency Situation Report No. 18*. UNFPA. <https://reliefweb.int/report/sudan/unfpa-sudan-emergency-situation-report-no-18-november-2024>
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNICEF. 2017. *Measuring Mid-Upper Arm Circumference (MUAC)*. UNICEF. https://www.unicef.org/media/120256/file/MUAC_guidelines.pdf
- UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2022. *Sudan Humanitarian Needs Overview 2023*. UNOCHA. <https://www.unocha.org/publications/report/sudan/sudan-humanitarian-needs-overview-2023-november-2022>
- WFP (World Food Programme). 2008. *Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis*. WFP.

- WFP. 2023. *Cadre Harmonis?: Harmonized Framework for the Identification of Areas and Populations in Food and Nutrition Insecurity—Chad and Nigeria Analysis Update, November 2023*. Rome: WFP and CILSS. <https://www.ipcinfo.org>
- WFP. 2024a. *Comprehensive Food Security and Vulnerability Assessment (CFSVA), Q1 2024*. WFP.
- WFP. 2024b. *Food Consumption Score & Food Consumption Score Nutritional Analysis: Guidance Note*. WFP. <https://docs.wfp.org/api/documents/WFP-0000158062/download/>
- WFP. 2025. *Food Consumption Score Nutritional Quality Analysis (FCS-N): Guidance Note*. WFP. <https://docs.wfp.org/api/documents/WFP-0000158062/download/>
- WHO (World Health Organization) and UNICEF. 2025. *Global Nutrition Targets 2030: Child Wasting Brief*. World Health Organization. <https://doi.org/10.2471/B09520>

WORSENING FOOD SECURITY IN SUDAN AMID CONFLICT

Oliver K. Kirui, Khalid Siddig, Alemayehu S. Taffesse, and Hala Abushama

The conflict in Sudan, primarily between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF), has escalated since April 2023 into a significant crisis, affecting the nation's stability and security and worsening humanitarian conditions. The conflict has severely degraded the food security of many Sudanese households, with profound effects on their diets, coping strategies, and overall welfare.

Sudan's food security situation was already precarious before April 2023, due to the combination of deteriorating macroeconomic conditions, economic sanctions, fluctuating agricultural production, and climate-related challenges, such as droughts and floods (Alhelo et al. 2023; Mohamed 2022; Abdalla 2018). Despite abundant arable land and water resources in some parts of the country, Sudan's economic performance has been constrained by underinvestment in agriculture, inadequate infrastructure, and a reliance on food imports. These conditions, coupled with high inflation and a depreciating currency, have made food access increasingly difficult for a significant portion of the population. Moreover, localized conflicts in the Darfur and Kordofan regions and Blue Nile state in the years before the current conflict laid the groundwork for food insecurity by hampering agricultural activities and displacing communities, which increased the vulnerability of some regions to food insecurity (FAO 2022).

Sudan's agriculture sector, the backbone of the economy, has also been severely affected by the conflict. Insecurity and displacement have prevented farmers in many areas from accessing their fields, and in some places, military operations have destroyed crucial agricultural infrastructure (Kirui, Ahmed, Siddig, et al. 2024). As a result, both agricultural output and food availability are expected to decline (FAO 2024; Guo et al. 2024; Kirui et al. 2023). Moreover, the blockade of supply routes and markets has disrupted the distribution of goods, making it challenging for communities, especially in conflict-affected areas, to access food (UNOCHA 2023; Abushama et al. 2023).

The ongoing conflict between the SAF and RSF has also created large populations of internally displaced persons (IDPs). As of February 2026, more than 7 million people are estimated to have been internally displaced, while an additional 4.5 million people have sought refuge in neighboring countries (UNHCR 2026). In short, the humanitarian situation is dire—approximately 21.2 million people across Sudan were experiencing high levels of acute food insecurity (IPC Phase 3 or above) as of September 2025 (IPC 2025). Between June and September 2024, 14 areas in nine states faced a risk of famine (IPC 2024b). Also, in August 2024, the IPC Famine Review Committee reported that the Zamzam camp near El-Fasher in North Darfur state was in IPC Phase 5 (famine), with these conditions projected to persist through October 2024 and likely beyond. The Committee also highlighted similar famine conditions in other IDP sites near El-Fasher, such as the Abu Shouk and Al Salam camps, emphasizing the urgent need to assess food security, nutrition, and health in these areas (IPC 2024a). Other regions in Sudan also remain at risk of famine due to conflict and limited access for humanitarian responders.¹

The United Nations' humanitarian response plan for Sudan requires US\$2.7 billion to provide multi-cluster and protection assistance to 18 million people. However, as of October 2024, the plan remained significantly underfunded, with only 49 percent of the total funding required (UNOCHA 2024).

This chapter contributes to the broader discourse on conflict and food security through an analysis of Sudan's food security before and during the current SAF–RSF conflict. Specifically, the study uses national datasets to measure and compare the severity of and changes in food insecurity among Sudan's rural and urban households before and during the conflict. Our empirical analysis is designed to provide insights on food insecurity dynamics in the context of conflict. We conclude by looking at the implications for the development of strategies and targeted interventions to mitigate the impact of food insecurity on vulnerable populations in conflict-affected areas.

While numerous studies have examined the relationship between conflict and food insecurity globally, there is a notable lack of empirical, real-time analysis focused on Sudan during periods of active conflict. This study helps

¹ Adding to the crisis, heavy rains and flooding affected more than 17,000 people in both western and eastern Sudan following the onset of the rainy season in June 2024. In Kassala state, 10,700 people were affected, many of whom had fled recent hostilities in Sennar state. Flooding destroyed homes and schools, further worsening the living conditions of affected populations (UNOCHA 2024b).

address that gap by offering updated, nationally representative evidence from Sudan—a country facing both extreme conflict and limited humanitarian access. Rather than covering the broader food security literature, this chapter provides country-specific insights into the current crisis. Even so, our findings speak to the broader literature by deepening understanding of how conflict disrupts food security across geographic and socioeconomic dimensions.

Drawing on nationally representative data collected both before and during the conflict, this study finds a dramatic deterioration in food security across Sudan since the conflict's outbreak in April 2023. The share of food-secure households has fallen from 49 percent preconflict to between 9 and 20 percent, varying by state. Estimates using the Rasch model (1980) indicate significant increases in moderate-to-severe food insecurity, which has risen from 37 to 59 percent in rural areas and from 32 to 48 percent in urban areas. The impacts are most severe in already vulnerable states such as South Darfur, Blue Nile, and North Darfur, while relatively better outcomes are observed in states such as Northern and Red Sea that have better market access and greater humanitarian presence. Consistent with global evidence, the conflict has disproportionately affected rural populations, large households, and female-headed households. These findings underscore the urgent need for targeted interventions that combine emergency relief with longer-term investments in food systems and infrastructure, particularly in the most affected regions.

This chapter is organized as follows. The next section details the data sources used, including sample characteristics, followed by a discussion of the empirical approach used for measuring household food insecurity, the Food Insecurity Experience Scale (FIES). The results and discussions section presents the raw FIES and Rasch model estimates, explores these estimates by income and by gender of the household head, and compares household FIES data before and during the conflict. The final section summarizes the findings and discusses their broader implications.

Methodology and data sources

Measurements of food security indicators

THE FOOD INSECURITY EXPERIENCE SCALE

FIES is a globally validated tool developed by the Food and Agriculture Organization of the United Nations (FAO) to assess the severity of food insecurity at the household or individual level (FAO 2016). FIES is rooted in the

premise that individuals and households facing food insecurity experience a predictable set of conditions, ranging from anxiety about food access to skipping meals or going without food entirely. The scale is designed for use at global, regional, or national levels (Ballard et al. 2013; Cafiero et al. 2018).

In surveys, the FIES module comprises eight binary (yes/no) questions designed to capture various food insecurity experiences over the previous 30 days or 12 months that reflect the respondent's access to adequate food. These questions include whether the respondent was ever concerned during the recall period about not having enough food, being unable to eat healthy and nutritious food, eating fewer kinds of foods, skipping meals, eating less than needed, running out of food, experiencing hunger but not eating, and going without food for a whole day. An affirmative response to any question in the module indicates the presence of a specific food insecurity condition. The aggregate FIES score for each respondent ranges from 0 to 8, with higher scores indicating more severe food insecurity (Smith et al. 2017).

For the analysis here, descriptive statistics were computed from each survey to summarize the distribution of food insecurity levels across the population, calculating the frequency and percentage of affirmative responses for each FIES question. We categorized households with raw aggregate scores of 0 as "food secure," households with scores between 1 and 3 as experiencing "moderate food insecurity," and those households with scores between 4 and 8 as experiencing "severe food insecurity." Additionally, average raw FIES scores were calculated to summarize the overall severity of food insecurity. This approach provides a straightforward measure of food insecurity among households and aligns with international reporting practices for Sustainable Development Goal (SDG) Indicator 2.1.2 (FAO et al. 2023).

HOUSEHOLD FOOD INSECURITY MEASURES BASED ON THE RASCH MODEL

The Rasch model enhances the measurement of food insecurity by addressing limitations inherent in the raw FIES scores. It provides a robust framework for assessing the severity of food insecurity across different populations (Owino et al. 2014; Bond and Fox 2015; Boone 2017). The Rasch model assumes a logistic function, where the probability of an affirmative response depends on the difference between the severity of an individual's or household's food insecurity (person ability) and the difficulty of a given food insecurity condition (item difficulty) (Bond and Fox 2015; Boone 2017). Unlike raw FIES scores, the Rasch model produces interval-level measures that allow for more accurate comparisons across demographic groups, regions, and time periods (Coleman-Jensen et al. 2015).

For assessing household food insecurity, the Rasch model estimates are preferred to raw FIES scores because they are an objective measure independent of the sample and specific items used, which can be used for longitudinal and cross-sectional analyses. Additionally, the model identifies which of the eight questions are most informative for detecting food insecurity, information which then can be used in guiding targeted interventions (Nord et al. 2016).

COMPARATIVE ANALYSIS

We also conducted a comparative analysis to evaluate food security before and during the conflict at the state level. This involved comparing average FIES scores and the distribution of food insecurity levels between these periods, highlighting significant changes attributable to the conflict. Combining raw scores and Rasch model estimates provided a robust cross-validation of findings. While raw scores offered a straightforward understanding of prevalence, Rasch estimates allowed for deeper insights into the severity and progression of food insecurity across diverse populations.

Estimating the household correlates of food insecurity

Empirical model and specification

To analyze the factors associated with household food insecurity in Sudan, a semi-nonparametric extended ordered probit (SNEOP) model was employed (Gallant and Nychka 1987). The SNEOP model relaxes the restrictive distributional assumptions of a traditional ordered probit model by allowing for greater flexibility in capturing the relationship between explanatory variables and the ordinal dependent variable, which is the food insecurity category of the household. This flexibility is particularly valuable in contexts like Sudan, where heterogeneity in socioeconomic conditions and conflict-induced shocks may lead to nonstandard distributions of food insecurity. Several previous studies have analyzed food insecurity using ordinal and semi-nonparametric models. Studies by Cafiero, Viviani, and Nord (2018) emphasize the relevance of FIES in quantifying food insecurity. Similarly, Gallant and Nychka (1987) and Stewart (2004) provide the theoretical foundation for employing SNEOP in contexts where traditional ordered probit models fail to capture distributional complexities.

The dependent variable in this study is the food insecurity level, measured as an ordinal variable based on the FIES score-based categories: (1) food secure,

(2) moderately food insecure, and (3) severely food insecure. The SNEOP model estimates the latent variable Y_i^* , defined as:

$$Y_i^* = \beta X_i + \epsilon_i \quad (1)$$

where Y_i represents the food insecurity level of household i ; X_i is a vector of explanatory variables, including demographic characteristics such as household size, education, employment status, and conflict exposure; β is the vector of coefficients to be estimated; and is ϵ_i the error term, following a flexible, semi-nonparametric distribution.

The observed categories of food insecurity Y_i are linked to the latent variable Y_i^* through thresholds τ_j where:

$$Y_i = \begin{cases} 1, & \text{if } Y_i^* \leq \tau_1, \\ 2, & \text{if } \tau_1 < Y_i^* \leq \tau_2, \\ 3, & \text{if } Y_i^* > \tau_2. \end{cases} \quad (2)$$

The SNEOP model extends the ordered probit framework by approximating the distribution of using a series of Hermite polynomials, enabling more accurate estimation in the presence of non-normality (Gallant and Nychka 1987; Stewart 2004). The SNEOP model is estimated using maximum likelihood methods. We posit here that conflict exposure increases the probability of severe food insecurity, while household-level variables, such as education, employment status, and access to basic services, mitigate the risk of food insecurity. The reduced form equation includes explanatory variables capturing demographic, socioeconomic, and contextual factors affecting food insecurity, as described in Table 9.1.

Data sources and sample characteristics

The data used in this study originate from three sources: the 2022 Sudan Labor Market Panel Survey (SLMPS) for the preconflict period (Krafft and Assaad 2023), the 2023/24 Sudan Rural Household Survey (SRHS) (Kirui, Ahmed, Taffesse, et al. 2024), and the 2024 Sudan Urban Household Survey (SUHS) (IFPRI and UNDP 2024b) for the conflict period (Table 9.2).

The 2022 Sudan Labor Market Panel Survey

The 2022 SLMPS provides a detailed snapshot of labor market dynamics in Sudan and is the first nationally representative labor market survey since 2014. Conducted by the Economic Research Forum in partnership with Sudan's

TABLE 9.1 Variables used in the analysis: Definitions and a priori expectations

Variable	Definition (SI units / coding)	Expected sign (a priori hypothesis on household food insecurity)
Age	Continuous variable: age of household head in years	Negative at lower ages, positive at higher ages (nonlinear relationship)
Age squared	Squared term of household head's age (years ²)	Positive (older age increases likelihood of food insecurity after a threshold)
Female-headed household	Binary (0 = male-headed; 1 = female-headed)	Positive (female-headed households more vulnerable to food insecurity)
Housing adequacy	Binary (0 = inadequate; 1 = adequate housing)	Negative (adequate housing reduces food insecurity risk)
Migration	Binary (0 = no movement; 1 = household moved)	Positive (migration, especially conflict-induced, increases food insecurity)
Access to safe water	Binary (0 = no; 1 = yes)	Negative (access to safe water lowers food insecurity)
Education level	Categorical (Low, Medium, High, based on years of schooling of household head)	Negative (higher education reduces household food insecurity)
Household size	Continuous (number of household members)	Positive (larger households more likely to face food insecurity)
Employment status	Binary (0 = unemployed; 1 = employed household head)	Negative (employment lowers risk of food insecurity)
SAF/RSF conflict exposure	Binary (0 = no; 1 = exposed to conflict)	Positive (conflict exposure increases food insecurity)
Decline in household income since conflict	Binary (0 = no; 1 = reported income decline)	Positive (income loss raises food insecurity)

Source: Authors' compilation.

TABLE 9.2 Summary of survey data used in the study

Survey	Sudan Labor Market Panel Survey	Sudan Rural Household Survey	Sudan Urban Household Survey
Coverage	Nationwide, all 18 states	Rural areas nationwide	Urban centers nationwide
Conflict context	Low-level generalized conflict; before April 2023 start of SAF/RSF conflict	During SAF/RSF conflict	During SAF/RSF conflict
Sample unit	Household and individual	Household	Household
Household sample	4,878	4,505	3,000
Urban / Rural	Both rural and urban	Rural	Urban
Data collection modality	In-person	Computer-assisted telephone interviewing	Computer-assisted telephone interviewing
Data collection period	June–September 2022	November 2023–January 2024	May–July 2024

Source: Authors' compilation based on Krafft et al. (2023); Kirui et al. (2024); and IFPRI and UNDP (2024b).

Central Bureau of Statistics, the survey sampled 4,878 households nationwide, who were selected using random stratified cluster sampling. Despite significant challenges posed by political unrest and economic instability, interviews with SLMPS sample households were conducted in person between June and September 2022. Given the survey's focus on employment, migration, and socioeconomic conditions, it oversampled vulnerable populations, including refugees and IDPs (Krafft and Assaad 2023). The survey addressed a wide range of topics, including violence and climatic shocks, migration patterns, household demographics, educational attainment, housing conditions, and access to essential services such as health and education.

The 2022 SLMPS was the first wave of a planned longitudinal study aimed at understanding human resource development and deployment in Sudan. The survey was modeled after similar labor market surveys conducted in Egypt, Jordan, and Tunisia, and includes modules focusing on gender-disaggregated asset, employment, and entrepreneurship data. The data were designed to be representative at the national level, for urban and rural areas, and across all regions of Sudan. The surveys collected information on all household members ages five years and above, as well as data on all enterprises run by the household.

2023/24 Sudan Rural Household Survey

The SRHS was conducted by IFPRI in collaboration with the United Nations Development Programme (UNDP) and World Food Programme (WFP). The respondents were interviewed using computer-assisted telephone interviewing (CATI) survey administration methods between early November 2023 and early January 2024 (that is, about six months after the onset of the SAF/RSF conflict). This survey provided the first nationwide data on rural households following the eruption of conflict. It provides baseline data on the economic activities and food security of rural households, forming part of a planned longitudinal study involving regular rural household survey rounds (IFPRI and UNDP 2024a).

2024 Sudan Urban Household Survey

The SUHS covered 3,000 urban households and was implemented by IFPRI in partnership with UNDP in May and July 2024, just over one year after the onset of the conflict. Like the SRHS, the SUHS was implemented using CATI. The survey sample was designed to provide both national and state-level estimates for urban households across Sudan (IFPRI and UNDP 2024b). Like the SRHS, the SUHS is also the first round of a planned panel survey program designed to enable longitudinal studies of urban households in Sudan.

The sampling strategies for the 2023/24 SRHS and the 2024 SUHS were crafted to account for the unpredictability associated with telephone surveys, including factors such as inactive numbers in the telephone number databases used for selecting the sample and interruptions to network connectivity.² While CATI facilitated data collection under difficult conditions, it introduced some limitations, including reduced depth of interaction in interviewing. Perhaps most importantly, disparities in phone ownership in the population potentially introduced bias in the survey estimates. In particular, the samples for both surveys implemented during the conflict likely underrepresented low-income households, as they are less likely than other household groups to have telephone access.

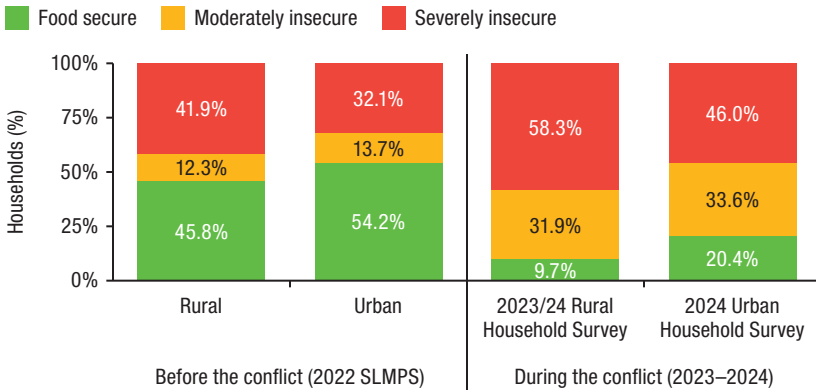
Results and discussions

Food security status: Food Insecurity Experience Scale raw score estimates

Although the two survey sampling frames are not strictly comparable, major differences in the FIES scores reported by the surveys indicate a significant decline in food security in Sudan following the onset of the conflict in April 2023 (Figure 9.1). Overall, prior to the conflict, about half of Sudanese households were food secure. In contrast, during the conflict, about 90 percent of rural households and 80 percent of urban households were estimated to be experiencing moderate or more severe levels of food insecurity. This high probability of household food insecurity highlights the conflict's profound impact on agricultural productivity and household livelihoods, especially in regions traditionally seen as major food production sources.

Rural areas, in particular, have felt the greatest impact of the conflict (FIES scores of “food secure” falling from of 45.8 to 9.7 percent). Many of these areas have suffered from reduced food production as insecurity and displacement caused by the conflict have hampered access to farmland. In addition, market disruptions have hindered the distribution of what food is available. Urban areas have also seen increased food insecurity, though they are less dependent on agriculture. The share of urban households with FIES food-secure scores fell from 54.2 to 20.4 percent. Rising prices and diminished

2 See Kirui et al. (2024b) for details of the methodology used to obtain accurate and reliable inferences, despite the inherent challenges of data collection in a conflict setting.

FIGURE 9.1 Household food security status based on Food Insecurity Experience Scale raw scores

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

household purchasing power, reflecting the economic fallout of the fighting, are likely major factors contributing to this decline. This pattern mirrors findings in Yemen, where conflict led to similar production and market disruptions that created severe food shortages and increased prices in urban settings (World Bank 2024b).

State-level analysis reveals widespread severe food insecurity during the conflict (Table 9.3). States including West Kordofan, Blue Nile, South Kordofan, White Nile, North Darfur, Kassala, Khartoum, and Sennar are estimated to have food insecurity levels significantly above the national average, highlighting the extensive and severe nature of the food crisis. Most of these states were already severely food insecure before the conflict, particularly in the Darfur and Kordofan regions, and the data show exacerbated levels of food insecurity with the outbreak of the conflict. Notably, 97 percent of households in River Nile state and 71 percent in East Darfur state were estimated to be food secure before the conflict. Measures of food security deteriorated sharply during the conflict, however, with the share of households estimated to be food secure falling sharply to just 17 percent in River Nile and 5 percent in East Darfur.

These findings align with earlier studies, which identified these regions as particularly prone to food insecurity due to their historical marginalization and weak infrastructure (IPC 2024b). Conversely, states such as Northern and Red Sea, which have benefited from better market access and

TABLE 9.3 Household food security status based on Food Insecurity Experience Scale raw scores, by state (percentage of households in each category)

State	Before the conflict (2022 SLMPS)						During the conflict (2023–2024)					
	Rural Households			Urban Households			2023/24 Rural Households			2024 Urban Households		
	Food secure	Moderately insecure	Severely insecure	Food secure	Moderately insecure	Severely insecure	Food secure	Moderately insecure	Severely insecure	Food secure	Moderately insecure	Severely insecure
Khartoum	41.9	11.4	46.7	40.1	13.3	46.6	6.6	29.8	63.6	21.3	29.5	49.3
Central Darfur	47.7	11.4	40.9	34.0	20.0	46.0	3.7	42.0	54.3	31.5	22.2	46.3
East Darfur	71.3	13.9	14.9	71.5	14.6	13.8	5.2	39.3	55.6	16.7	22.2	61.1
North Darfur	40.0	23.4	36.6	53.8	15.4	30.8	7.5	26.1	66.4	5.9	31.5	62.6
South Darfur	29.8	4.1	66.1	48.7	10.1	41.3	3.8	36.8	59.4	9.2	32.5	58.3
West Darfur	70.3	21.6	8.1	60.1	16.1	23.8	3.4	49.0	47.7	11.1	41.4	47.5
North Kordofan	70.6	8.4	21.0	57.2	6.2	36.6	11.9	31.5	56.6	16.4	44.3	39.3
South Kordofan	30.6	9.5	59.9	25.7	40.0	34.3	7.9	22.2	69.8	17.9	29.8	52.4
West Kordofan	16.6	11.7	71.8	30.6	16.1	53.2	7.4	21.9	70.7	17.2	46.7	36.1
Sennar	45.9	17.2	36.9	62.3	18.8	18.8	10.8	29.5	59.7	23.1	33.3	43.6
Gedaref	22.7	18.2	59.1	37.7	21.7	40.6	11.7	30.9	57.4	27.8	36.1	36.1
Blue Nile	35.2	9.3	55.6	47.9	9.4	42.7	6.3	24.4	69.3	13.7	31.6	54.7
White Nile	33.9	10.9	55.2	43.6	19.1	37.2	10.7	28.2	61.1	25.6	32.1	42.3
Northern	66.0	12.4	21.6	63.9	17.5	18.6	20.4	35.4	44.2	24.0	29.3	46.7
River Nile	100.0	0.0	0.0	95.7	4.3	0.0	16.7	33.9	49.4	22.5	35.0	42.5
Al Jazirah	52.0	14.9	33.1	48.2	14.2	37.6	12.1	36.3	51.6	28.8	32.0	39.2
Kassala	52.5	5.8	41.7	69.4	10.8	19.8	12.9	32.0	55.2	26.4	29.5	44.2
Red Sea	60.3	17.6	22.1	70.6	14.1	15.3	23.6	35.0	41.4	33.3	26.9	39.8
Total	45.8	12.3	41.9	54.2	13.7	32.1	9.7	31.9	58.3	20.4	33.6	46.0

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, 2024 SUHS.

humanitarian aid, have not experienced such severe declines in the percentages of food secure households. Similar patterns were also observed by Guo and colleagues (2024) in other conflict zones.

Data from the preconflict period (2020 to 2022) from the WFP's Consolidated Approach for Reporting Indicators of Food Security show similar patterns (Table 9.4). In this survey, about three-fourths of households were food secure, while only about 4 percent were classified as severely food insecure. However, severe food insecurity increased between 2021 and 2022, possibly indicating growing vulnerabilities even before the current conflict, driven by economic, social, and environmental pressures.

Persistent hotspots and emerging challenges

Data from the three surveys show both the persistence of food insecurity in historically vulnerable states and the emergence of new hotspots caused by the widespread and uneven impact of the conflict. Several states, including South Darfur, Blue Nile, North Darfur, and Central Darfur, consistently ranked among the most food-insecure regions both before and during the conflict. For example, households in South Darfur experienced a jump in moderate and severe food insecurity from 60.8 percent preconflict to 93.5 percent during the conflict, reflecting worsening conditions in an already vulnerable area (Table 9.5). Other states with only moderate levels of food insecurity preconflict saw dramatic escalations in food insecurity levels. For example, in West Darfur, 34.8 percent of households were estimated to be food insecure preconflict, but during the current conflict, that rate rose to 92.8 percent—the third highest prevalence of household food insecurity among Sudan's states. Similarly, Khartoum and Sennar, which had relatively low preconflict food insecurity rates of 59.0 percent and 45.9 percent, respectively, reported alarming levels of 86.1 percent and 83.1 percent during the conflict (Table 9.5).

Food security status: Rasch model estimates

To further assess food insecurity severity, we used the Rasch model to classify household food security status on a probabilistic scale (Reise and Revicki 2015). The model estimates show a sharp increase after the start of the conflict in the probability of moderate to severe food insecurity, particularly in rural areas where agricultural disruptions and displacement have been most acute. During the conflict period, about 59 percent of rural and 46 percent of urban households in Sudan were estimated to be experiencing moderate or severe food insecurity, a significant increase from about 41 percent and 32 percent, respectively, in 2022 (Figure 9.2).

TABLE 9.4 Prevalence of household food insecurity in Sudan between 2020 and 2022 using WFP data (percentage)

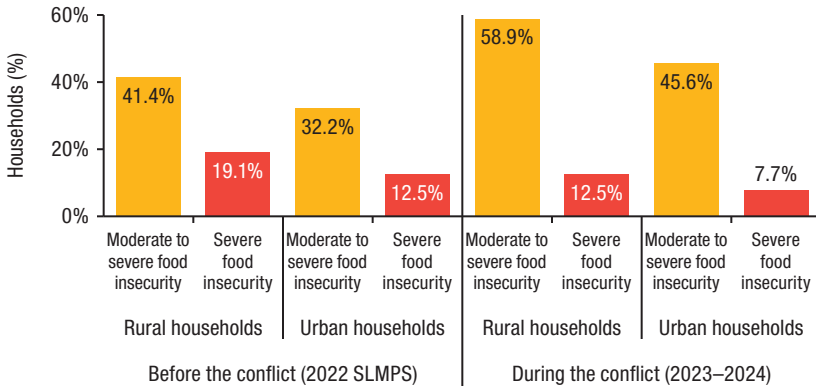
Year	Food secure	Moderately food insecure	Severely food insecure
2020	74.5	22.1	3.4
2021	77.3	20.1	2.6
2022	73.1	22.0	4.9

Source: Authors' analysis of WFP (n.d.).

TABLE 9.5 Rank of states by household prevalence of moderate and severe food insecurity in the preconflict period and during the conflict

Before the conflict 2022 SNLPS		During the conflict 2023/24 SRHS and 2024 SUHS	
State	% of households	State	% of households
West Kordofan	76.4	South Darfur	93.5
South Kordofan	71.8	North Darfur	93.3
Gedaref	69.8	West Darfur	92.8
White Nile	61.2	Blue Nile	90.0
South Darfur	60.8	East Darfur	89.1
Central Darfur	59.1	West Kordofan	87.7
Khartoum	59.0	South Kordofan	87.1
Blue Nile	58.5	Khartoum	86.1
North Darfur	53.1	North Kordofan	85.8
Aj Jazirah	49.9	Sennar	83.1
Sennar	45.9	Central Darfur	82.4
Kassala	39.1	White Nile	81.8
North Kordofan	36.1	River Nile	80.4
Northern	35.1	Kassala	80.4
West Darfur	34.8	Gedaref	80.2
Red Sea	34.6	Aj Jazirah	79.6
East Darfur	28.6	Northern	77.8
River Nile	2.2	Red Sea	71.5

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, 2024 SUHS.

FIGURE 9.2 Rasch model estimates: Prevalence of moderate-to-severe and severe food insecurity among rural and urban households before and during the conflict in Sudan

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

In urban areas, where rising food prices and reduced incomes have diminished the purchasing power of households, food insecurity has significantly increased, a result that is consistent with the findings of Siddig and colleagues (2023).

State-level analysis of food insecurity using the Rasch model reveals a stark escalation in food insecurity across Sudan following the onset of the conflict (Table 9.6). Both rural and urban households have experienced a marked increase in the probability of moderate to severe food insecurity. Particularly notable in this respect are the states of Blue Nile, East Darfur, and South Kordofan, which exhibit some of the highest increases in food insecurity probabilities. These trends underscore the deepening crisis in regions already vulnerable due to preexisting socioeconomic challenges. The disparities in food insecurity across states, with states such as Blue Nile and South Kordofan seeing the highest increases in food insecurity, are also in line with global patterns observed in conflict-affected regions, where preexisting vulnerabilities, such as limited market access and poor infrastructure, exacerbate the effects of conflict (Cappelli et al. 2024).

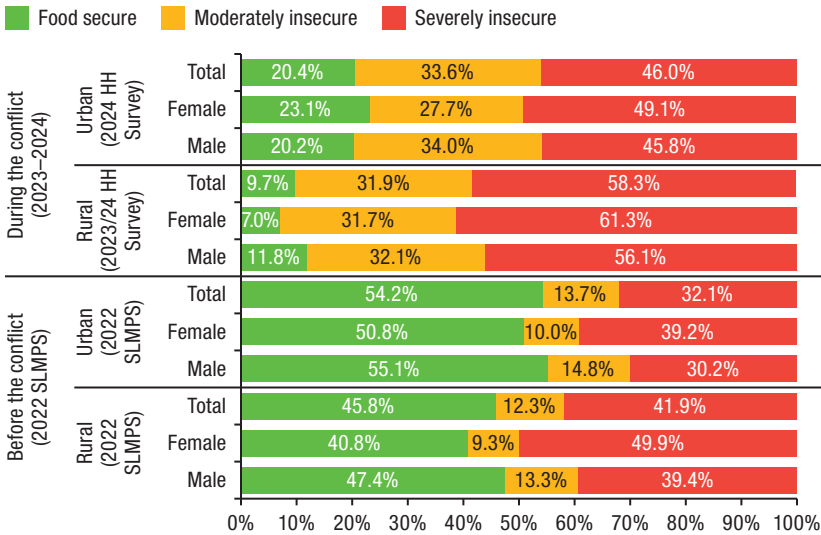
In contrast, states with better access to markets and humanitarian aid, such as Northern and Red Sea, experienced relatively smaller increases in food insecurity, suggesting possible mitigating effects of such factors (Table 9.6). For example, although Northern state's probability of severe food insecurity increased after the start of the conflict, it remains lower than in more

TABLE 9.6 Rasch model estimates: Probability of households being food insecure by state (percent of households in each category)

State	Before the conflict				During the conflict			
	Rural Households (2022 SLMPS)		Urban Households (2022 SLMPS)		2023/24 Rural Household Survey		2024 Urban Household Survey	
	Probability of moderate or severe food insecurity	Probability of severe food insecurity	Probability of moderate or severe food insecurity	Probability of severe food insecurity	Probability of moderate or severe food insecurity	Probability of severe food insecurity	Probability of moderate or severe food insecurity	Probability of severe food insecurity
Khartoum	46.6	25.0	45.4	18.3	63.6	13.7	49.5	11.7
Central Darfur	41.3	24.5	45.5	23.3	55.6	4.7	42.5	6.8
East Darfur	15.2	5.0	15.5	4.5	59.3	11.7	58.2	8.4
North Darfur	38.3	13.0	30.1	8.3	63.7	15.3	60.4	10.4
South Darfur	65.9	42.1	41.9	23.3	59.6	6.9	57.2	8.3
West Darfur	12.0	0.3	24.6	5.4	53.6	5.4	47.0	4.9
North Kordofan	21.0	2.6	36.9	19.6	55.9	10.5	40.1	4.6
South Kordofan	60.0	38.1	38.6	8.7	69.0	17.7	52.8	12.5
West Kordofan	71.5	34.2	54.6	27.7	70.5	20.9	36.7	5.6
Sennar	37.6	18.5	20.0	3.8	59.7	13.1	41.8	5.7
Gedaref	56.5	12.5	40.2	16.0	57.5	10.3	36.3	5.7
Blue Nile	49.1	5.0	41.0	6.6	68.7	19.0	53.2	7.5
White Nile	54.0	30.4	40.3	21.5	62.7	16.2	41.8	7.3
Northern	18.8	1.8	18.8	3.3	46.7	10.6	46.5	5.1
River Nile	0.0	0.0	0.5	0.0	50.3	8.2	43.7	6.9
Aj Jazirah	32.4	13.8	36.7	12.0	52.4	11.2	38.9	6.0
Kassala	41.0	24.1	19.7	11.3	57.4	13.8	45.3	9.6
Red Sea	18.7	0.4	15.3	2.5	43.5	8.9	38.4	7.6
Total	41.4	19.1	32.2	12.5	58.9	12.5	45.6	7.7

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

FIGURE 9.3 Households estimated as experiencing moderate or severe food insecurity, before and during current conflict, by gender of household head (percentage)



Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

conflict-affected areas. Such findings are consistent with a hypothesis that infrastructure and external support play a critical role in buffering the impacts of conflict. At the national level, the probability of moderate-to-severe food insecurity rose from 36.8 percent to 58.9 percent, and severe food insecurity decreased slightly from 15.8 percent to 12.5 percent. This overall trend reflects the broader impact of the conflict on Sudan's food security landscape.

Food security status and selected household demographic characteristics

Our analysis of the three household surveys shows that demographic factors also significantly influence food insecurity. In particular, female-headed households and larger households are disproportionately affected by the conflict (Figure 9.3). This pattern for female-headed households is consistent with findings from Somalia and the Democratic Republic of the Congo, where these households were found to be particularly vulnerable to food insecurity during conflict. Likewise, the trend toward higher food insecurity among larger households has also been observed in other conflict zones, such as Somalia, due to their increased needs (World Bank 2024a).

TABLE 9.7 Descriptive statistics of explanatory variables

Variable	Before the conflict (2022)				During the conflict (2023–2024)			
	Rural		Urban		Rural		Urban	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Age (years)	46.02	15.68	47.98	14.43	36.05	12.57	45.31	12.01
Age squared	2363.3	1591.46	2509.6	1476.65	1458	1045.73	2197.4	1138.24
Female head	23.9	42.6	21.5	41.1	42.78	50.78	5.9	77
Education Level								
Low	4.65		4.3		50.83		21.51	
Medium	32.55		35.56		33.24		50.25	
High	62.8		60.14		15.92		28.24	
Housing adequacy	49.6	50	76.1	42.6	29.3	45.5	52.9	49.9
RSF/SAF conflict exposure	—	—	—	—	11.1	31.4	14	34.7
Migration	23.3	42.3	35.7	47.9	23.8	42.6	36.4	48.1
Access to safe water	12.24	21.86	8.34	17.19	3.58	2.24	4.11	3.94
Household size (members)	5.13	2.45	5.3	2.42	10.41	6.12	8.85	4.24
Employment status	57.1	49.5	67.7	46.8	64.8	47.8	69.0	72.0

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

Empirical results

Descriptive statistics of explanatory variables

The descriptive statistics reveal clear shifts in household characteristics before and during the conflict. In the preconflict period (2022), household heads were older on average in both rural (46 years) and urban (48 years) areas, compared with 2024, when rural heads were much younger (36 years) and urban heads slightly younger (45 years) (Table 9.7). Female-headed households were more common in rural areas before the conflict (24 percent) than in urban areas (22 percent), and this share rose sharply to 43 percent in rural areas during the conflict, while falling in urban settings. Education levels also changed markedly: in 2022, most household heads reported medium or high levels of education, while in 2024 the share with low or no education rose to more than half in rural areas and one-fifth in urban areas. Housing adequacy was higher in urban than rural areas, both before and during the conflict, but declined substantially in rural areas during the crisis. Conflict exposure was reported by 11 percent of rural and 14 percent of urban households in 2024. Access to safe

water dropped sharply during the conflict in both settings. Household sizes increased dramatically during the conflict, averaging 10.4 members in rural areas and 8.9 in urban areas, compared to about 5 members in both contexts preconflict. Employment remained relatively stable overall, though somewhat higher in urban areas. These descriptive results point to worsening vulnerabilities, particularly in rural areas, where conflict, displacement, and household crowding have coincided with deteriorating living conditions.

Determinants of household food insecurity before and during the conflict

Table 9.8 presents the SNEOP estimates³ for rural households in Sudan in the preconflict period (2022). The results indicate several strong and statistically significant associations between household characteristics and food insecurity. The age of the household head shows a nonlinear effect: while increases in age reduce the likelihood of food insecurity, the positive and significant age-squared term suggests diminishing returns at older ages. Female-headed households are significantly more likely to be food insecure, while households with adequate housing are less likely to experience food insecurity. Migration is positively and significantly associated with a higher probability of severe food insecurity, reflecting the vulnerabilities of displaced households. Access to safe water reduces the probability of being severely food insecure, while larger household size increases vulnerability. Education of the household head is associated with reduced food insecurity, although the effect is relatively modest. Employment status of the household head shows no significant effect in rural areas.

Table 9.8 shows the SNEOP estimates for urban households in the same preconflict period. Compared to rural areas, the relationships are weaker and less consistently significant. Age again shows a nonlinear pattern, with younger household heads associated with reduced food insecurity, but the age-squared term indicating rising risk at older ages. Female-headed households are significantly more food insecure in urban areas, while households with adequate housing are better protected. Migration again significantly increases the probability of severe food insecurity, suggesting that displacement is a critical driver regardless of setting. Access to safe water reduces severe food

3 Model comparisons revealed that the extended semi-nonparametric specification outperformed the standard ordered probit model in all cases, as indicated by log-likelihood ratio tests (as recommended by Stewart, 2004). The default polynomial order of three was rejected, and order four was selected for the datasets. The Wald test further demonstrated that the included variables were jointly significant, meaning they significantly explained variations in food security outcomes. The log pseudolikelihood values and chi-squared statistics further support the reliability of the fitted models.

TABLE 9.8 Semi-nonparametric extended ordered probit for rural households in the preconflict period, 2022

	Estimates		Marginal effects					
			Food secure		Moderately food insecure		Severely food insecure	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of HH head, years	-0.022***	0.008	0.008***	0.000	-0.001***	0.000	-0.007***	0.000
Age squared	0.000**	0.000	-0.000***	0.000	0.000***	0.000	0.000***	0.000
Female-headed household, 0/1	0.286***	0.082	-0.100***	0.001	0.011***	0.001	0.089***	0.001
Adequate housing, 0/1	-0.175**	0.076	0.072***	0.001	-0.014***	0.001	-0.057***	0.001
Migrated, 0/1	0.182**	0.076	-0.064***	0.001	0.008***	0.001	0.056***	0.001
Safe water access, 0/1	0.029***	0.003	-0.006***	0.000	-0.001***	0.000	0.008***	0.000
Education of HH head	-0.080	0.051	0.026***	0.001	-0.002***	0.000	-0.024***	0.001
Household size, no.	0.025*	0.013	-0.009***	0.000	0.001***	0.000	0.008***	0.000
Employed HH head, 0/1	0.003	0.064	0.001	0.001	-0.001**	0.001	0.001	0.001
cut2 constant	0.322***	0.055	0.423***	0.005	0.173***	0.003	0.403***	0.003
b1_constant	1.360***	0.508						
b2_constant	-0.157***	0.092						
b3_constant	-0.517	0.137						
Observations	2258		2258		2258		2258	
Chi-squared	244.960							
P	0.000		0.000		0.000		0.000	

Source: Authors' analysis of 2022 SLMPS, 2023/24 SRHS, and 2024 SUHS.

Note: Robust standard errors in parentheses. For dummy variables, the discrete change from 0 to 1 is used. *p < 0.1, **p < 0.05, ***p < 0.01. Estimates are reported as 0 in the table when they are smaller than (1 × 10⁻⁵) in absolute value and insignificant. HH = household.

insecurity, though with smaller magnitude compared to rural areas. Education of the household head shows mixed effects, with weak protective associations, while larger households are significantly more vulnerable to food insecurity in urban areas. Employment of the household head has only limited protective effects, with significance at the margin.

Overall, the preconflict analysis demonstrates that socioeconomic and demographic characteristics had structured and significant relationships with household food insecurity, though with stronger and more consistent effects in rural areas than in urban areas. These findings highlight the importance

TABLE 9.9 Semi-nonparametric extended ordered probit for urban households in the preconflict period, 2022

	Estimates		Marginal effects					
			Food secure		Moderately food insecure		Severely food insecure	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of HH head, years	-0.027	0.023	0.010***	0.000	-0.001***	0.000	-0.009***	0.000
Age squared	0.000	0.000	-0.000***	0.000	0.000***	0.000	0.000***	0.000
Female-headed household, 0/1	0.230	0.217	-0.085***	0.001	0.004***	0.001	0.082***	0.001
Adequate housing, 0/1	-0.315	0.260	0.118***	0.001	-0.004***	0.001	-0.113***	0.001
Migrated, 0/1	0.413	0.357	-0.154***	0.001	0.007***	0.001	0.147***	0.000
Safe water access, 0/1	0.009	0.008	-0.003***	0.000	-0.000***	0.000	0.003***	0.000
Education of HH head	0.024	0.059	-0.008***	0.000	0.000	0.000	0.008***	0.000
Household size, no.	0.100	0.084	-0.037***	0.000	0.002***	0.000	0.035***	0.000
Employed HH head, 0/1	-0.052	0.107	0.019***	0.001	-0.001*	0.001	-0.017***	0.001
cut2 constant	0.466	0.403	0.446***	0.003	0.147***	0.003	0.407***	0.002
b1_constant	-0.020	0.160						
b2_constant	0.117	0.415						
b3_constant	0.008	0.046						
Observations	2278		2278		2278		2278	
Chi-squared	2.657							
P	0.976		0.000		0.000		0.000	

Source: Authors' analysis of 2022 SLMPS.

Note: Robust standard errors in parentheses. For dummy variables, the discrete change from 0 to 1 is used. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Estimates are reported as 0 in the table when they are smaller than (1×10^{-5}) in absolute value and insignificant. HH = household.

of household-head demographics, gender, housing conditions, migration, and basic services access as critical correlates of food insecurity in Sudan before the outbreak of the 2023 conflict.

For the regression analysis of rural households during the conflict period (Table 9.10), key factors influencing food security include the age of the household head, housing adequacy, conflict exposure, education, and income dynamics. The impact of the household head's age on food security is non-linear, with older individuals more likely to experience severe food insecurity; however, this effect diminishes as age increases. Housing adequacy

TABLE 9.10 Semi-nonparametric extended ordered probit for rural households during the conflict period, 2023/24

	Estimates		Marginal effects					
			Food secure		Moderately food insecure		Severely food insecure	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of HH head, years	0.014	0.012	-0.003***	0.000	-0.003***	0.000	0.005***	0.000
Age squared	0.000	0.000	0.000***	0.000	0.000***	0.000	-0.000***	0.000
Female-headed household, 0/1	0.219	0.181	-0.031***	0.000	-0.050***	0.000	0.081***	0.000
Adequate housing, 0/1	-0.432	0.333	0.073***	0.001	0.092***	0.000	-0.165***	0.000
Migrated, 0/1	0.002	0.048	0.000	0.001	0.000	0.000	0.001**	0.000
Safe water access, 0/1	0.037	0.027	-0.005***	0.000	-0.008***	0.000	0.014***	0.000
Education of HH head	-0.031	0.041	0.005***	0.000	0.007***	0.000	-0.012***	0.000
Household size, no.	0.025	0.019	-0.003***	0.000	-0.006***	0.000	0.009***	0.000
Employed HH head, 0/1	-0.042	0.055	0.006***	0.000	0.009***	0.000	-0.015***	0.000
SAF/RSF conflict, 0/1	0.325	0.316	-0.043***	0.001	-0.076***	0.001	0.119***	0.000
Income decline, 0/1	0.095	0.077	-0.014***	0.000	-0.021***	0.000	0.036***	0.000
Constant			0.234***	0.002	0.583***	0.002	0.182***	0.001
cut2 constant	0.869	1.050						
b1_constant	0.094	0.257						
b2_constant	0.015	0.413						
b3_constant	-0.029	0.023						
Observations	4,485		4,485		4,485		4,485	
Chi-squared	4.211							
p	0.9630		0.0000		0.0000		0.0000	

Source: Authors' analysis of 2023/24 SRHS.

Note: Robust standard errors in parentheses. For dummy variables, the discrete change from 0 to 1 is used. *p < 0.1, **p < 0.05, ***p < 0.01. Estimates are reported as 0 in the table when they are smaller than (1 × 10⁻⁵) in absolute value and insignificant. HH = household.

significantly reduced the likelihood of severe food insecurity, while exposure to conflict increased it. Education and income stability were also critical, with more educated individuals and households experiencing fewer income shocks and being less likely to face severe food insecurity. Household size and employment also showed significant effects, with larger households facing higher probabilities of severe food insecurity but also benefiting slightly from resource pooling.

The analysis of urban households during the conflict period (Table 9.11) likewise found housing adequacy to be a critical factor, significantly correlated with the probability of being food secure. Conflict exposure greatly worsened food security, with substantial positive effects on the likelihood of severe food insecurity. The household head being employed was notably associated with a reduced probability of severe food insecurity. Age and education of the household head also had significant, albeit smaller, impacts. The nonlinear relationship of the age of the household head with food security was observed here as well, and higher education levels were associated with a reduction in severe food insecurity.

Conclusions and implications

The ongoing conflict in Sudan has had a profound and far-reaching impact on food security, drastically reducing the number of food-secure households in both rural and urban areas. This study, which draws on nationally representative data from the preconflict 2022 SLMPS and from the 2023/24 SRHS and 2024 SUHS conducted during the conflict, shows a sharp decline in food security since the start of the conflict in April 2023. Before the conflict, approximately 49 percent of households were considered food secure; this figure has now dropped to between 9 and 20 percent, depending on the state. The probability of moderate-to-severe food insecurity, as estimated by the Rasch model, has surged from 37 to 59 percent in rural areas and from 32 to 48 percent in urban areas, illustrating the conflict's widespread impact on food availability and access.

At the state level, the conflict has deepened existing vulnerabilities, particularly in regions such as South Darfur, Blue Nile, North Darfur, and Central Darfur, where preconflict conditions were already challenging due to poor infrastructure and limited access to markets. These areas have seen some of the most significant increases in food insecurity, highlighting how the conflict has compounded existing socioeconomic difficulties. In contrast, states such as Northern and Red Sea, which have better market access and humanitarian

TABLE 9.11 Semi-nonparametric extended ordered probit for urban households during the conflict period, 2024

	Estimates		Marginal effects					
			Food secure		Moderately food insecure		Severely food insecure	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Age of HH head, years	0.036**	0.018	-0.010***	0.000	-0.003***	0.000	0.013***	0.000
Age squared	-0.000**	0.000	0.000***	0.000	0.000***	0.000	-0.000***	0.000
Female-headed household, 0/1	0.024	0.092	-0.003*	0.002	-0.006***	0.002	0.009***	0.001
Adequate housing, 0/1	-0.517***	0.137	0.136***	0.001	0.059***	0.001	-0.196***	0.000
Migrated, 0/1	0.034	0.046	-0.006***	0.001	-0.006***	0.001	0.013***	0.000
Safe water access, 0/1	0.016**	0.007	-0.004***	0.000	-0.002***	0.000	0.006***	0.000
Education of HH head	-0.102**	0.044	0.027***	0.001	0.009***	0.001	-0.037***	0.000
Household size, no.	0.030***	0.009	-0.006***	0.000	-0.004***	0.000	0.011***	0.000
Employed HH head, 0/1	0.106***	0.034	-0.028***	0.000	-0.011***	0.000	0.039***	0.000
SAF/RSF conflict, 0/1	0.503***	0.142	-0.110***	0.001	-0.074***	0.001	0.184***	0.000
Income decline, 0/1	0.101**	0.047	-0.029***	0.001	-0.007***	0.001	0.036***	0.000
Constant			0.490***	0.006	0.441***	0.006	0.069***	0.002
cut2 constant	1.187***	0.253						
b1_constant	-0.019	0.189						
b2_constant	-0.010	0.129						
b3_constant	0.008	0.020						
Observations	2,999		2,999		2,999		2,999	
Chi-squared	15.927							
P	0.144		0.000		0.000		0.000	

Source: Authors' analysis of 2024 SUHS.

Notes: Robust standard errors in parentheses. For dummy variables, the discrete change from 0 to 1 is used. *p < 0.1, **p < 0.05, ***p < 0.01. Estimates are reported as 0 in the table when they are smaller than (1 × 10⁻⁵) in absolute value and insignificant. HH = household.

support, have fared somewhat better. This contrast underscores the importance of infrastructure and external aid in buffering the effects of conflict.

The findings from this study align with global research on the impact of conflict on food security. As seen in similar contexts, such as Yemen and South Sudan, disrupted livelihoods, market failures, and mass displacement have driven food insecurity to unprecedented levels, with rural populations and vulnerable groups, including female-headed households and large families, disproportionately affected. These trends reinforce the need for targeted, context-specific interventions to address both the immediate and structural drivers of household food insecurity.

Given current trends, targeted interventions are urgently needed to address immediate food insecurity and its root causes. Policymakers and humanitarian actors should prioritize aid delivery in the hardest hit areas while supporting agricultural production and market access in safer regions. A coordinated strategy that combines emergency relief with long-term investments, such as farm support and infrastructure, will be key to stabilizing food systems and enabling recovery. Ultimately, lasting impact will depend on promoting regional stability and addressing the conflict's underlying drivers.

The crisis in Sudan has significant implications that extend beyond its borders, underscoring the urgent need for stronger regional and international engagement. At the regional level, neighboring countries and organizations such as the Intergovernmental Authority on Development and the African Union all have a critical role to play in facilitating dialogue, supporting peacebuilding initiatives, and coordinating cross-border humanitarian assistance to displaced populations. Globally, the scale of food insecurity in Sudan highlights the importance of sustained support from international actors, including the United Nations, international financial institutions, and humanitarian agencies, to address both immediate relief and longer-term resilience needs. Increased humanitarian aid must be coupled with diplomatic efforts to secure a negotiated resolution to the conflict, as sustainable improvements in food security will only be possible in an environment of peace and stability. Lessons from other protracted crises, such as Yemen and South Sudan, point to the necessity of a dual approach that combines emergency food assistance with investments in restoring livelihoods, rebuilding agricultural systems, and ensuring access to markets and services. Without coordinated regional and global action, the impacts of Sudan's conflict on hunger, displacement, and instability risk spilling over to neighboring states, threatening wider regional security, and undermining progress toward global food security targets, including SDG 2 (Zero Hunger).

Limitations and future research

This study has several limitations that warrant acknowledgment. First, reliance on CATI data may introduce selection bias, as households without reliable phone access are likely underrepresented. Second, the analysis relies on a single food security indicator, the FIES, which, while widely validated, does not capture all dimensions of food security such as dietary diversity, nutrition adequacy, or food utilization. Third, the econometric approach provides valuable insights into correlates of household food insecurity but does not fully address potential endogeneity between conflict dynamics and welfare outcomes. Future research should expand on this work by incorporating multiple indicators of food security, applying mixed methods designs, and using longitudinal or experimental approaches to better capture the causal pathways linking conflict and household food insecurity.

References

- Abdalla, R. 2018. *Food Security in Sudan: Challenges and Prospects*. Khartoum University Press.
- Abushama, H., D. Resnick, K. Siddig, and O.K. Kirui. 2023. "Political and Economic Drivers of Sudan's Armed Conflict: Implications for the Agri-Food System." Sudan SSP Working Paper 15. IFPRI. <https://hdl.handle.net/10568/137896>
- Alhelo, A., K. Siddig, and O.K. Kirui. 2023. "The Architecture of the Sudanese Agricultural Sector and Its Contribution to the Economy between 1990 and 2021." IFPRI Discussion Paper 02191. IFPRI. <https://hdl.handle.net/10568/131415>
- Ballard, T.J., A.W. Kepple, and C. Cafiero. 2013. *Political and Economic Drivers of Sudan's Armed Conflict: Implications for the Agri-Food System*. FAO. <https://openknowledge.fao.org/handle/20.500.14283/as583c>
- Bond, T.G., and C.M. Fox. 2015. *Applying the Rasch Model: Fundamental Measurement in the Human Sciences*. Third ed. Routledge.
- Boone, W.J. 2017. "Rasch Analysis for Instrument Development: Why, When, and How?" *CBE: Life Sciences Education* 15:rm4. <https://doi.org/10.1187/cbe.16-04-0148>
- Cafiero, C., S. Viviani, and M. Nord. 2018. "Food Security Measurement in a Global Context: The Food Insecurity Experience Scale." *Measurement* 116:146–152. <https://doi.org/10.1016/j.measurement.2017.10.065>
- Cappelli, F., V. Costantini, M. D'Angeli, G. Marin, and E. Paglialunga. 2024. "Local Sources of Vulnerability to Climate Change and Armed Conflicts in East Africa." *Journal of Environmental Management* 355:120403. <https://doi.org/10.1016/j.jenvman.2024.120403>

- Coleman-Jensen, A., C. Gregory, and A. Singh. 2015. *Household Food Security in the United States in 2013*. USDA-ERS Economic Research Report No. 173. USDA. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2504067
- FAO (Food and Agricultural Organization of the United Nations). 2016. *Methods for Estimating Comparable Rates of Food Insecurity Experienced by Adults Throughout the World*. FAO. <https://openknowledge.fao.org/handle/20.500.14283/i4830e>
- FAO. 2022. *Special Report – 2021 FAO Crop and Food Supply Assessment Mission to the Sudan*. FAO. <https://openknowledge.fao.org/handle/20.500.14283/cb9122en>
- FAO. 2024. “5 Things You Should Know About How Conflict in Sudan Is Devastating Agriculture and People’s Food Security.” *FAO News* (blog). April 15. <https://www.fao.org/emergencies/resources-repository/news/detail/5-things-you-should-know-about-how-conflict-in-sudan-is-devastating-agriculture-and-people%27s-food-security/en>
- FAO, IFAD (International Fund for Agricultural Development), UNICEF, WFP (World Food Programme), and WHO (World Health Organization). 2023. *The State of Food Security and Nutrition in the World 2023: Urbanization, Agrifood Systems Transformation and Healthy Diets across the Rural–Urban Continuum*. FAO. <https://openknowledge.fao.org/handle/20.500.14283/cc3017en>
- Gallant, R.A., and D.W. Nychka. 1987. “Semi-Nonparametric Maximum Likelihood Estimation.” *The Econometric Society* 55 (2):363–390. <https://doi.org/10.2307/1913241>
- Guo, Z., H. Abushama, K. Siddig, O.K. Kirui, K. Abay, and L. You. 2024. “Monitoring Indicators of Economic Activities in Sudan Amidst Ongoing Conflict Using Satellite Data.” *Defence and Peace Economics* 35 (8):992–1008. <https://doi.org/10.1080/10242694.2023.2290474>
- IFPRI and UNDP (United Nations Development Programme). 2024a. *Livelihoods in Sudan Amid Armed Conflict: Evidence from a National Rural Household Survey*. IFPRI and UNDP. <https://www.undp.org/sudan/publications/livelihoods-sudan-amid-armed-conflict>
- IFPRI and UNDP. 2024b. *The Socio-Economic Impact of Armed Conflict on Sudanese Urban Households*. IFPRI. <https://hdl.handle.net/10568/159599>
- IPC (Integrated Food Security Phase Classification). 2024a. *Famine Review Committee: Combined Review Of: (i) the Famine Early Warning System Network (FEWS NET) IPC Compatible Analysis for IDP Camps in El Fasber, North Darfur; and (ii) the IPC Sudan Technical Working Group Analysis of Zamzam Camp (North Darfur), Sudan. Conclusions and Recommendations*. IPC. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Famine_Review_Committee_Report_Sudan_July2024.pdf
- IPC. 2024b. *Sudan: IPC Acute Food Insecurity Analysis June 2024 - February 2025 Report*. IPC. https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Sudan_Acute_Food_Insecurity_Jun2024_Feb2025_Report.pdf

- IPC. 2025. *Sudan: Acute Food Insecurity Situation September 2025 – May 2026*. Integrated Food Security Phase Classification. <https://reliefweb.int/report/sudan/sudan-ipc-acute-food-insecurity-analysis-september-2025-may-2026-issued-november-2025>
- Kirui, O.K., M.O.M. Ahmed, K. Siddig et al. 2024. *Food Security and Social Assistance in Sudan during Armed Conflict: Evidence from the First Round of the Sudan Rural Household Survey (November 2023–January 2024)*. A joint report by the International Food Policy Research Institute (IFPRI) and the World Food Programme (WFP). IFPRI. <https://hdl.handle.net/10568/145388>
- Kirui, O.K., M. Ahmed, A.S. Taffesse, H. Abushama, and K. Siddig. 2024. “Sudan Rural Household Survey 2023: Sampling and Implementation Procedures for the First Round.” Sudan SSP Working Paper 18. IFPRI. <https://hdl.handle.net/10568/141598>
- Kirui, O.K., K. Siddig, M. Ahmed, H. Abushama, and A.S. Taffesse. 2023. “Impact of the Ongoing Conflict on Smallholder Farmers in Sudan: Evidence from a Nationwide Survey.” “Sudan SSP Working Paper 17. IFPRI. <https://hdl.handle.net/10568/140241>
- Krafft, C., and R. Assaad. 2023. “Introducing the Sudan Labor Market Panel Survey 2022.” ERF Working Paper No. 1647. ERF (Economic Research Forum). <https://erf.org.eg/publications/introducing-the-sudan-labor-market-panel-survey-2022/?tab=undefined&c=undefined>
- Mohamed, E.S.E. 2022. “Climate Change, Agricultural Production, and Food Security in Sudan.” *Journal of Economics and Research* 3 (1):1–19. <https://doi.org/10.53280/jer.1082393>
- Nord, M., C. Cafiero, and S. Viviani. 2016. “Methods for Estimating Comparable Prevalence Rates of Food Insecurity Experienced by Adults in 147 Countries and Areas.” *Journal of Physics: Conference Series* 772 (1):012060. <https://doi.org/10.1088/1742-6596/772/1/012060>
- Owino, A., R. Wesonga, and F. Nabugoomu. 2014. “Determining Food Insecurity: An Application of the Rasch Model with Household Survey Data in Uganda.” *International Journal of Food Science* 2014 (1):121269. <https://doi.org/10.1155/2014/121269>
- Rasch, G. 1980. *Probabilistic Models for Some Intelligence and Attainment Tests*. University of Chicago Press.
- Reise, S.P., and D.A. Revicki. 2015. *Handbook of Item Response Theory Modeling: Applications to Typical Performance Assessment*. Routledge.
- Siddig, K., M. Raouf, and M.O.M. Ahmed. 2023. “The Economy-Wide Impact of Sudan’s Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty.” Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>
- Smith, M.D., M.P. Rabbitt, and A. Coleman-Jensen. 2017. “Who Are the World’s Food Insecure? New Evidence from the Food and Agriculture Organization’s Food Insecurity Experience Scale.” *World Development* 93:402–412. <https://doi.org/10.1016/j.worlddev.2017.01.006>
- Stewart, M.B. 2004. “Semi-Nonparametric Estimation of Extended Ordered Probit Models.” *The Stata Journal* 4 (1):27–39. <https://doi.org/10.1177/1536867X0100400102>

UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>

UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2023. *Sudan Humanitarian Needs and Response Plan 2024*. UNOCHA. <https://reliefweb.int/node/4025287>

UNOCHA. 2024. *Sudan Humanitarian Update (1 October 2024)*. UNOCHA. <https://www.unocha.org/publications/report/sudan/sudan-humanitarian-update-1-october-2024>

WFP (World Food Programme). n.d. “2020-2022 WFP Consolidated Approach for Reporting Indicators of Food Security data.” Unpublished dataset.

World Bank. 2024a. *Livelihoods Lost - Findings from Two Rounds of the Somalia Displacement Phone Survey (2022)*. World Bank. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/099062824105528285>

World Bank. 2024b. *Yemen Country Climate and Development Report*. World Bank. <https://hdl.handle.net/10986/42274>

HUMAN CAPITAL AT RISK: THE IMPACT OF CONFLICT ON HEALTH AND EDUCATION IN SUDAN

Ebaidalla M. Ebaidalla, Mohammed Gebrail, Gotada Suliman, Oliver K. Kirui, Tarig Alhaj Rakhy, and Halefom Yigzaw Nigus

Human capital, including the knowledge, skills, and health of a population, is the foundation for economic growth and development (Lucas Jr. 1988; Mankiw et al. 1992; Pelinescu 2015). Healthcare and education stand out as critical pillars that directly enhance human capital, influencing individual well-being, workforce productivity, and development (Barro and Sala-i-Martin 1995; Schultz 2003; Hanushek and Woessman 2012). Access to quality healthcare ensures a healthy and productive population capable of contributing to economic activities, while education equips individuals with the skills and knowledge essential for innovation and global competitiveness. Together, these sectors constitute the backbone of a nation's resilience and long-term prosperity (Kim and Ahn 2020; Wang and Gu 2024).

Conflicts and wars lead to severe disruptions in healthcare and education, with long-term consequences for human capital development and economic growth (Amara and Hendricks 2009; Milton and Barakat 2016). In conflict zones, healthcare systems often collapse as a result of the destruction of infrastructure, shortages of medical supplies, and the displacement of healthcare professionals, leading to increased mortality rates and the spread of preventable diseases (Ghobarah et al. 2003; Levy and Sidel 2008; Goniewicz et al. 2023). Similarly, wars have a profound impact on education, as schools are frequently damaged or repurposed, teachers are displaced, and students are forced to abandon their studies (Lai and Thyne 2007; Justino 2011; Merrouche 2011). This disruption not only halts individual learning but also weakens the foundation for future economic productivity and societal progress (Égert and de la Maisonneuve 2024).

The eruption of war between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) in mid-April 2023 has had devastating effects, crippling all service sectors in Sudan (Taha et al. 2023; Konozy 2024b). In the healthcare sector, hospitals, pharmacies, and health centers in conflict zones have been destroyed or rendered inoperable (Khogali and Homeida 2023; Al Mahdi and Fahal 2024), while medical staff have been displaced or forced to

cease work due to deteriorating security conditions. This severe disruption has resulted in acute shortages of healthcare services, rising mortality rates, and the spread of infectious diseases. Likewise, the education sector has experienced a near-total collapse. Schools and universities across the country have been closed, depriving millions of students, and thousands of teachers, of continuing the educational process (Konozy 2024a). Moreover, the war has compounded preexisting challenges in these sectors, which had already faced significant setbacks in previous years due to political instability, economic challenges, and the COVID-19 pandemic (Konozy 2024a; Ebaidalla and Nour 2021). At a time when healthcare and education were already at their most vulnerable, the outbreak of the current war has pushed these systems to the brink of collapse, even in relatively safer areas, due to severe shortages of essential supplies.

This chapter shifts the analytical lens from macroeconomic narratives of collapse to bottom-up strategies of survival and adaptation. We explore how civilians, often portrayed as passive victims, have emerged as central economic and social actors navigating a fragmented service environment. The chapter draws on new evidence from the 2024 IFPRI-UNDP Urban Households Survey, alongside qualitative data from interviews with teachers, healthcare workers, and community leaders. Together, these sources offer an integrated perspective on how communities across Sudan are grappling with the collapse of formal systems, while simultaneously devising grassroots solutions to sustain health and education access.

Building on this backdrop, this chapter assesses the impact of the war on Sudan's healthcare and education sectors. Specifically, it addresses the following key questions: How has the war affected Sudan's healthcare system, particularly regarding infrastructure destruction, supply chain disruptions, displacement of healthcare workers, and disease outbreaks? How has the education sector been impacted, including damage to schools and universities and the displacement of teachers and students? What are the long-term consequences of the conflict for human capital, such as brain drain, skill shortages, and generational setbacks in education? Finally, what strategies can support recovery and rebuilding?

The findings underscore a dual imperative: to protect existing grassroots capacities and to reimagine inclusive, decentralized systems that can thrive even in fragile contexts. In examining the erosion of health and education systems, we pay particular attention to regional disparities, gendered vulnerabilities, and the shifting roles of informal actors. We further highlight the need for policies that integrate emergency aid with long-term rebuilding of systems, with special focus on inclusivity, local engagement, and resilience-building.

The rest of this chapter is structured as follows: The next section highlights the prewar conditions, evaluating the performance of the healthcare and education sectors. This is followed by sections that analyze the war's impact on healthcare and education, focusing on infrastructure destruction, service disruptions, and the displacement of healthcare workers and educators. We then explore the long-term implications and recovery pathways, including human capital erosion and strategies for rebuilding. The chapter concludes with key findings and policy recommendations.

Preconflict state of healthcare and education

Sudan's healthcare and education sectors were fragile even before the outbreak of the current conflict. Despite some development efforts following the ouster of President Omar Al-Bashir in 2019, years of chronic underfunding, economic mismanagement, political instability, and regional inequalities left these sectors underdeveloped and poorly equipped to meet the needs of the population.

This chapter draws on secondary data and published reports, including publications from international organizations,¹ Sudan's prewar national statistics, and recent humanitarian assessments by international organizations. The analysis adopts a descriptive and comparative approach, reviewing trends before and after the outbreak of the conflict and synthesizing evidence from regional and global experiences in fragile contexts. The aim is to provide a structured assessment of how the war has disrupted service delivery and to identify feasible policy responses based on evidence from similar crisis settings.

Healthcare: Accessibility, preexisting challenges, and key performance indicators

Accessibility and preexisting challenges

By 2021, an estimated 9.2 million people—or nearly 23 percent of the population—required healthcare assistance. Access was hindered by the high cost of medicines, the weak health insurance system, and the shortage of functioning facilities. Particularly in conflict-affected areas such as Darfur, South Kordofan, and Blue Nile, healthcare infrastructure was scarce or nonexistent. Poor road

1 These include the World Health Organization, UNICEF, the United Nations Educational, Scientific and Cultural Organization, and the World Bank, among others.

infrastructure, high poverty levels, and sociocultural barriers—including distrust in modern medicine—further compounded these challenges (WHO 2025).

Staffing shortages were acute. Sudan had just 4.1 physicians and 8.2 nurses per 10,000 people (Wharton et al. 2020). The country faced a sustained brain drain, as doctors and health professionals emigrated in search of better opportunities. In addition, weak data systems, the rising burden of noncommunicable diseases, and high out-of-pocket healthcare costs further undermined access and quality (Charani et al. 2019; Ebaidalla and Ali 2019).

Government spending remained consistently low. In 2021, Sudan’s public health expenditure was estimated at just 2 percent of GDP—significantly below the average for sub-Saharan Africa. Hospitals and clinics in urban areas such as Khartoum and Port Sudan provided comparatively better services, but faced overcrowding, outdated equipment, frequent shortages of essential medicines, and understaffing. The disease burden remained high, especially communicable diseases such as malaria, tuberculosis, and diarrheal diseases. The COVID-19 pandemic further exposed weaknesses in healthcare infrastructure, overwhelming hospitals and disrupting essential services (Ebaidalla and Nour 2021).

Healthcare performance indicators

Life expectancy at birth in Sudan has improved only marginally over the last two decades, from 58.9 to 66.3 years (2000–2023), and remains significantly lower than in North African countries such as Egypt, Tunisia, and Morocco, but similar to life expectancy in Kenya and 9 years longer than in South Sudan (Table 10.1).

TABLE 10.1 Average life expectancy at birth (in years), 2000, 2010, and 2023

	2000	2010	2023	2000–2023
Algeria	70.6	74.1	76.3	5.7
Egypt	67.3	69.1	71.6	4.3
Eritrea	56.3	63.7	68.6	12.3
Ethiopia	50.9	59.7	67.3	16.4
Kenya	56.1	60.9	63.6	7.6
Morocco	66.8	70.8	75.3	8.5
South Sudan	47.6	57.5	57.6	10.0
Sudan	58.9	63.0	66.3	7.4
Tanzania	53.2	61.1	67.0	13.8
Tunisia	72.6	74.4	76.5	3.9
Uganda	49.6	60.0	68.3	18.6
Average	59.1	64.9	69.0	9.9

Source: World Bank (2025)

Sudan's infant mortality and under-five mortality rates in 2023 were also similar to those in Kenya, with infant mortality rates of 39.2 and 34.7 per 1,000 live births in Sudan and Kenya, respectively, but notably better than South Sudan (see Tables 10.2 and 10.3). Again, South Sudan's welfare indicators are the worst in the region, with mortality rates far higher than other countries in the region—an infant mortality rate of 72.6 per 1,000 live births

TABLE 10.2 Infant mortality rate (per 1,000 live births), 2000, 2010, and 2023

	2000	2010	2023	2000–2023 (% change)
Algeria	34.7	24.4	19.7	–15.0
Egypt	39.6	25.6	16.1	–23.5
Eritrea	50.8	37.5	25.5	–25.3
Ethiopia	92.2	59.3	35.7	–56.5
Kenya	63.8	41.4	34.7	–29.1
Morocco	45.2	28.2	15.5	–29.7
South Sudan	118.5	79.0	72.6	–45.9
Sudan	70.8	54.5	39.2	–31.6
Tanzania	85.3	48.5	29.9	–55.4
Tunisia	23.9	16.7	10.6	–13.3
Uganda	89.8	49.5	27.6	–62.2
Average	65.0	42.2	29.7	–35.2

Source: World Bank (2025).

TABLE 10.3 Under-five mortality rate (per 1,000 live births), 2000, 2010, and 2023

	2000	2010	2023	2000–2023 (% change)
Algeria	41.6	28.1	22.0	–19.6
Egypt	46.6	28.6	17.5	–29.1
Eritrea	85.3	55.0	35.4	–49.9
Ethiopia	140.4	83.2	46.5	–93.9
Kenya	96.3	53.5	39.9	–56.4
Morocco	52.2	31.1	16.6	–35.6
South Sudan	182.7	109.4	98.7	–84.0
Sudan	103.4	74.2	50.1	–53.3
Tanzania	128.4	68.6	38.9	–89.5
Tunisia	29.2	18.7	12.9	–16.3
Uganda	145.6	76.1	38.8	–106.8
Average	95.6	57.0	37.9	–57.7

Source: World Bank (2025).

in 2023. These trends align with findings from previous studies, such as Ebaidalla (2023) and Nour and Ebaidalla (2025), which document the worsening health conditions of children under five in Sudan.

Education: Infrastructure, systemic barriers, and key indicators

Educational infrastructure and systemic barriers

Prior to the war, Sudan's education sector faced critical challenges at all levels. Enrollment rates were among the lowest in the region, with a primary net enrollment of just 59 percent (UNESCO UIS 2025). Stark disparities persisted between urban and rural areas and between boys and girls, particularly in conflict-affected states such as Darfur and South Kordofan.

Public school infrastructure was widely inadequate. Many schools lacked basic furniture and sanitation, operated on double shifts, and were housed in dilapidated buildings. Teacher strikes, protesting unpaid salaries, were frequent, which disrupted academic calendars even before the conflict. Moreover, systemwide underinvestment plagued the sector. Public education spending in Sudan in the last decade has been around 1.2 percent of GDP, which is substantially below the sub-Saharan African average of about 4 percent of GDP (World Bank 2025). Curricula were outdated, teacher training weak, and language policy inconsistencies further complicated learning outcomes. COVID-19 intensified these issues, causing prolonged school closures and increasing dropout rates.

The higher education sector, though expanded in recent decades, also suffered. Sudan hosted 128 higher education institutions, including both public and private entities, with more than half of them concentrated in Khartoum. Academic staff exceeded 21,000, supporting nearly 670,000 students (Beshir et al. 2020). However, funding constraints under the Bashir regime resulted in salary erosion and a decline in research productivity. Many lecturers were compelled to take on secondary employment, reducing time for academic responsibilities (Elgadal and Glade 2024).

These financial and operational challenges were compounded by political unrest from 2018 onward as well as pandemic-related disruptions. As a result, even before the war, Sudan's education system was marked by fragmentation, inequality, and declining performance. These vulnerabilities left the sector ill-prepared to withstand the devastation that followed the April 2023 conflict.

Educational indicators: Enrollment and literacy rates

Quantitative indicators reflect the structural weaknesses in Sudan's education system prior to the conflict. Figure 10.1 presents comparative enrollment rates for Sudan and selected countries in North and East Africa from 2000 to 2022. While countries such as Morocco and Kenya achieved preprimary enrollment rates of about 56 percent, Sudan recorded just 33 percent, evidence of Sudan's significant lag in early childhood education. This low coverage reflects socioeconomic barriers to education, such as widespread poverty and the high cost of early education (Ebaidalla 2018; Ebaidalla and Rakhy 2024).

At the primary level, Sudan consistently recorded the lowest enrollment rates in the region (except for South Sudan), reflecting chronic underperformance and limited school access. Secondary school enrollment was approximately 40 percent, ranking below most East African comparators, which highlights the elevated dropout rates driven by low household incomes, insecurity, and child labor. At the tertiary level, Sudan's enrollment rate stood at 12.5 percent, again trailing behind countries such as Egypt and Libya, reflecting affordability issues, capacity constraints, and regional disparities in access to universities.

Literacy indicators paint a similarly grim picture. As Figure 10.2 shows, Sudan's adult literacy rate was just 60.7 percent in 2018—ranking only above Ethiopia within the comparison group. This persistent illiteracy points to the cumulative effects of low enrollment, poor education quality, and systemic barriers to learning across decades. Together, these figures underscore the dire state of Sudan's education system on the eve of war and the need for long-term structural reform.

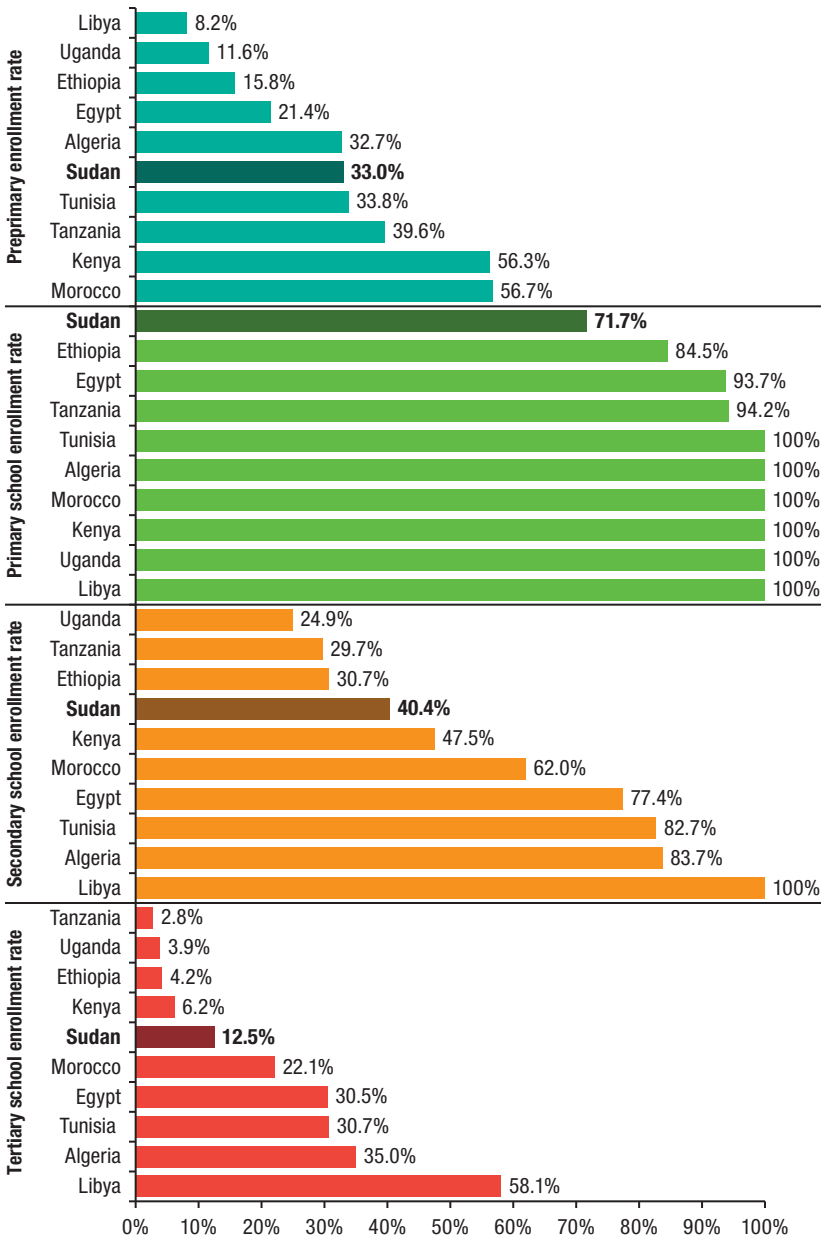
Impact of the war on healthcare

The conflict that erupted in April 2023 has pushed Sudan's healthcare system to the brink of collapse. Igniting amid chronic underinvestment and preexisting workforce shortages, the war has compounded existing vulnerabilities, leading to a near-total breakdown of essential services, especially in Khartoum, Aj Jazirah, and Darfur.

Destruction of infrastructure and supply chain disruptions

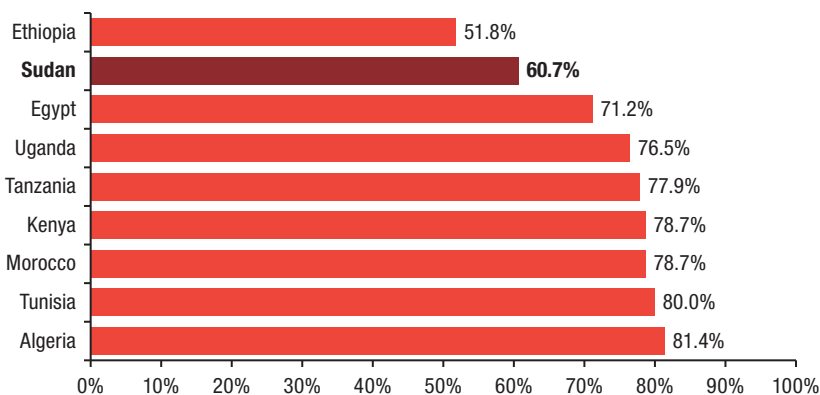
According to the World Health Organization (WHO), approximately 70 percent of healthcare facilities in conflict-affected areas have been destroyed or forced to close, leaving an estimated 11 million people in urgent

FIGURE 10.1 Enrollment rate by educational level, average 2000–2022 (percent)



Source: World Bank (2025).

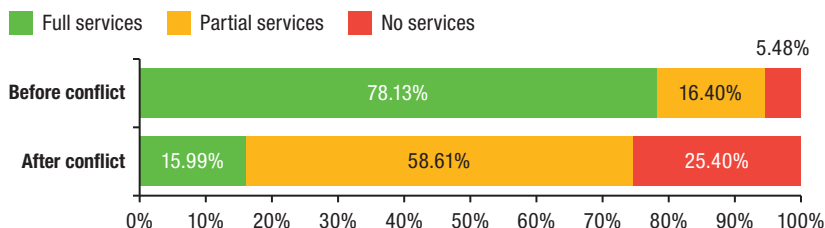
FIGURE 10.2 Literacy rate, adult total (percentage of people ages 15 and above), 2018



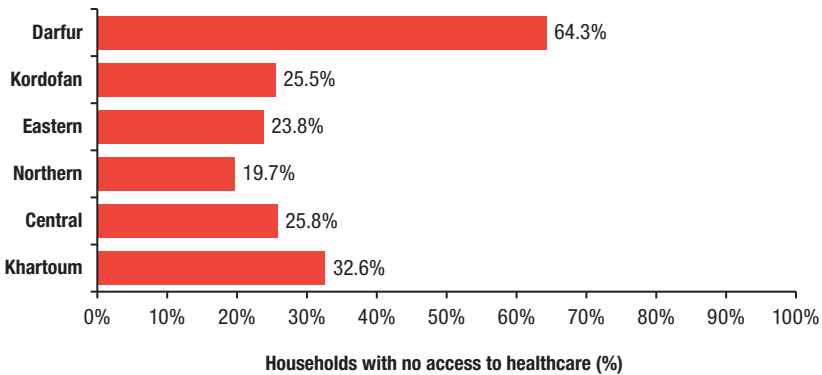
Source: World Bank (2025).

need of medical assistance (WHO 2024). The Safeguarding Health in Conflict Coalition (SHCC), an international consortium of humanitarian and medical organizations that monitors attacks on healthcare in conflict settings, recorded 521 attacks on healthcare services, including the occupation of health facilities on at least 41 occasions (Insecurity Insight 2024). Data from the 2024 IFPRI Urban Household Survey reveals a sharp decline in access to healthcare: while 78 percent of households reported having full access to health services before the war, only 15 percent maintained such access after the conflict began, and nearly one-quarter (24.6 percent) reported no access at all (Figure 10.3).

FIGURE 10.3 Households’ reported ability to obtain health services before and during the conflict



Source: Authors’ compilation from 2024 IFPRI-UNDP Urban Households Survey.

FIGURE 10.4 Urban households reporting no access to health services, by region

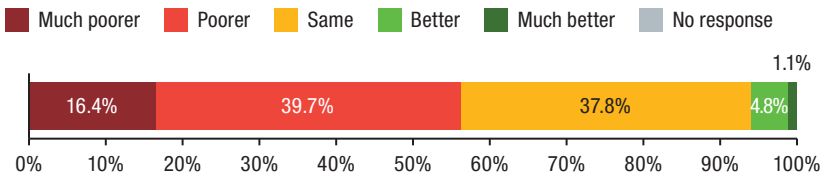
Source: Authors' compilation from 2024 IFPRI-UNDP Urban Households Survey.

Supply chain disruptions have been driven by insecurity, destruction of transport infrastructure, and looting. The World Food Programme reported losses of US\$13–14 million in medical supplies, while SHCC estimated a \$500 million loss in essential medical resources. The survey shows stark regional disparities in unmet health needs. As shown in Figure 10.4, urban households in Darfur reported the highest levels of no access (64.3 percent), followed by Khartoum (32.6 percent). Regions such as the River Nile and Gedaref experienced relatively better access to healthcare, reflecting their relatively lower exposure to conflict compared to other regions.

Displacement of healthcare workers and its effects

Prior to the war, Sudan already faced health worker shortages; for example, there were only 3.6 physicians per 10,000 people. The war worsened the situation through mass displacement and targeted attacks on health workers. SHCC documented the deaths of 56 healthcare workers, with many others abducted or threatened (Insecurity Insight 2024). Hospitals were looted or occupied, and medical training institutions shut down—undermining the pipeline for future health professionals.

This exodus has contributed to one of Africa's most acute cases of medical brain drain, with many Sudanese professionals migrating to Gulf states. Those who remained have often worked under threat or in severely resource-constrained environments, particularly in conflict hotspots including Khartoum and Darfur.

FIGURE 10.5 Urban households' own rating of current health status relative to before the conflict

Source: Authors' compilation from 2024 IFPRI-UNDP Urban Households Survey.

Public health outcomes: Disease, malnutrition, and maternal health

Widespread service disruption has contributed to a quadruple burden of disease—rising communicable diseases, noncommunicable diseases, malnutrition, and mental health challenges. WHO (2024) reports that 12 of 18 Sudanese states are experiencing three or more disease outbreaks concurrently. Cholera alone has sickened 9,500 people and caused 315 deaths, while dengue fever has been recorded in 12 states.

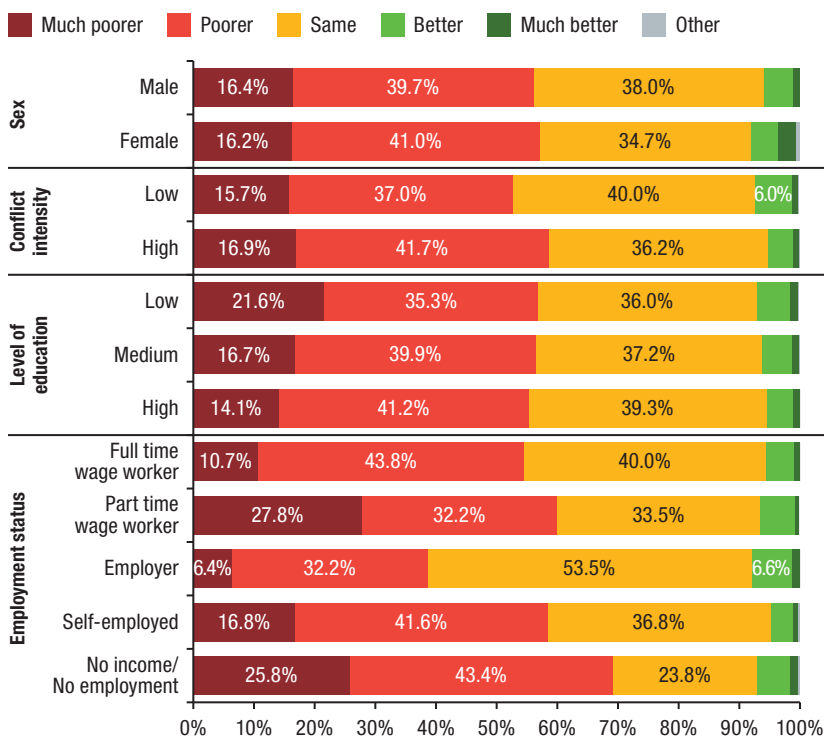
Child and maternal health outcomes have worsened rapidly. According to Médecins Sans Frontières, 114 maternal deaths were reported in South Darfur alone by mid-August 2024 (Doctors Without Borders 2024). Immunization programs were suspended when cold chain facilities were looted and vaccine stockpiles destroyed. SHCC estimates that more than 700,000 children face malnutrition amid rising food insecurity and the shutdown of nutrition services.

The IFPRI-UNDP Survey underscores that vulnerable groups—the poor, unemployed, and less educated—report significantly worse health outcomes. In highly affected regions, 39.7 percent of respondents said their health status had become “poorer” and 16.4 percent reported it was “much poorer” (Figure 10.5).

Households with better employment status (for example, self-employed) showed greater resilience, likely due to stronger financial coping mechanisms and better access to care (Figure 10.6).

Impact of the war on education

The ongoing war has triggered one of the worst education crises globally. Sudan now has the highest number of out-of-school children worldwide.

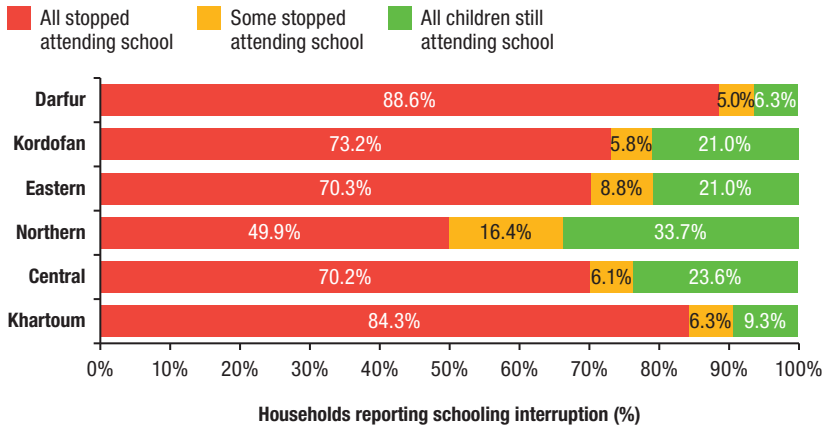
FIGURE 10.6 Urban households' health status by household characteristics

Source: Authors' compilation from 2024 IFPRI-UNDP Urban Households Survey.

The disruption has affected nearly every region, destroying physical infrastructure, displacing educators and students, and leaving an entire generation at risk.

School closures and infrastructure damage

More than 10,400 schools have closed, leaving 19 million children without access to formal education (UNICEF 2023). Results from 2024 IFPRI-UNDP survey show that school disruptions were widespread across Sudan, affecting households across all socioeconomic groups. Overall, dropout rates exceeded 80 percent in several regions, particularly Darfur and Khartoum, where 88.6 percent and 84.3 percent of households with school-going children, respectively, reported that all children had stopped attending school (Figure 10.7). In Kordofan and Central Sudan, the share of households

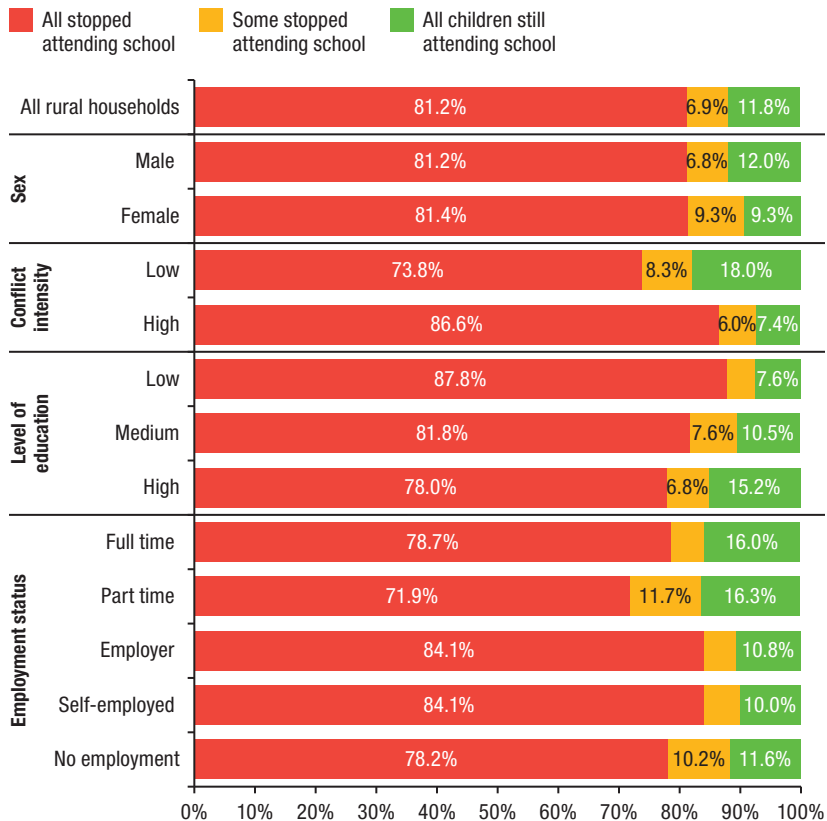
FIGURE 10.7 Distribution of households with school-age members and status of enrollment, by region

Source: Authors' compilation from 2024 IFPRI-UNDP Urban Households Survey.

reporting that all children had stopped schooling was also very high, at 73.2 percent and 70.2 percent, respectively. Even in relatively more stable regions such as eastern Sudan, 70.3 percent of households reported complete school dropout, with only 21 percent indicating that their children were still enrolled.

Northern Sudan presented somewhat lower rates of full dropout (49.9 percent), but nearly one-fifth of households (16.4 percent) reported partial dropout, reflecting closures, insecurity, or the use of schools as shelters. While a small share of households across all regions managed to keep children enrolled, these were typically concentrated in pockets with greater stability or access to private/community schooling.

Analysis further shows that school interruptions affected nearly all rural household groups, with more than 75 percent of children stopping schooling regardless of household characteristics (Figure 10.8). Differences by sex of household head and education level were modest, though households with higher education were slightly more likely to keep children in school (15 percent still attending compared to 7–10 percent among others). Conflict intensity and employment status, however, show clearer patterns: in low-intensity conflict areas, 18 percent of households reported children still in school, compared to only 7 percent in high-intensity zones. Similarly, part-time and non-employed households experienced the highest dropout rates, while

FIGURE 10.8 Households with school-age members and status of enrollment, by selected household characteristics

Source: Authors' compilation from 2024 IFPRI-UNDP Urban Households Survey.

households with more stable employment were somewhat better positioned to maintain schooling (Figure 10.8). Overall, the results underscored that while school dropout was widespread, socioeconomic conditions and conflict intensity shaped the degree of disruption.

Teacher and student displacement

The ongoing war in Sudan has forced mass migration from conflict-affected regions, including thousands of teachers and students. As of February 2026, the United Nations High Commissioner for Refugees reported that nearly 12 million people had been forcibly displaced, with 4.5 million fleeing to

neighboring countries, and 7 million internally displaced within Sudan (UNHCR 2026). This widespread displacement has completely disrupted the continuity of education (Elhag and Baleela 2025).

Educators and students who fled to countries such as Egypt, South Sudan, Ethiopia, and Uganda face a host of challenges. In Egypt, Sudanese academics encounter a saturated and underfunded higher education system, leaving many unable to secure employment. Students, meanwhile, are confronted with high tuition fees and complex bureaucratic processes that inhibit continued learning. In Uganda and other host countries, restrictions on employment and inadequate recognition of academic qualifications—especially for those whose studies were interrupted—further complicate the integration of Sudanese refugees into host-country education systems (Elgadal and Glade 2024).

Moreover, the use of more than 3,000 schools as shelters for displaced families has constrained the availability of learning spaces, even in regions with relatively lower conflict intensity (UNICEF 2024). Teachers who relocated to safer cities in Sudan face uncertain futures, with most no longer receiving salaries and many forced to accept low-skilled or informal jobs to survive.

Gendered impacts and inequality

Gender inequality in Sudan, particularly in education, is deeply rooted in patriarchal norms that restrict female autonomy and participation. Despite decades of efforts by women and girls to challenge these norms through literacy programs and educational advancement, traditional barriers—especially in rural areas—continue to constrain their access to schooling (Ebaidalla and Rakhy 2024). Early marriage, long distances to schools, and the prioritization of male education are longstanding impediments (Taha 2021), all of which are magnified in times of conflict.

The war has dramatically increased girls' vulnerability to school dropout, sexual exploitation, and early marriage. Hyperinflation, widespread poverty, and the breakdown of educational infrastructure have driven families to withdraw girls from school, often compelling them into early marriage as a coping mechanism. According to UNICEF (2024), girls who are out of school face a significantly greater risk of child marriage than their peers who remain enrolled.

Gender-based violence has also surged in conflict-affected areas. The Human Rights Council's Fact-Finding Mission on Sudan documented systematic sexual and gender-based violence, including widespread incidents of rape and gang rape committed by armed actors. Victims range from age 8 to 75, with women and girls constituting the majority of reported victims. These

violations further diminish their ability to access safe education or medical services (UNHRC 2024).

The compounding effect of displacement, poverty, and insecurity has resulted in a deepening gender gap in education access, with long-term implications for female empowerment, community resilience, and human capital development in Sudan.

Long-term implications and pathways to recovery

Human capital erosion: Brain drain, skill gaps, and generational effects

International experience shows that postconflict societies often take decades to rebuild lost human capital. Rwanda, Liberia, Sierra Leone, and Syria all faced prolonged brain drain, skill shortages, and setbacks in education and health services despite international support (Collier 2008; Roy-Campbell 2005; Sesay and Ukeje 2009; Tigau 2019).

Sudan now faces a similar challenge. Nearly two years into the war, widespread displacement of skilled professionals—especially in healthcare and education—has deepened the country’s human capital crisis. Thousands of doctors, nurses, professors, and researchers have fled to neighboring and Western countries to escape insecurity and economic collapse (Omar et al. 2024; Saleh et al. 2024).

Once peace is achieved, this exodus threatens to derail postwar recovery, as the departure of professionals creates urgent service gaps. With universities and training institutions either closed or severely impaired, replenishing lost skills will be difficult. The compound effect of workforce loss, institutional breakdown, and prolonged school closures risks generating long-term deficits across critical sectors. The generational effects of the war are particularly alarming. Millions of children and youth have lost access to education, risking a decline in literacy, productivity, and national growth. Research shows that disruptions to education can limit intergenerational mobility and deepen poverty (Justino 2012; Haveman et al. 2015). Without urgent interventions, Sudan could face a “lost generation”—one unable to contribute meaningfully to future recovery.

Role of international and local actors in rebuilding

Rebuilding Sudan’s education and healthcare systems will require sustained collaboration among international partners, government institutions,

civil society, and the diaspora population. Multilateral organizations such as the United Nations (UN), WHO, and UN Educational, Scientific and Cultural Organization (UNESCO) are critical for mobilizing immediate aid, technical expertise, and long-term funding (Collier and Hoeffler 2004; Buckland 2005).

Humanitarian nongovernmental organizations (NGOs) and local initiatives can also bridge immediate service gaps. Their deep community ties enable culturally responsive delivery of healthcare and education. During the ongoing conflict, NGOs have played a vital role in reaching displaced populations, particularly in eastern and northern Sudan.

The Sudanese diaspora presents an underutilized but vital asset. Many skilled professionals abroad can be reengaged through strategic programs that offer incentives, reintegration pathways, or virtual collaboration opportunities. For instance, Rwanda and Sierra Leone implemented diaspora engagement programs that facilitated investment, temporary return, and remote service delivery through telemedicine and education (IOM 2018a; 2018b).

Community-based strategies for education and health recovery

Given the destruction of healthcare infrastructure and the severe disruption to education, recovery efforts should prioritize low-cost, context-appropriate approaches with proven effectiveness in fragile and resource-constrained settings (Banerji and Chavan 2020). In the education sector, the Teaching at the Right Level (TaRL)² approach offers an evidence-based method to help children who have missed months or years of schooling to catch up. Instead of following rigid age- or grade-based instruction, TaRL groups students according to their actual learning levels and focuses on building foundational literacy and numeracy skills (J-PAL 2018). This method has improved learning outcomes across countries and, as it can be delivered by teachers or trained volunteers, is well-suited for conflict-affected contexts like Sudan.

In the health sector, strengthening the role of community health workers (CHWs) presents a feasible and effective strategy. CHWs can provide essential health services, preventive care, and health education directly within communities, especially where health facilities have been damaged or are inaccessible (Perry et al. 2021). Evidence demonstrates that CHWs improve access and outcomes in fragile, low-resource contexts (Gilmore and McAuliffe 2013). Adopting CHW programs in Sudan would help sustain primary healthcare delivery and build resilience at the community level.

2 See <https://teachingattherightlevel.org/>

Conclusion and recommendations

The armed conflict has devastated Sudan's healthcare and education systems, inflicting long-term damage on the country's human capital. Widespread destruction of infrastructure, displacement of professionals, and severe shortages in essential services have brought both sectors near collapse.

In healthcare, hospitals and clinics have been destroyed or rendered inoperable. Displacement and targeted attacks on medical personnel have left millions without access to essential care. Disruptions in supply chains have caused critical shortages of medicines, vaccines, and equipment. The breakdown of public health infrastructure has fueled disease outbreaks, rising mortality, and maternal and neonatal complications, particularly in conflict-affected and displaced communities.

The education sector has experienced similar devastation. The prolonged closure of schools and universities has disrupted the learning trajectories of millions of students. Displaced teachers and damaged infrastructure have deepened inequality in access—especially among marginalized groups, including girls and rural communities. If unaddressed, these disruptions risk producing a “lost generation” with limited prospects for recovery or social mobility. Compounding this crisis is a massive brain drain. The migration of doctors, educators, and researchers has created acute skills gaps. With training institutions shuttered, and professional pipelines broken, Sudan faces long-term deficits in expertise essential for rebuilding its public services and economy.

Policy recommendations for recovery and resilience

To restore essential services, rebuild human capital, and foster long-term resilience, the following priority actions should be considered:

1. Strengthen partnerships with multilateral agencies (for example, WHO, UNESCO, and UNICEF) to mobilize financial resources, technical assistance, and policy support.
2. Empower community-based organizations and NGOs to deliver locally responsive healthcare and education services in the absence of formal infrastructure.
3. Improve governance and sector resilience through transparent planning, accountability mechanisms, and crisis contingency strategies.

4. Retain and reintegrate skilled professionals, including diaspora members, through targeted incentives and remote engagement initiatives.
5. Ensure inclusive, gender-sensitive programming, prioritizing access for girls, persons with disabilities, and internally displaced populations.
6. Integrate mental health and psychosocial support into recovery plans, with community outreach, training, and stigma reduction efforts.
7. Invest in teacher training and modernized curricula to address learning loss and promote quality education in recovery settings.
8. Establish a National Human Capital Task Force to coordinate health-care and education recovery, streamline resource allocation, and oversee long-term rebuilding efforts.
9. Implement TaRL to support catch-up learning and restore foundational skills among conflict-affected children.
10. Expand and support CHW programs to sustain essential healthcare delivery in areas with damaged or inaccessible facilities.

References

- Al Mahdi, T.A.S., and A.H. Fahal. 2024. "The Effect of Sudan's April 2023 War on Medical Education and Prospects for Recovery." *Sudan Journal of Medical Sciences* 19 (3):356–366. <https://doi.org/10.18502/sjms.v19i3.14819>
- Amara, J., and A. Hendricks. 2009. "Healthcare Issues of the Iraq and Afghan Wars: Short- and Long-Term Impacts on US Veterans' Healthcare." *Defense & Security Analysis* 25 (3):285–298. <https://doi.org/10.1080/14751790903201422>
- Banerji, R., and M. Chavan. 2020. "A Twenty-Year Partnership of Practice and Research: The Nobel Laureates and Pratham in India." *World Development* 127:104788. <https://doi.org/10.1016/j.worlddev.2019.104788>
- Barro, R.J., and X. Sala-i-Martin. 1995. *Economic Growth*. McGraw Hill.
- Beshir, M.M., N.E. Ahmed, and M.E. Mohamed. 2020. "Higher Education and Scientific Research in Sudan: Current Status and Future Direction." *African Journal of Rural Development* 5 (1):115–146. <https://afjrdev.org/index.php/jos/article/view/599>
- Buckland, P. 2005. *Reshaping the Future: Education and Post Conflict Reconstruction*. World Bank.

- Charani, E., A.J. Cunnington, A.H.A. Yousif et al. 2019. "In Transition: Current Health Challenges and Priorities in Sudan." *BMJ Global Health* 4:e001723. <https://doi.org/10.1136/bmjgh-2019-001723>
- Collier, P. 2008. *The Bottom Billion: Why the Poorest Countries Are Failing and What Can Be Done About It*. Oxford University Press.
- Collier, P., and A. Hoeffler. 2004. "Aid, Policy and Growth in Post-Conflict Societies." *European Economic Review* 48 (5):1125–1145. <https://doi.org/10.1016/j.eurocorev.2003.11.005>
- Doctors Without Borders. 2024. "Shocking Number of Maternal and Child Deaths in South Darfur, Sudan." *Doctors Without Borders News & Stories* (blog), September 24. <https://www.doctorswithoutborders.org/latest/shocking-number-maternal-and-child-deaths-south-darfur-sudan>
- Ebaidalla, E.M. 2018. "Understanding Household Education Expenditure in Sudan: Do Poor and Rural Households Spend Less on Education?" *African Journal of Economic Review* 6 (1):160–178. <https://doi.org/10.61538/ajer.v6i1.415>
- Ebaidalla, E.M. 2023. "Inequality of Opportunity in Child Health in Sudan: Across-Region Study." *Journal of Economic Development* 48 (1):59–83. <https://doi.org/10.35866/caujed.2023.48.1.003>
- Ebaidalla, E.M., and M.E.M. Ali. 2019. "Determinants and Impact of Household's Out-of-Pocket Healthcare Expenditure in Sudan: Evidence from Urban and Rural Population." *Middle East Development Journal* 11 (2):181–198. <https://doi.org/10.1080/17938120.2019.1668163>
- Ebaidalla, E.M., and S.S.O.M. Nour, eds. 2021. "Economic Growth and Labour Market Outcomes in an Agrarian Economy: The Case of Sudan." In *Regional Report on Jobs and Growth in North Africa 2020*, 152–182. ILO (International Labour Organisation) and ERF (Economic Research Forum).
- Ebaidalla, E.M., and T.A. Rakhy. 2024. "Education in Sudan: Disparities in Enrollment, Attainment and Quality. Economic Research Forum." ERF Working Paper No. 1707. ERF. <https://erf.org.eg/publications/education-in-sudan-disparities-in-enrollment-attainment-and-quality/?tab=undefined&c=undefined>
- Égert, B., and C. de la Maisonnette. 2024. "The Impact of the War on Human Capital and Productivity in Ukraine." *Policy Studies* 45 (3-4):282–292. <https://doi.org/10.1080/01442872.2023.2288687>
- Elgadal, M., and R. Glade. 2024. *Research in Displacement: The Impact of War on Sudan's Higher Education and Academic Research Community*. RVI (Rift Valley Institute). https://riftvalley.net/wp-content/uploads/2024/09/Research-in-Displacement-English_FINAL-update-291024.pdf
- Elhag, H.E.E.A., and R.M.H. Baleela. 2025. "Preliminary Investigation and Analysis of the Impact of the Sudan War on Higher Education and Scientific Research Sectors." *International Journal of Educational Development* 112:103190. <https://doi.org/10.1016/j.ijedudev.2024.103190>

- Ghobarah, H.A., P.K. Huth, and B. Russett. 2003. "Civil Wars Kill and Maim People—Long after the Shooting Stops." *American Political Science Review* 97:189–202. <https://doi.org/10.1017/S0003055403000613>
- Gilmore, B., and E. McAuliffe. 2013. "Effectiveness of Community Health Workers Delivering Preventive Interventions for Maternal and Child Health in Low- and Middle-Income Countries: A Systematic Review." *BMC Public Health* 13 (1):847. <https://doi.org/10.1186/1471-2458-13-847>
- Goniewicz, K., F.M. Burkle, M. Dzhus, and A. Khorram-Manesh. 2023. "Ukraine's Healthcare Crisis: Sustainable Strategies for Navigating Conflict and Rebuilding for a Resilient Future." *Sustainability* 15 (15):11602. <https://doi.org/10.3390/su151511602>
- Haveman, R., R. Blank, R. Moffitt, T. Smeeding, and G. Wallace. 2015. "The War on Poverty: Measurement, Trends, and Policy." *Journal of Policy Analysis and Management* 34 (3):593–638. <https://doi.org/10.1002/pam.21846>
- Hanushek, E.A., and L. Woessmann. 2012. "Do Better Schools Lead to More Growth? Cognitive Skills, Economic Outcomes, and Causation." *Journal of Economic Growth* 17 (4):267–321. <https://doi.org/10.1007/s10887-012-9081-x>
- Insecurity Insight. 2024. *Sudan: Violence against Health Care in Conflict 2023*. Insecurity Insight. <https://reliefweb.int/report/sudan/sudan-violence-against-health-care-conflict-2023-enar#:~:text=GENEVA%20E2%80%93%20Health%20care%20was%20attacked,under%20attack%20from%20the%20outset>
- IOM (International Organisation for Migration). 2018a. *Engaging the Diaspora to Strengthen the Health, Flood Prevention and Agriculture Sectors in Sierra Leone: Free Medical Mission Report*. IOM. <https://www.idiaspora.org/sites/g/files/tmzbd12361/files/resources/document/IOM%2520Diaspora%2520medical%2520Mission%25202018.pdf>
- IOM. 2018b. *Rwandan Diaspora*. IOM. https://www.iom.int/sites/g/files/tmzbd1486/files/country/EEA/info_sheet_diaspora.pdf
- J-PAL (Abdul Latif Jameel Poverty Action Lab). 2018. *Teaching at the Right Level to Improve Learning*. J-PAL. <https://www.povertyactionlab.org/case-study/teaching-right-level-improve-learning>
- Justino, P. 2011. "Violent Conflict and Human Capital Accumulation." *IDS Working Papers* 2011 (379):1–17. https://doi.org/10.1111/j.2040-0209.2011.00379_2.x
- Justino, P. 2012. "War and Poverty." In *The Oxford Handbook of the Economics of Peace and Conflict*, eds. M.R. Garfinkel and S. Skaperdas, 676–705. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780195392777.013.0027>
- Khogali, A., and A. Homeida. 2023. "Impact of the 2023 Armed Conflict on Sudan's Healthcare System." *Public Health Challenges* 2 (4):e134. <https://doi.org/10.1002/puh2.134>

- Kim, S.-W., and S.-H. Ahn. 2020. "Social Investment Effects of Public Education, Health Care, and Welfare Service Expenditures on Economic Growth." *Asian Social Work and Policy Review* 14 (1):34–44. <https://doi.org/10.1111/aswp.12190>
- Konozy, E.H.E. 2024a. "Commentary: Navigating Sudan's Education System through Turmoil and Conflict." *International Journal of Educational Development* 109:103088. <https://doi.org/10.1016/j.ijedudev.2024.103088>
- Konozy, E.H.E. 2024b. "Sudan's Devastating War: Unravelling Its Multifaceted Impact." *Medicine, Conflict and Survival* 40 (1):53–57. <https://doi.org/10.1080/13623699.2023.2299736>
- Lai, B., and C. Thyne. 2007. "The Effect of Civil War on Education, 1980–97." *Journal of Peace Research* 44 (3):277–292. <https://doi.org/10.1177/0022343307076631>
- Levy, B.S., and V.W. Sidel, eds. 2008. *War and Public Health*. Second ed. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195311181.001.0001>
- Lucas, Jr., R.E. 1988. "On the Mechanics of Economic Development." *Journal of Monetary Economics* 22 (1):3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Mankiw, N.G., D. Romer, and D.N. Weil. 1992. "A Contribution to the Empirics of Economic Growth." *The Quarterly Journal of Economics* 107 (2):407–437. <https://doi.org/10.2307/2118477>
- Merrouche, O. 2011. "The Long Term Educational Cost of War: Evidence from Landmine Contamination in Cambodia." *The Journal of Development Studies* 47 (3):399–416. <https://doi.org/10.1080/00220388.2010.485633>
- Milton, S., and S. Barakat. 2016. "Higher Education as the Catalyst of Recovery in Conflict-Affected Societies." *Globalisation, Societies and Education* 14 (3):403–421. <https://doi.org/10.1080/14767724.2015.1127749>
- Nour, S.M., and E.M. Ebaidalla. 2025. "Impact of Agricultural Land Ownership on Child Nutrition in Rural Sudan: An Investigation across Gender." *China Agricultural Economic Review* 17 (1):42–63. <https://doi.org/10.1108/CAER-06-2023-0145>
- Omar, S.M., A.A. Hassan, A. Al-Nafeesah, A. AlEed, J. Alfaifi, and I. Adam. 2024. "Prevalence of Hypertension and Its Associated Factors among Adolescents in Eastern Sudan: A Community-Based Study." *Children* 11 (8):888. <https://doi.org/10.3390/children11080888>
- Pelinescu, E. 2015. "The Impact of Human Capital on Economic Growth." *Procedia Economics and Finance* 22:184–190. [https://doi.org/10.1016/S2212-5671\(15\)00258-0](https://doi.org/10.1016/S2212-5671(15)00258-0)
- Perry, H.B., M. Chowdhury, M. Were et al. 2021. "Community Health Workers at the Dawn of a New Era: 11. CHWs Leading the Way to "Health for All"." *Health Research Policy and Systems* 19 (3):111. <https://doi.org/10.1186/s12961-021-00755-5>

- Roy-Campbell, Z.M. 2005. "Promoting African Languages as Conveyors of Knowledge in Educational Institutions." In *Black Linguistics*, eds. A. Ball, S. Makoni, G. Smitherman, A.K. Spears, Chapter 4. Routledge. <https://doi.org/10.4324/9780203986615-12>
- Saleh, E., K.M. Dousa, A. Babiker et al. 2024. "Health and Humanitarian Toll of Sudan's Forgotten War." *The Lancet* 404 (10461):1383–1385. [https://doi.org/10.1016/S0140-6736\(24\)01939-1](https://doi.org/10.1016/S0140-6736(24)01939-1)
- Schultz, T.P. 2003. "Human Capital, Schooling and Health." *Economics & Human Biology* 1 (2):207–221. [https://doi.org/10.1016/S1570-677X\(03\)00035-2](https://doi.org/10.1016/S1570-677X(03)00035-2)
- Sesay, A., and C. Ukeje. 2009. *Post-War Regimes and State Reconstruction in Liberia and Sierra Leone*. African Books Collective.
- Taha, M.H., N.E. Husain, W.N.O. Mukhtar, and M.E. Abdalla. 2023. "Consolidating Medical Education in Sudan during War." *Sudan Journal of Medical Sciences* 18 (3):402–412. <https://doi.org/10.18502/sjms.v18i3.14093>
- Taha, N.B.I. 2021. "Girls' Educational Aspirations and Gender Inequalities in Education among Disadvantaged Groups in Sudan." *The Afhad Journal* 38 (2):3–10.
- Tigau, C. 2019. "Conflict-Induced Displacement of Skilled Refugees: A Cross-Case Analysis of Syrian Professionals in Selected Oecd Countries." *Norteamérica, Revista Académica del CISAN-UNAM* 14 (1):341–368. <https://doi.org/10.22201/cisan.24487228e.2019.1.359>
- UNESCO UIS (UNESCO Institute for Statistics). 2025. "School Enrollment, Primary (% Net)." UNESCO UIS database. Accessed February 17, 2025. <https://data.worldbank.org/indicador/SE.PRM.NENR>
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNHRC (United Nations Human Rights Council). 2024. *Report on the Independent International Fact-Finding Mission for the Sudan HRC 2024*. UNHRC. <https://reliefweb.int/report/sudan/report-independent-international-fact-finding-mission-sudan-advance-unedited-version-ahrc5723>
- UNICEF. 2023. *19 Million Children in Sudan out of School as Conflict Rages on – UNICEF, Save the Children*. Press Release, October 9. <https://www.unicef.org/sudan/press-releases/19-million-children-sudan-out-school-conflict-rages-unicef-save-children>
- UNICEF. 2024. *Sudan Humanitarian Situation Report No. 21*. UNICEF. <https://www.unicef.org/media/161221/file/UNICEF%20Sudan%20Humanitarian%20Situation%20Report%20No.%2021%20-%201%20-%202031>
- Wang, L., and W. Gu. 2024. "Sustainable Common Prosperity and Resource Rents: Regional Analysis." *Resources Policy* 97:105283. <https://doi.org/10.1016/j.resourpol.2024.105283>

Wharton, G., O.E. Ali, S. Khalil, H. Yagoub, and E. Mossialos. 2020. "Rebuilding Sudan's Health System: Opportunities and Challenges." *The Lancet* 395 (10219):171–173. [https://doi.org/10.1016/S0140-6736\(19\)32974-5](https://doi.org/10.1016/S0140-6736(19)32974-5)

WHO (World Health Organization). 2024. *Sudan Conflict and Refugee Crisis: Multi-Country External Situation Report #1*. WHO. <https://www.who.int/publications/m/item/sudan-conflict-and-refugee-crisis-1>

WHO. 2025. "Sudan Country Profile." Accessed February 17, 2025. <https://www.who.int/countries/sdn/>

World Bank. 2025. "World Development Indicators." Accessed February 1, 2025. <https://databank.worldbank.org/source/world-development-indicators>

SECTION III

Resilience and Recovery Strategies

SHOCKS, COPING, AND HOUSEHOLD LIVELIHOOD STRATEGIES IN WARTIME

Oliver K. Kirui and Tarig Alhaj Rakhy

Since the eruption of conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) in April 2023, Sudan has experienced one of the most severe humanitarian and economic crises in recent history. Beyond the tragic toll in lost and displaced lives, the conflict has profoundly disrupted livelihoods, dismantled social safety nets, and eroded the foundations of food and income security across the country. The ongoing war has affected millions, displacing communities and decimating livelihood systems across both rural and urban areas.

This aligns with evidence from other conflict-affected contexts showing that wars erode human capital, restrict market access, and reshape livelihood strategies in ways that persist long after violence subsides (Justino 2012; Brück et al. 2019). Research has further shown that households adopt coping mechanisms that may stabilize consumption in the short term but risk undermining long-term resilience by depleting assets or disrupting education and health investments (Dercon 2004; Carter and Barrett 2006). Yet, much of this literature has focused on rural contexts, with limited attention to the distinct vulnerabilities of urban households or to gender-differentiated strategies. Sudan thus provides an important and timely case to deepen understanding of how shocks are absorbed and livelihoods are adapted in protracted conflict settings.

Conflict affects livelihoods through multiple, often overlapping pathways: destruction of assets and infrastructure, loss of employment, displacement, market disruptions, and weakening of state and community institutions. These shocks often compound existing vulnerabilities such as poverty, gender inequality, and environmental degradation.

This chapter examines exposure to shocks and the coping and livelihood strategies adopted by households in Sudan during the conflict. We explore patterns of vulnerability, household responses to acute and protracted shocks, and institutional support mechanisms, providing a comprehensive perspective on resilience in the face of crisis. The analysis is based on household-level data from IFPRI's 2023–2024 Rural and Urban Household Surveys (IFPRI and

UNDP 2023; 2024), supplemented by secondary data from United Nations (UN) agencies, nongovernmental organizations (NGOs), and insights from the 2025 Sudan Resilience Conference.

Because coping strategies vary significantly between rural and urban households in Sudan, we present results both in aggregate and, where relevant, separately for rural and urban samples. Rural households are typically engaged in subsistence farming and small-scale trade, making them more vulnerable to disruptions in agricultural production and input availability. Urban households, by contrast, depend heavily on market purchases and wage labor, and are therefore more exposed to inflation and market price shocks. To ensure clarity, each figure and table specifies whether results are rural, urban, or combined, and transitions between rural and urban findings are highlighted explicitly in the text.

In Section 2, we discuss conceptual linkages between resilience, vulnerability, and livelihoods. Section 3 discusses the findings from our analysis of the data: it begins by summarizing data on household exposure to shocks, then follows with our analysis of coping mechanisms and livelihood strategies. The last section presents conclusions and policy recommendations.

Conceptual linkages: Resilience, vulnerability, and livelihoods

Resilience is broadly understood as the capacity of individuals, households, and systems to absorb, adapt, and recover from shocks without compromising long-term well-being (Walker et al. 2004; Folke 2006). In development practice, resilience is often framed around three interrelated capacities: absorptive capacity (ability to withstand and buffer shocks), adaptive capacity (ability to make incremental adjustments), and transformative capacity (ability to create systemic change that reduces vulnerability in the long term) (Barrett and Constanas 2014). In fragile contexts such as Sudan, these capacities manifest in everyday practices like food rationing, informal trade, and reliance on remittances. Yet, as research on coping in conflict settings shows, these strategies often blur the line between short-term stabilization and “erosive coping,” which depletes assets and undermines future resilience (Maxwell et al. 2013).

Vulnerability, in contrast, is best conceptualized as a multidimensional condition shaped by exposure, sensitivity, and capacity to respond (Chambers 1989; Cutter et al. 2003). In Sudan, overlapping political, economic, and environmental stressors have created a particularly acute vulnerability context (de Waal 1989). Gender inequality, displacement, and the prevalence of informal

employment compound these risks, leaving certain groups (especially female-headed households, youth, and displaced populations) disproportionately exposed. These dynamics are consistent with broader evidence that conflict-affected households face not only income shocks but also structural barriers that constrain their coping options and recovery trajectories (Justino 2012; Brück et al. 2019).

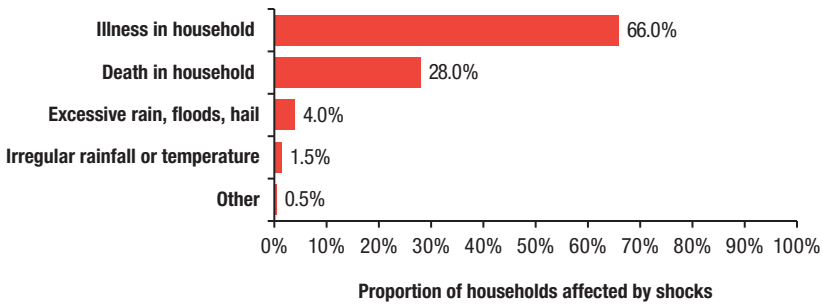
Livelihoods provide the operational lens through which resilience and vulnerability are experienced. The Sustainable Livelihoods Framework (DFID 1999) highlights how access to different forms of capital—natural, financial, human, social, and physical—shapes the strategies households adopt to achieve their goals. In conflict settings, these assets are systematically eroded: land is abandoned, markets disrupted, and social networks fragmented. Sudan is no exception. Rural households shift toward low-input, fast-growing crops; liquidate livestock; or migrate for work, while urban households rely on wage labor, petty trade, and humanitarian assistance. Women dominate low-paid, informal livelihood activities such as food preparation and domestic services, reflecting both adaptation and exclusion.

In sum, resilience, vulnerability, and livelihoods form an interlinked framework for analyzing household responses to conflict. Shocks reshape the asset base, coping strategies influence resilience pathways, and socioeconomic inequalities mediate outcomes. Understanding these linkages is essential for designing policies that not only alleviate immediate hardship but also prevent the erosion of long-term resilience and inclusive development.

Findings from the current conflict in Sudan

Exposure to shocks

Households across Sudan have been exposed to a diverse set of shocks since the onset of the conflict, with clear variation between rural and urban contexts. In rural areas, just over half of respondents (51 percent) reported that at least one household member had been affected by one or more shocks. Health-related crises emerged as the most common, with two-thirds (66 percent) of affected households reporting illness and nearly one-third (28 percent) reporting the death of a family member. Climatic shocks—including excessive or irregular rainfall—also contributed to household stress, though they were cited less frequently than in previous years, reflecting both changing weather patterns and the overshadowing effect of conflict. Security-related shocks were also significant: theft was reported by 14 percent of rural households and direct violence

FIGURE 11.1 Types of shocks experienced by rural households

Source: IFPRI and UNDP (2023); authors' calculations.

by 5 percent. These findings are consistent with evidence from other conflict-affected contexts, where households often face overlapping health, environmental, and security shocks that compound vulnerability and strain coping capacities (Justino 2012; Brück et al. 2019; Maxwell et al. 2013).

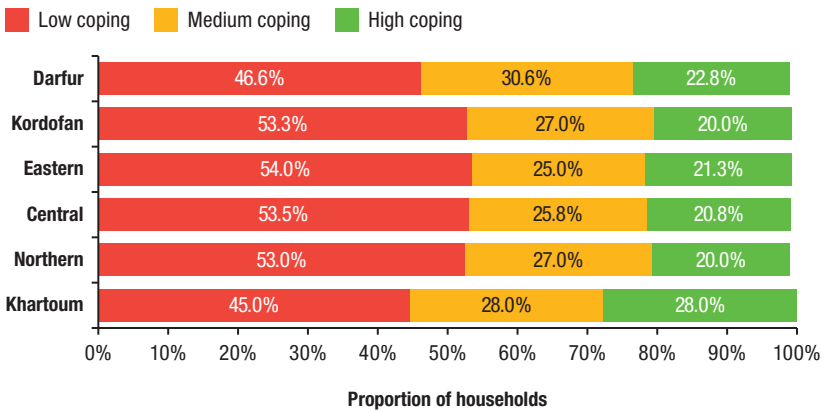
Figure 11.1 illustrates the distribution of these shocks, highlighting the predominance of illness and death. Table 11.1 presents a breakdown of the number of shocks experienced, revealing that 44 percent of households experienced one and about 7 percent faced two shocks. Only a small fraction reported experiencing three or more, suggesting concentrated vulnerability among certain groups. The table also shows the proportion of affected households who experienced each respective number of shocks, with the majority (86 percent) reporting only one type of shock.

Households headed by women or with larger family sizes were more likely to report multiple shocks, signaling greater exposure among already vulnerable

TABLE 11.1 Number of shocks experienced by households

Number of shocks	Frequency	Households (%)	Households experiencing shocks (%)
None	2,198	48.8	–
One	1,971	43.8	85.5
Two	315	7.0	13.7
Three	16	0.4	0.7
Four	2	0.0	0.1
Five	1	0.0	0.0

Source: IFPRI and UNDP (2023); authors' calculations.

FIGURE 11.2 Use of food-based coping strategies, by region

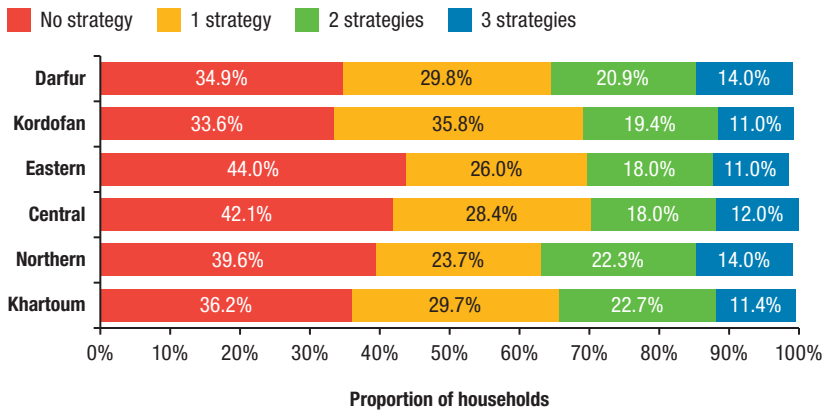
Source: IFPRI and UNDP (2023); authors' calculations.

demographics. In urban areas, the profile of shocks differed: 29 percent of households reported theft or street violence, 20 percent reported psychological stress due to insecurity, and 14 percent were directly affected by SAF–RSF confrontations. Disaggregated analysis shows that younger, less educated, and informally employed individuals were disproportionately impacted, which is consistent with evidence that urban households in conflict settings face distinct forms of vulnerability linked to labor market insecurity and exposure to violence in densely populated areas (Justino 2012; IDS 2015).

Coping mechanisms and livelihood strategies

FOOD-BASED COPING

In response to these shocks, food-related coping strategies were among the most immediate and widespread, especially in urban areas. Approximately 75 percent of urban households reported switching to cheaper or less preferred foods. More than half reduced the number of meals consumed per day or decreased portion sizes, while others relied on borrowing food from friends or neighbors. To protect their most vulnerable members, many households prioritized children's food consumption over that of adults. These strategies were especially prevalent in high-conflict regions such as North Darfur, where nearly one-third (32 percent) of households reported frequent use of food-based coping (Figure 11.2).

FIGURE 11.3 Number of livelihood coping strategies used, by region

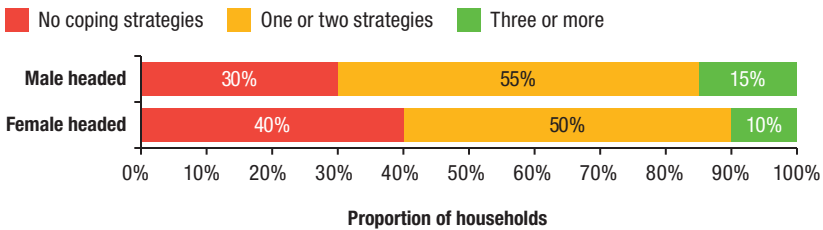
Source: IFPRI and UNDP (2024); authors' calculations.

ASSET-BASED AND INCOME STRATEGIES

Households also resorted to a range of financial and asset-related strategies to manage the economic impact of the conflict. In urban areas, 39 percent sold household items, while 27 percent sold productive assets necessary for income generation. Spending on health and education was also reduced by a significant number of households. In rural settings, the Livelihood Coping Strategy Index revealed that 35 percent of households did not adopt any coping strategy, while 50 percent adopted one or two. A smaller subset—15 percent—adopted three or more, including asset liquidation and migration for work. In West Kordofan, for instance, nearly 30 percent of households used multiple strategies, as seen in Figure 11.3.

Gender and socioeconomic status strongly shaped coping capacity. Female-headed households were generally less likely to adopt multiple coping strategies, either because they had fewer assets to liquidate or less access to external support systems. Figure 11.4 illustrates disparities in coping strategies by sex of the household head.

While regional variation was evident, household characteristics such as poverty status, displacement, and gender were more decisive in shaping coping responses (IFPRI and UNDP 2024). For example, poorer households across all regions were disproportionately reliant on severe food-based and asset-depleting strategies. Similarly, displaced and female-headed households consistently reported greater reliance on multiple coping mechanisms than

FIGURE 11.4 Coping strategies by sex of household head, rural households

Source: IFPRI and UNDP (2023); authors' calculations.

their counterparts, underscoring the importance of socioeconomic and demographic targeting rather than purely regional approaches.

REMITTANCES, MOBILITY, AND COMMUNITY SUPPORT

In addition to food- and asset-based coping, households relied heavily on external support systems to withstand the shocks of conflict. One striking trend is the increased reliance on remittances, particularly in urban areas. The proportion of urban households receiving remittances rose from just 3.3 percent before the conflict to 14.1 percent during the conflict, reflecting the growing importance of transnational ties as a safety net (IFPRI and UNDP 2024). Remittances enabled families to meet essential expenses such as rent, food, and healthcare. This shift is consistent with evidence from other fragile contexts where remittances serve as a critical buffer during crises but remain unevenly distributed, often dependent on banking infrastructure and preexisting migration networks (Justino 2012; Brück et al. 2019).

Migration (both internal and cross-border) also emerged as a crucial livelihood strategy. Families sent members to safer regions or neighboring countries such as South Sudan and Egypt to seek work, while seasonal migration for agricultural labor increased. Such mobility-based coping strategies are well-documented in conflict settings, where households pursue both survival and opportunity through internal displacement or cross-border migration (Maxwell et al. 2013; IDS 2015).

At the community level, informal support networks played an equally vital role. Households drew on kinship ties, rotating savings groups, and food-sharing arrangements that provided relief where formal systems were absent. While these grassroots mechanisms are often modest in scale, they have proven essential for enhancing local resilience, echoing findings from

resilience literature that highlight the centrality of social capital in times of crisis (Chambers 1989; Barrett and Constanas 2014).

Social assistance and institutional support

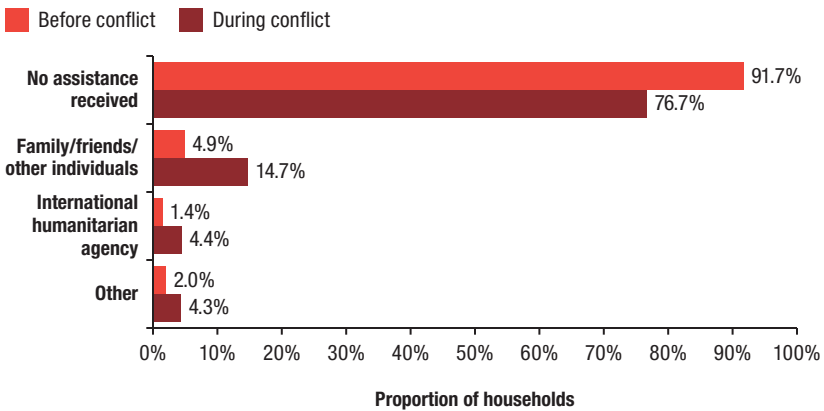
Formal assistance from institutional actors, whether national or international, was comparatively sparse. Survey data show that only 4.6 percent of urban households reported receiving support from international agencies, while less than 2 percent benefited from government aid. By contrast, 15 percent reported receiving help from family or friends, underscoring the greater relative weight of informal over formal support. Figure 11.5 presents the distribution of assistance sources for urban households.

Where formal aid was provided, delivery mechanisms leaned heavily on financial and digital channels. More than half (53.7 percent) of beneficiaries received transfers via bank accounts, while 19.1 percent received direct cash, and 24 percent were supported through in-kind or community-based distributions. Yet even these mechanisms were fragile: 53 percent of households reported disruptions in aid flows, with women, youth, and less educated individuals disproportionately affected (Figure 11.6). This aligns with broader humanitarian evidence that marginalized groups are often least able to reliably access institutional support in conflict zones (UNOCHA 2025).

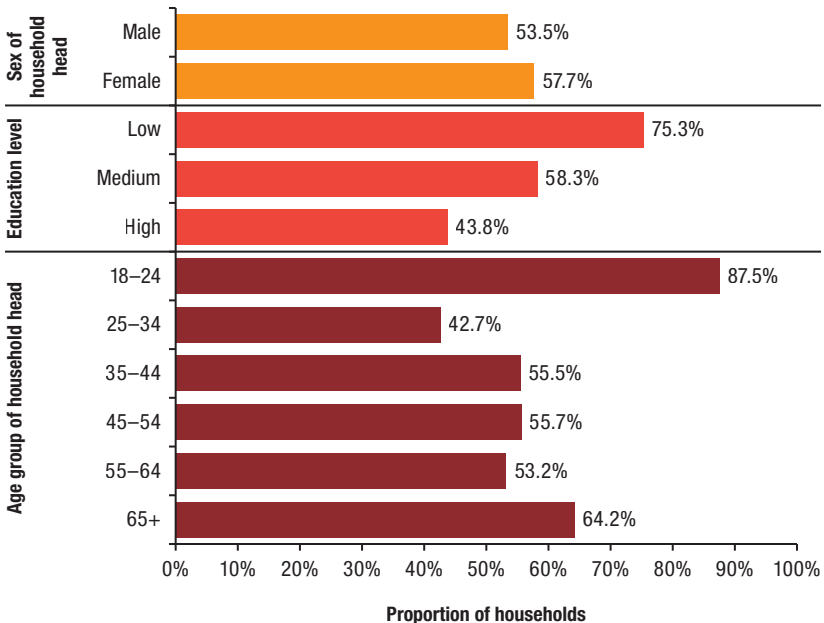
Some efforts have been made to improve the coordination and impact of assistance. Humanitarian agencies such as the World Food Programme (WFP), Food and Agriculture Organization, and United Nations Development Programme implemented integrated programs combining short-term relief with long-term livelihood recovery (WFP, FAO, and UNDP 2024). These included cash-based transfers, distribution of seed and tools, and programs for community asset creation. Local NGOs also played a significant role in providing mobile health clinics, psychosocial services, and informal education, especially in camps for internally displaced people and peri-urban settlements. However, these interventions were often hampered by insecurity, limited funding, and bureaucratic barriers.

Conclusion: Policy implications and recommendations

The findings in this chapter highlight the severe and overlapping pressures faced by Sudanese households during the ongoing conflict. Coping strategies such as food rationing, asset sales, migration, and reliance on social networks have enabled many to survive, but often at the cost of long-term well-being.

FIGURE 11.5 Assistance received by source, urban households

Source: IFPRI and UNDP (2024); authors' calculations.

FIGURE 11.6 Disruptions in assistance by age, education, and household headship

Source: IFPRI and UNDP (2024); authors' calculations.

Persistent conflict, combined with weak institutional support, risks entrenching households in cycles of chronic vulnerability.

Recent IPC (2024/25) estimates indicate that more than 21 million people face acute food insecurity, with the highest concentrations in Darfur, Kordofan, and urban displacement sites (IPC 2024, 2025). As markets fragment and trade routes are disrupted, households are forced to shift from “stress” strategies (borrowing food, reducing meals) toward “crisis” and “emergency” strategies (selling productive assets, distress migration). The policy challenge, therefore, is not only to close immediate consumption gaps but also to halt this downward spiral before resilience is irreparably eroded.

Sudanese households have demonstrated remarkable resilience in the face of crisis. Yet resilience alone cannot secure recovery. Without strengthened institutions, inclusive social protection, and sustained investments in both livelihoods and human capital, the risks of protracted vulnerability and stalled recovery remain high. Coordinated, evidence-based policy responses are therefore urgently needed to transform resilience from survival into a pathway toward sustainable and inclusive development.

The first priority must be to stabilize market access and household purchasing power. Evidence from the WFP Sudan Market Monitor (WFP 2025) shows sorghum and millet prices at record highs, while rapid currency depreciation continues to erode household incomes. Cash-based safety nets can be effective, but they must be inflation-indexed and regularly adjusted to maintain real value. Where mobile networks are functioning, digital transfers can enhance dignity and choice; where access is disrupted, food distributions remain essential. At the same time, protecting trade corridors through humanitarian access agreements and risk-sharing measures is critical to sustaining flows of food and fuel.

Second, livelihood recovery interventions must be strengthened. Farmers and pastoralists in relatively stable areas require timely access to seeds, tools, and veterinary support, aligned with seasonal calendars, to prevent further losses in production capacity. In parallel, human capital investments—including mobile health clinics, school feeding programs, and protections for displaced populations—are needed to mitigate the long-term developmental costs of conflict.

Third, social protection systems must be both inclusive and context-sensitive. Mobile, cash-based safety nets have strong potential, but our analysis shows that not all vulnerable households—particularly rural, female-headed, and displaced households—have reliable access to mobile phones or functioning networks. This underscores the need for a layered approach that combines

digital transfers where feasible with alternative modalities such as direct cash, vouchers, or in-kind distributions. Support for community-based initiatives, especially those led by women and youth, can strengthen local resilience by complementing formal assistance.

Fourth, agricultural recovery and climate adaptation must be prioritized. Expanding access to inputs, extension services, and climate-smart practices (such as drought-tolerant seeds, water harvesting) can protect production systems from collapse. In addition, safe and legal migration pathways should be supported to preserve remittance flows, which have already become an important coping mechanism for urban households.

Finally, all interventions must be embedded within integrated, multi-sectoral planning that links emergency relief with long-term recovery and development. As the UN's Humanitarian Needs and Response Plan (UNOCHA 2025) emphasizes, no policy can succeed without overcoming severe access constraints. This requires coordinated humanitarian negotiations, support for local civil society organizations, and stronger partnerships with diaspora networks that are already sustaining communities through remittances and savings groups.

References

- Barrett, C.B., and M.A. Conostas. 2014. "Toward a Theory of Resilience for International Development Applications." *Proceedings of the National Academy of Sciences* 111 (40):14625–14630. <https://doi.org/10.1073/pnas.1320880111>
- Brück, T., M. d'Errico, and R. Pietrelli. 2019. "The Effects of Violent Conflict on Household Resilience and Food Security: Evidence from the 2014 Gaza Conflict." *World Development* 119:203–223. <https://doi.org/10.1016/j.worlddev.2018.05.008>
- Carter, M.R., and C.B. Barrett. 2006. "The Economics of Poverty Traps and Persistent Poverty: An Asset-Based Approach." *The Journal of Development Studies* 42 (2):178–199. <https://doi.org/10.1080/00220380500405261>
- Chambers, R. 1989. "Editorial Introduction: Vulnerability, Coping and Policy." *IDS Bulletin* 20 (2):1–7. <https://doi.org/10.1111/j.1759-5436.1989.mp20002001.x>
- Cutter, S.L., B.J. Boruff, and W.L. Shirley. 2003. "Social Vulnerability to Environmental Hazards." *Social Science Quarterly* 84 (2):242–261. <https://doi.org/10.1111/1540-6237.8402002>
- de Waal, A. 1989. *The Real Politics of the Horn of Africa: Money, War and the Business of Power*. Polity Press.

- Dercon, S. 2004. "Growth and Shocks: Evidence from Rural Ethiopia." *Journal of Development Economics* 74 (2):309–329. <https://doi.org/10.1016/j.jdeveco.2004.01.001>
- DFID (Department for International Development, United Kingdom). 1999. *Sustainable Livelihoods Guidance Sheets*. DFID. <https://www.livelihoodscentre.org/-/sustainable-livelihoods-guidance-sheets>
- Folke, C. 2006. "Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses." *Global Environmental Change* 16 (3):253–267. <https://doi.org/10.1016/j.gloenvcha.2006.04.002>
- IDS (Innovative Development Strategies). 2015. *Livelihoods in Crisis: Insights from the Literature on Conflict and Resilience*. IDS.
- IFPRI and UNDP (United Nations Development Programme). 2023. *Sudan Rural Household Survey 2023*. IFPRI and UNDP.
- IFPRI and UNDP. 2024. *Sudan Rural Household Survey 2024*. IFPRI and UNDP.
- IPC (Integrated Food Security Phase Classification). 2024. *Sudan: Acute Food Insecurity Analysis, October 2024 – February 2025*. IPC.
- IPC. 2025. *Sudan: Acute Food Insecurity Situation September 2025 – May 2026*. Integrated Food Security Phase Classification. <https://reliefweb.int/report/sudan/sudan-ipc-acute-food-insecurity-analysis-september-2025-may-2026-issued-november-2025>
- Justino, P. 2012. "War and Poverty." In *The Oxford Handbook of the Economics of Peace and Conflict*, eds. M.R. Garfinkel and S. Skaperdas, 676–705. Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780195392777.013.0027>
- Maxwell, D., J. Coates, and B. Vaitla. 2013. *How Do Different Indicators of Household Food Security Compare? Empirical Evidence from Tigray*. FIC (Feinstein International Center). <https://fic.tufts.edu/publication-item/how-do-different-indicators-of-household-food-security-compare/>
- UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2025. *Sudan Humanitarian Needs and Response Plan 2025*. UNOCHA. <https://humanitarianaction.info/plan/1220#page-title>
- Walker, B., C.S. Holling, S. Carpenter, and A. Kinzig. 2004. "Resilience, Adaptability and Transformability in Social–Ecological Systems." *Ecology and Society* 9 (2):5. <https://doi.org/10.5751/ES-00650-090205>
- WFP (World Food Programme). 2025. *Sudan Market Monitor – August 2025*. WFP. <https://reliefweb.int/report/sudan/wfp-sudan-market-monitor-august-2025>
- WFP, FAO (Food and Agriculture Organization of the United Nations), and UNDP. 2024. *Sudan Emergency Response and Resilience Frameworks*. UN.

DELIVERING AID AMID ACTIVE CONFLICT AND INSECURITY: DIGITAL TRANSFERS FOR DELIVERING SOCIAL AND HUMANITARIAN ASSISTANCE IN SUDAN

Kibrom A. Abay, Hala Abushama, Shima Mohamed, and Khalid Siddig

The recent resurgence of armed conflict in Africa is increasing the need for shock-responsive humanitarian and social assistance programs. For example, the armed conflict in Sudan, which erupted in April 2023, has caused the world's largest displacement crisis, creating a multifaceted humanitarian crisis that requires significant investments in assistance. Armed conflicts in Africa are aggravating poverty and hunger (Corral et al. 2020)¹ and threatening important gains in poverty reduction made in the last few decades. This is causing major setbacks to achieving the Sustainable Development Goals (SDGs) by 2030 (Corral et al. 2020; World Bank Group 2020), particularly SDG2 (Zero Hunger), SDG3 (Good Health and Well-Being), and SDG16 (Peace, Justice, and Strong Institutions).

While armed conflicts increase the need for humanitarian and social assistance, they complicate the delivery of assistance to vulnerable populations. Conflicts and associated fragilities can significantly limit the reach, breadth, and impact of humanitarian and social assistance programs, especially in contexts where markets and livelihood services are unavailable and/or informal.² They can affect the implementation, targeting, delivery, and access to various humanitarian and social assistance programs, which in turn, reduces the impact of these programs (Ghorpade 2017; Sabates-Wheeler et al. 2022). Beyond the difficulties associated with delivering humanitarian services amid protracted armed conflicts, humanitarian organizations are facing a growing funding gap as donor aid dwindles. This dual challenge is forcing humanitarian organizations to revisit the effectiveness and cost-efficacy of their programs and services for conflict-affected

1 While poverty has declined in much of the world, it is resurging in fragile and conflict-affected settings (see Corral et al. 2020; Abay et al. 2023a).

2 In the presence of active conflict, armed state and nonstate actors that control territories and associated populations can restrict access of humanitarian actors to vulnerable populations or sometimes divert humanitarian assistance for their own use (Kurtzer 2019). Indeed, aid diversion and siphoning of humanitarian aid by military actors have been documented in Africa in the past few years (Igoe 2023).

populations. Yet the choice and relative efficacy of alternative modalities and delivery of social assistance programs in conflict-affected communities remains an active area of debate. While a long-existing empirical literature and debate on the relative effectiveness of in-kind versus cash transfers provides some guidance that is applicable in stable settings,³ we know little about how these modalities fare in conflict-affected settings. Indeed, some of the market failures and uncertainties in fragile and conflict-affected settings may make some delivery mechanisms prohibitively costly or less impactful than others. Reduced or disturbed delivery of assistance, as well as politicization of assistance amid economic instability, can intensify divisions within the political marketplace. In such contexts, political actors may use control over aid for political gains at the expense of those who are food insecure (Thomas and de Waal 2022). Furthermore, while empirical evidence from stable contexts provides some guidance on households' preference for different delivery modalities such as cash-in-hand, in-kind, or vouchers (Hirvonen and Hoddinott 2021; Berkouwer et al. 2021; Gadenne et al. 2024), there is little evidence on what households in conflict-affected settings may prefer and benefit from most. Such households face unique challenges and environments, which can shape preferences for and effectiveness of alternative modalities for delivering humanitarian assistance. Emerging studies demonstrate the potential benefits of digital transfers in improving financial inclusion and empowering women (Kipchumba and Sulaiman 2021; Riley 2024); ensuring transparency and security (Suri 2017; Suri et al. 2023; Idris 2024); reducing social pressure to share assistance with relatives or community members (Riley 2024); and reducing transaction costs (Suri 2017; Callen et al. 2025). However, whether these gains can be accrued and are appreciated by potential beneficiaries in conflict-affected settings remains unknown.

Understanding beneficiaries' preferences for different modalities of assistance delivery is crucial for ensuring their delivery and impactful programming. This is particularly true in conflict-affected settings, where beneficiaries often prefer options that reduce their exposure to harm and limit the visibility of the support they receive. For example, in active conflicts and evolving environments, delivering social assistance through conventional in-kind and physical cash-in-hand may not be feasible or effective because of access challenges. Moreover, where violence and vandalism are pervasive, delivering in-kind or physical cash transfers to vulnerable populations under the control of warring armed groups can endanger their safety.

3 See Currie and Gahvari 2008; Cunha 2014; Hidrobo et al. 2014; Gentilini 2016; Aker 2017; Alderman et al. 2017; Hoddinott et al. 2018; Schwab 2019; and Hirvonen and Hoddinott 2021.

In this chapter, we study potential beneficiaries' preferences for different transfer modalities for social assistance—in-kind versus cash-in-hand versus digital transfers—focusing on urban households in Sudan, where some beneficiaries are grappling with active conflict and fragility. The ongoing armed conflict between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) has disrupted the lives and livelihoods of millions and destroyed essential infrastructure and public services (Abushama et al. 2023; Kirui et al. 2023; Siddig et al. 2023; Guo et al. 2024). The conflict has left more than 30 million of Sudan's 47.5 million residents needing humanitarian assistance (Humanitarian Action 2025). It has been characterized by widespread local violence as well as massive theft and looting of public, private, and cultural property in several conflict hotspots (Amin 2023; ACJPS 2023; Amin and Rickett 2023; Mobley 2024).⁴ Recent literature on social assistance in Sudan highlights significant challenges in providing assistance digitally. However, Abd Elkreem and Jaspars (2025) show that despite liquidity constraints, limited internet infrastructure and digital literacy, and security concerns, digitalization of food assistance continues to be the best and perhaps the most feasible mechanism of delivering assistance to vulnerable populations amid conflict.

Beyond surveying preferences for different modalities, we also explain these preferences using empirical data. For example, we examine the impact of exposure to armed conflict, violence, and theft as well as associated insecurity on preferences for different transfer modalities. Similarly, we explore whether lack of trust in financial institutions and aid organizations shapes these preferences. We find that about two-thirds of potential beneficiaries prefer digital transfers (both through mobile banking and mobile airtime), while the remaining share prefers cash-in-hand or in-kind transfers. We find that about 48 percent prefer mobile banking transfers through Bankak, a mobile banking platform provided by the Bank of Khartoum, while 44 percent prefer airtime transfers that can be cashed out. In contrast, a study in Uganda—a more stable context with better banking and internet infrastructure—found that 70 percent of beneficiaries preferred mobile money (Maghsoudi and Abakar 2024). These are interesting patterns worth noting and suggest a significant surge in preference for digital cash transfers via mobile banking apps and airtime money transfers, even in contexts where digital infrastructure is not well developed. The growing preference for digital transfers in contexts characterized by poor physical and digital infrastructure suggests they may address some

4 Humanitarian assistance and movement of commodities inter- and intrastate are also subject to threats of looting, and possible theft of stocks and warehouses (Lewis, 2023; UNOCHA, 2024a).

of the bottlenecks associated with delivering physical cash or in-kind transfer amid active conflict. Most important, we find that exposure to armed conflict, violence, and theft as well as associated feelings of insecurity are significantly associated with higher demand for digital transfers over cash and in-kind transfers. In addition, greater trust in relevant institutions—local community-based organizations (CBOs), nongovernmental organizations (NGOs), and local government—is strongly associated with preference for digital transfers. Finally, access to markets and transaction costs associated with each type of transfer are important factors shaping preferences for different modalities. These findings offer important insights that can inform the design and delivery of humanitarian services in conflict-affected settings.

The remainder of the chapter is organized as follows: We first review the theoretical and empirical literature on the choice of modality for delivering social and humanitarian assistance. We then present the context and data for our study, and in the next section, we provide empirical explanations for households' transfer modality preferences for delivery of humanitarian and social assistance. We conclude by highlighting relevant policy and programmatic implications.

Literature: Theoretical and conceptual foundations

The debate about choice of delivery mechanisms for welfare and social assistance builds on an established neoclassical model of consumer choice between cash and in-kind transfers (Southworth 1945). In this model, a consumer has preferences among two or three goods, such as food and an equivalent amount of cash or digital money. Southworth (1945) demonstrates that rational consumers' preference for in-kind or cash transfers depends on the nature of the in-kind transfers and target beneficiaries. A fundamental aspect of this model is the distinction between inframarginal and extramarginal in-kind transfers. In-kind transfers are defined as inframarginal if the amount of the transfer is less than what specific target beneficiaries would buy. Extramarginal in-kind transfers are more than the amount a specific household would consume. Whether a specific amount of in-kind transfer is inframarginal or extramarginal varies across households, as a result of different household characteristics that impact consumption patterns, such as household size. Southworth's model predicts that if in-kind transfers are inframarginal, consumers will be indifferent between cash and in-kind transfers. However, if the food transfer is extramarginal for a specific household and there is no possibility of cash transfers, the latter would result in a welfare loss, which Cunha (2014) refers to as a "distortion" effect. Because of

this, economists have usually defaulted to the notion that cash is preferred over in-kind transfers, although many empirical studies fail to support this (Gentilini 2007; 2016; Hirvonen and Hoddinott 2021).

The empirical literature on the choice between in-kind and cash transfers has identified a range of additional factors that influence their relative effectiveness and preferences. These factors include, for example, the characteristics of the target population, notably gender, education, and literacy, and other exogenous factors such as exposure to conflict and security risks, implementation costs, and the capacity of local markets, among other considerations (Brück and d’Errico 2019; Jeong and Trako 2022; Ravallion 2022). While evidence consistently shows that both cash and in-kind transfers increase overall consumption relative to scenarios without transfers (Cunha 2014; Gentilini 2016; Hidrobo et al. 2014; Schwab 2020), their comparative effectiveness is highly context-dependent. For instance, studies from middle-income settings—such as Ecuador and Mexico—indicate that cash transfers tend to promote more diverse diets than in-kind assistance (Hidrobo et al. 2014; Cunha 2014). In contrast, in very low-income and rural contexts such as Niger, in-kind transfers have been found to be more effective in enhancing dietary diversity (Hoddinott et al. 2018).

In addition to these contextual differences, fluctuations in food prices also influence preferences for cash or in-kind transfers, adding another layer of complexity to the choice. When food prices rise sharply, preferences can shift significantly. In such contexts where markets are volatile, recipients may favor in-kind assistance, as it ensures more stable access to essential goods (Gentilini 2023; Hirvonen and Hoddinott 2021). Gadenne and colleagues (2024) reinforce this argument by emphasizing that in-kind transfers can serve an important insurance function, as the real value of the transfer automatically adjusts with fluctuations in the price of the transferred goods. Specifically, they demonstrate that such transfers help smooth household consumption in the face of market price shocks, thereby offering a stabilizing effect beyond their immediate material value.

While cash transfers offer greater autonomy and flexibility (Gentilini 2016; 2023), their effectiveness may be constrained by the level of financial development and access to markets (Berkouwer et al. 2021; Hirvonen and Hoddinott 2021). Moreover, from the perspective of implementers, in-kind transfers may still be strategically preferable in certain contexts and purposes, for example, for promoting the consumption of specific goods, encouraging self-selection among beneficiaries, or increasing the availability of scarce commodities in local markets (Cunha 2014; Aker 2017).

The cost of delivering in-kind and cash transfers is another factor usually considered in the debate about in-kind versus cash transfers. Studies assessing the relative costs indicate that in-kind food transfers are generally more expensive to deliver than cash transfers and vouchers (Hidrobo et al. 2014; Cunha 2014; Gentilini 2016; Schwab 2020). This is unsurprising, given the logistical complexities typically associated with food distribution programs (Cunha 2014; Gentilini 2016). Cunha (2014) suggests that the additional distribution costs of in-kind transfers, compared with cash transfers, is at least 17.6 percent of the transfer amount, while Caldés, Coady, and Maluccio (2006) report distribution costs of only about 5 percent of transfer amounts in large-scale cash transfer programs. Furthermore, given that in-kind transfers may be extramarginal for some households and their resale values can be lower than market values, many economists favor cash over in-kind transfers. Because of these cost-effectiveness considerations, humanitarian services have been shifting from in-kind assistance to cash transfers, and more recently toward digital payments (Idris 2024).⁵ Nonetheless, in contexts of active conflict, a significant caveat to note is the politicization and weaponization of telecommunications and banking services, which can create disruptions to GPS and access and use of internet (broadband or Starlink) and banking services, when these are controlled by one of the warring factions (Abd Elkreem and Jaspars 2025; Digital Rights Lab 2024).

Political and institutional factors also influence the design and sustainability of assistance programs. From a political economy perspective, food is a sensitive issue, as described by Gentilini (2023). Moreover, in-kind assistance involves complex logistics, which can attract political support from actors engaged in supply chains (Gentilini 2023). Similar discussion applies to energy (electricity) transfer programs and other types of in-kind transfers. Recent evidence suggests that subsidies can increase public support for the government. For example, a study in Ghana found that support for the ruling party was 7 percent higher among those who received an in-kind electricity transfer than nonbeneficiaries (Berkouwer et al. 2022).⁶ In conflict-affected settings marked by politicization and weaponization of telecommunications and humanitarian assistance, these preferences can also be shaped by the degree of surveillance, potential diversion, and security risks (Abd Elkreem and Jaspars 2025; Jaspars et al. 2022).

5 Moreover, the distinction between cash and vouchers is becoming less clear, as vouchers can now be used for online purchases, and cash transfers can be restricted to specific vendors or regions (Gentilini 2023).

6 Their analysis also shows that the government may have gained political support by emphasizing the benefits of the program while avoiding discussion of its costs.

Several studies offer important empirical explanations for preferences for in-kind versus cash transfers, including inflation and price levels, trust in financial institutions, and social pressure to share resources. Price fluctuations significantly affect beneficiaries' preferences, with a tendency to increase preference for in-kind transfers over cash transfers when prices are high (Gentilini 2016).⁷ Gadenne and colleagues (2024) demonstrate that in the presence of significant food price volatility, in-kind transfers can serve as insurance against deterioration in food security. Consistent with this, Hirvonen and colleagues (2021) show that beneficiaries experiencing high food prices are more likely to prefer in-kind food assistance over cash. Individuals who trust their banks are more likely to trust financial innovations, such as internet banking and digital transfers, handled by these banks (van der Crujisen et al. 2023). Similarly, Abay and colleagues (2025) suggest that households' trust in banking institutions is key to adoption of digital cash transfers. Conversely, when there is little trust, people may prefer holding their assets in cash rather than banks (Stix 2013) and prefer cash over digital transfers (Berkouwer et al. 2021).

Building on these debates and literature, our study expands on two areas of investigation. First, the advent of digital transfers offers unique and fundamentally different options to transfer humanitarian and social assistance. Payments are classified as digital if they meet either of the following criteria: (1) payment status and transaction details are reported digitally to the financial service provider, or (2) beneficiaries receive, store, and use money digitally without making direct payments or collecting physical cash (Idris 2024). Providing aid through digital means can reduce coordination costs and delays, enhance transparency for donors, protect the privacy of beneficiaries, and leverage local supply chains for purchases without relying directly on local authorities, thereby minimizing concerns about the diversion of transfers (Callen et al. 2025). Another advantage for donors and humanitarian agencies is the increased transparency and decentralization of digital transfers compared with in-kind or physical cash transfers. For beneficiaries, digital transfers reduce the travel costs and time burdens involved in reaching distribution centers (Callen et al. 2025). According to Callen and colleagues (2025), the delivery cost of digital transfers is 40 percent less than the

7 Inflationary environments can weaken the purchasing power of cash transfers and hence make cash transfers less effective than in-kind transfers. For example, Sabates-Wheeler and Devereux (2010) argue that high inflation in Ethiopia weakened the purchasing power of transfers associated with the national Productive Safety Net Programme and hence were less effective than food transfers.

World Food Programme's (WFP's) average figure for cash-based transfers. Digital transfers can also address social pressures and risk-sharing practices, which can ultimately affect the effectiveness of cash and in-kind transfers. Emerging evidence shows that beneficiaries who face high familial pressure to share money are more likely to prefer transfers through mobile money (Riley 2024).

Second, active conflicts and associated insecurity present unique challenges to the different delivery mechanisms. In contexts where security is a major concern, physical delivery of food or cash can be both costly and logistically challenging, if not impossible, because of inaccessibility and disruption in road infrastructure (Callen et al. 2025). While digital transfers are becoming a viable option for transferring humanitarian payments in conflict-affected settings, the feasibility of this transfer mode depends on the capacity of service providers. This capacity, in turn, depends on the reliability of critical infrastructure, including banks, electricity, mobile phone networks, and internet connectivity (Idris 2024).

Context and data

The armed conflict in Sudan

As we write this chapter, it has been more than two years since the violent conflict began between the SAF and the RSF, creating a severe humanitarian crisis, including large-scale population displacement. As of February 2026, an estimated 7 million individuals have been internally displaced within Sudan (UNHCR 2026), and humanitarian needs are at an all-time high. The latest update from the UN Office for the Coordination of Humanitarian Affairs reports that 64 percent of the population—30.4 million people of the 47.5 million Sudanese population—needs humanitarian assistance (UNOCHA 2025b). Despite ongoing efforts, the humanitarian response faces a growing funding gap and has fallen significantly short of addressing the magnitude and intensity of people's needs, reaching only 8.6 million people with at least one form of assistance out of a target of 20.9 million (UNOCHA 2025b; 2025a).

Beyond the funding gap, two key factors constrain delivery of humanitarian assistance across Sudan. First, active hostilities in many regions and blockages along the country's main trade routes, as well as the lack of security on alternative and remote desert roads, often force humanitarian organizations to rely on either alternative routes or alternative assistance delivery

mechanisms (Abushama et al. 2023; Kirui et al. 2023; SPARC and Crises) 2025). This likely increases the cost of delivery of humanitarian services. Second, the control of distinct regions by the SAF and RSF and increased politicization and weaponization of telecommunication channels by both factions creates bureaucratic impediments to access. These include the need for approvals for movement or delivery of humanitarian assistance as well as limited access to civilians trapped in some parts of the country, complicating the delivery of assistance to all those in need (UNOCHA 2024a; Abd Elkreem and Jaspars 2025).

Figure 12.1 maps the access and logistical constraints imposed by the conflict's evolving landscape, with continued obstacles to movement between the eastern and western regions of Sudan but relatively easier movement within the regions controlled by the SAF and by the RSF.⁸ Because the delivery of physical goods is hindered by insecurity, logistical challenges, and infrastructure damage, humanitarian responses have to shift from traditional in-kind assistance to various forms of cash assistance (CCS 2024b). In the context of the significant disruptions to Sudan's banking and telecommunication sectors since the conflict began, humanitarian organizations have identified and employed various modalities to deliver cash to populations in need. Notably, they have utilized multiple financial service providers, including banks, micro-finance institutions, and money transfer agents, which can continue operations during network outages and address liquidity and access constraints in collaboration with delivery agencies (CCS 2024b; 2024a).

Data and data source

Our study builds on the large Sudan Urban Household Survey (SUHS 2024), which was conducted between May and July 2024, to monitor the impact of the armed conflict on the livelihoods of urban households (IFPRI and UNDP 2024). The survey covered more than 2,500 urban households across Sudan's 18 states. The sample utilized telephone numbers of urban households assembled from databases maintained by three different sources: the WFP, International Food Policy Research Institute (IFPRI), and Geo-Poll. The households included in the survey were drawn from these databases (IFPRI and UNDP 2024). Due to the difficulties of running in-person surveys in conflict zones, the survey was conducted through computer-assisted telephone interviewing (CATI) technology, which avoided security and accessibility

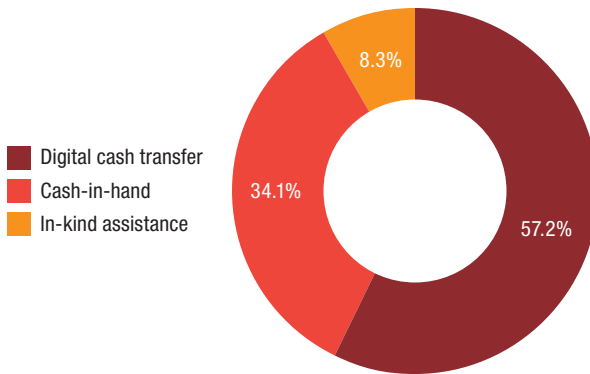
8 We define SAF-controlled and RSF-controlled regions as regions where military authority and control of trade routes persists by one of the two factions.

constraints, particularly in areas heavily affected by conflict. Despite persisting network instability across Sudan's 18 states, the CATI approach enabled completion of the survey, along with inclusion of mechanisms such as consent, scheduling of call-backs, and smooth engagement throughout the administration of the survey.

Building on this baseline survey, IFPRI and partners implemented a pilot intervention that delivered digital cash to a randomly selected portion of urban households included in our sample. At the time of the intervention (January–February 2025), about 86 percent of the baseline sample (2,582 urban households) was reachable and hence were included in the randomized controlled trial.⁹ The intervention used individual-level randomization, in which the households were assigned to either a control group or one of the two treatment groups. Specifically, 38 percent of the sample was assigned to the control group, which received no digital transfers, and 62 percent was further split into two treatment arms based on the amount transfer households were assigned to receive: either US\$50 per household or \$75 per household. The sample is stratified by state as well as mode of digital transfer, as households indicated varying preferences for means of delivery of digital cash. About two to four weeks after the intervention, we conducted an endline survey that reached about 97 percent (2,513 urban households) of the sample who responded to this CATI survey between February and March 2025. The survey included a wide array of questions to follow up on households' economic and security conditions and to elicit respondents' preferences for in-kind, cash-in-hand, or digital transfers. These included questions on household livelihoods, food insecurity, and mental health. Questions also addressed respondents' experience with using the digital cash transfers and associated transaction costs incurred to get the transfers. They were also asked about their access to alternative means of digital payments and markets, and their trust in financial institutions and other organizations involved in the delivery of humanitarian services. Most importantly, the survey asked about respondents' exposure to armed conflict, violence, theft, and associated insecurity in the last two months.

Figure 12.2 shows that digital cash transfers were the most preferred modality of assistance for urban households, with 57 percent of respondents preferring digital transfers, 34 percent choosing cash-in-hand, and the

9 We note potential selection biases as a result of the conflict and lack of security, as some households may have not had access to phones at the time of data collection as a result of theft, looting, confiscation (or fear of these losses).

FIGURE 12.2 Overall preference for transfer modality

Source: Authors' calculations based on household phone survey data.

remaining 8 percent opting for in-kind transfers. We disaggregated these preferences across gender and age of respondents. Younger respondents exhibited slightly greater preference for digital transfers, while older respondents show slightly greater preference for cash. This may be explained by differences in digital literacy. We do not observe major differences across gender, in contrast with findings from Maghsoudi and colleagues (2024), which imply that gender differences in digital and financial literacy are significant factors impacting the effectiveness of digital cash assistance. This may be explained by contextual variation; in the context of Sudan, the widening funding gap of humanitarian assistance and active conflict together impede delivery of assistance, with the result that all beneficiaries prefer digital assistance over other means for which access may be uncertain. The popularity of digital transfers in contexts where digital infrastructure and associated regulatory institutions remain weak merits further investigation and explanation. The accessibility challenges described in Figure 12.1 as well as the security situation and fear of keeping cash at hand may explain some of these patterns.

Explaining the preferences for modality of delivery in conflict-affected settings

Sudan provides a unique case of large-scale active conflict that is geographically dispersed across various regions, each with distinct economic and social characteristics. Consequently, the preferences of urban households

regarding assistance modalities are likely to be influenced by a complex set of factors. While several studies in low- and middle-income countries show that in-kind assistance is preferred over cash transfers (Gentilini 2023; Hirvonen and Hoddinott 2021) and these preferences are particularly pronounced in contexts characterized by surging inflation and high food prices (Gentilini 2016; Gadenne et al. 2024), the disruption of trade routes and humanitarian corridors in Sudan presents significant challenges to the consistency and efficiency of in-kind assistance delivery in conflict areas. In view of these problems, cash-in-hand may be preferred over in-kind transfers, as it allows for greater diversity in nutrition and more autonomy over food preferences and access amid the ensuing conflict. This option can be especially appealing in situations where there is a lack of trust in banks and financial services (Stix 2013). Nevertheless, the physical risks associated with theft and looting of property (ACJPS 2023; Amin and Rickett 2023) raise concerns about beneficiaries' ability to save and secure cash assistance effectively.

Digital cash transfers can be advantageous in contexts where physical access to beneficiaries is impeded, the costs of delivering assistance are high, and there is social pressure to share transfers (Suri 2017; Riley 2024; Callen et al. 2025). In sub-Saharan Africa, where 86 percent of men and 77 percent of women have mobile phones, 165 million adults without bank accounts (56 percent of the “unbanked”) do possess a mobile phone, indicating a potential avenue for digital assistance (Demirguc-Kunt et al. 2022). However, Sudan's limited digitalization and access to financial innovations raise questions about the level of trust in local banks and the banking system. Thus, while some individuals may prefer to keep their money in cash because they distrust banks, the risks of looting and theft may also drive beneficiaries to consider digital cash options. In light of all these factors, it is key to understand and adopt a user-centric approach to delivering humanitarian services, especially to minimize risk to communities under active conflict (Mercy Corps 2023; Idris 2024).

Against this backdrop, we empirically explore some of these hypotheses and findings from the literature on the impact of several factors discussed in the previous section. We note that while the randomized digital cash transfers introduce exogenous variation in access to digital transfers, the remaining factors and attributes such as exposure to armed conflict cannot be randomized and hence can be considered endogenous. Thus, we refrain from causal interpretation in our analysis and focus on generating associational evidence and interpretation.

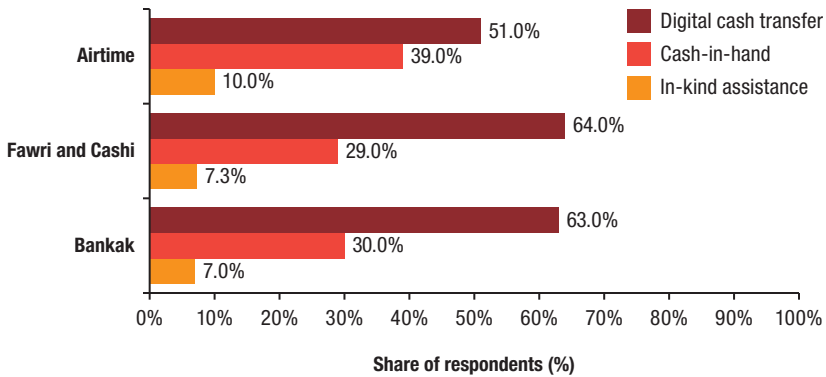
Access and exposure to alternative digital payment services and associated transaction costs

Access to digital financial services in Sudan was in a nascent stage prior to the outbreak of conflict. In 2014, only 15 percent of adults had bank accounts (Singer et al. 2014). In 2017, while more than 28 million people (approximately 66 percent of the population in 2018)¹⁰ had mobile phones, only about 12 million had mobile internet (TPRA 2017). However, in more recent years, the Bank of Khartoum and its mobile banking app Bankak have become widespread, while Faisal Islamic Bank's Fawry mobile banking app has also shown some prevalence. Mobile money remains an underdeveloped tool in Sudan, despite the emergence of Cashi, a mobile money platform, albeit limited in reach and possibly not of interest to potential users. Interestingly, transfer of airtime followed by cashing out is also a popular means of money transfer. This approach to cash transfers has gained momentum amid the country's conflict and the challenges of internet coverage gaps¹¹ and banking connectivity.

In the survey, we asked respondents about their preferred digital payment method. Half of them (48 percent) chose Bankak, 44 percent chose airtime, and the remaining share chose either Fawry or Cashi. Most households who have bank accounts in their own names or in the name of friends or relatives chose Bankak. Figure 12.3 shows that households who have a mobile bank account or mobile money apps prefer digital cash transfers more often than unbanked households do. For example, 63 percent of respondents who have a Bankak account prefer digital transfers while the corresponding rate among those who opted for airtime transfers is 51 percent. Similarly, 39 percent of those who resorted to airtime transfers prefer cash compared with around 30 percent of banked households. In sum, cash-in-hand is more often preferred by unbanked households compared with households with bank accounts or mobile money accounts. This may be explained by accessibility to banking services and financial inclusion as well as transaction costs associated with the different modalities of transfers. For example, cashing out airtime transfers in Sudan involves some fees. Thus, in practice, the choice of modality affects the amount of the transfer received by beneficiary; for example, the use of airtime may be more costly due to transaction fees compared to mobile banking cash transfers, causing the transfer to lose value.

10 Calculation based on World Bank Data Portal estimates: <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=SD>

11 Preconflict data show that the mobile network coverage for Sudan for 2G, 3G, and 4G stand at 83, 46, and 12 percent, respectively (TPRA 2017).

FIGURE 12.3 Preference for assistance by preference for transfer modality

Source: Authors' calculations based on household phone survey data.

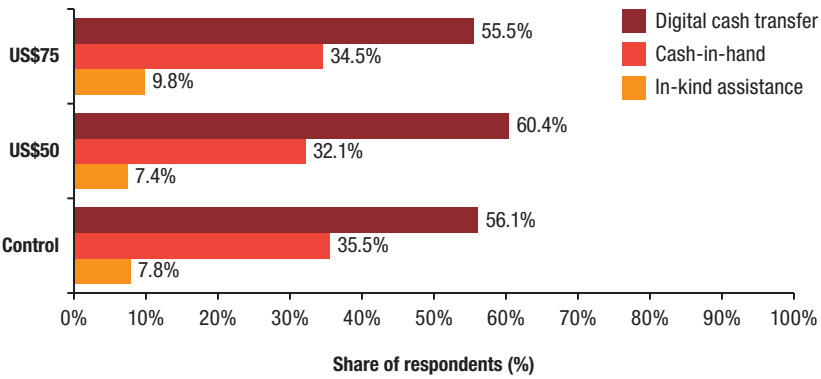
Beyond access to digital payment methods, exposure to digital transfers may also affect trust and preference for digital transfers over cash-in-hand or in-kind transfers.¹² To test this hypothesis, we relied on the random assignment of the digital transfer described above. Figure 12.4 shows that exposure to the digital transfer introduced as part of this project does not generate distinguishable impact on preference for digital transfers over cash or in-kind transfers.

As mentioned, the transaction costs associated with each of the delivery mechanisms is another factor that may shape respondents' preferences for different modalities. Armed conflicts can directly or indirectly increase these transaction costs for recipients of social assistance. Among those households randomly selected to receive the digital transfer, about one-quarter reported some costs paid to access the transfers. This varies across the different payment methods used, as shown in Figure 12.5. Among those receiving their transfer through Bankak, about 15 percent reported paying a portion of the transfer to access their money. This share increased to 35 percent for the airtime transfers.

Our results show that digital cash transfers entail non-uniform transaction fees, varying by digital modality (Bankak, Fawri, and Cashi,

12 For example, in Egypt, exposure to randomly offered in-kind transfers shifted demand toward in-kind over cash transfers, especially among those households experiencing inflationary environments (Abay et al. 2023b).

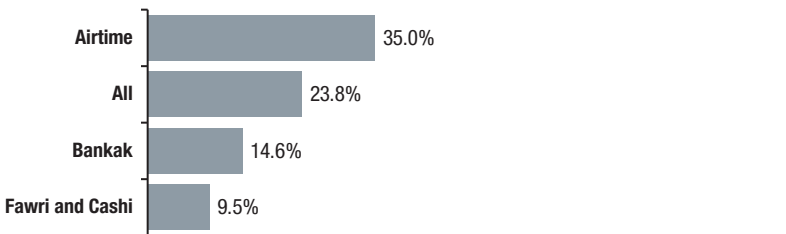
FIGURE 12.4 Exposure to digital transfers by preference for transfer modality



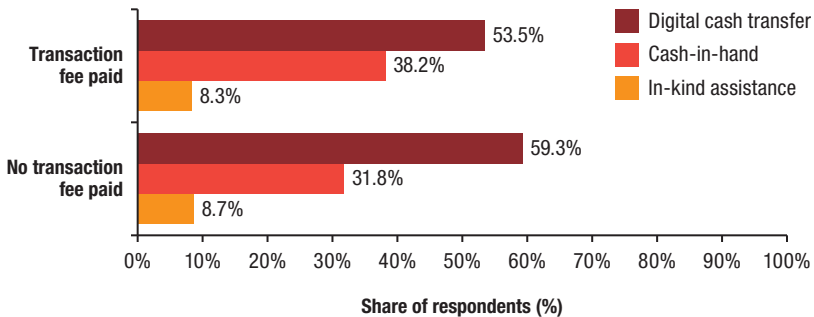
Source: Authors' calculations based on household phone survey data.

FIGURE 12.5 Share of respondents who paid transaction fees, by transfer method and preference for transfer modality

A. Share of respondents who paid transaction fee



B. Preference by whether transaction fee was paid

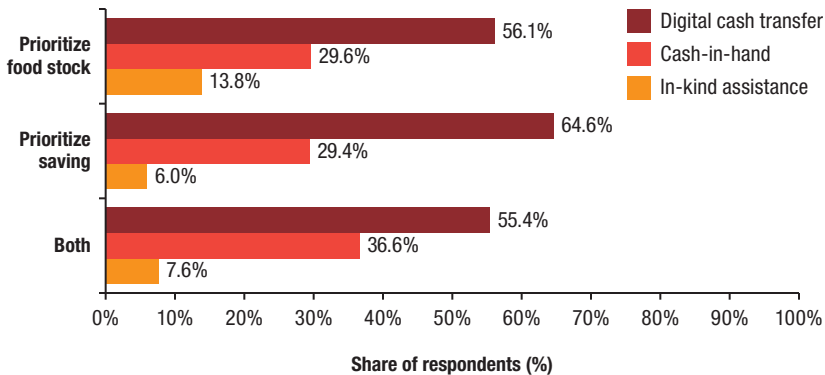


Source: Authors' calculations based on household phone survey data.

or airtime), which can affect the households' preference of modality. Households that reported no payment of transaction fees to receive transfers show strong preference for digital cash (59 percent) compared with cash-in-hand (32 percent) and in-kind (9 percent) (Figure 12.5, panel B). Households that paid transaction fees, despite their nonlinearity in amount of transaction cost paid, also prefer digital cash transfers (53 percent). This preference is likely related to the security situation and uncertainty about consistent receipt of cash or in-kind assistance. Among those who paid some transaction fees, 38 percent prefer cash-in-hand while the corresponding rate among those who did not pay such fees is 32 percent. However, the fact that more than half of those who paid transaction fees still prefer digital transfers implies that they are willing to pay to receive their transfers through digital means.

Urban households in Sudan, grappling with the adverse effects of conflict, have limited or no food stocks or cash savings, with 43 percent of households reporting no savings. The scarcity of food stocks and cash savings impacts households' preferences for the modality of assistance. As discussed, in-kind transfers can be inframarginal or extramarginal for households (Cunha 2014; Hidrobo et al. 2014; Hoddinott et al. 2018). For poorer households that rely heavily on humanitarian and social assistance, potential in-kind transfers (such as the type of cereals usually provided by humanitarian organizations in Sudan) are likely to be inframarginal.

To examine this hypothesis, we asked about respondents' immediate priorities and needs: food stocks, cash savings, or both. For those households targeting savings as an immediate priority, in-kind food transfers are likely to be extramarginal and can cause a distortionary consumption effect (that is, increasing consumption of the foods transferred compared with what households would purchase with cash) (Cunha 2014; Hoddinott et al. 2018). For these households, and following Southworth's theoretical model, digital and cash transfers afford them greater fungibility than in-kind transfers. Consistent with this hypothesis, the results in Figure 12.6 show that those respondents prioritizing savings over food consumption report higher demand for digital transfers (65 percent) than those prioritizing food stocks. Similarly, our results show that 14 percent of households that prioritize food stocks prefer in-kind assistance, compared with only 6 percent of households who prioritize cash savings (Figure 12.6). Thus, preference for in-kind assistance is correlated with preference for securing food stocks, which may reflect the lack of market access or inflated prices of commodities.

FIGURE 12.6 Priorities (savings and food stocks) by preference for transfer modality

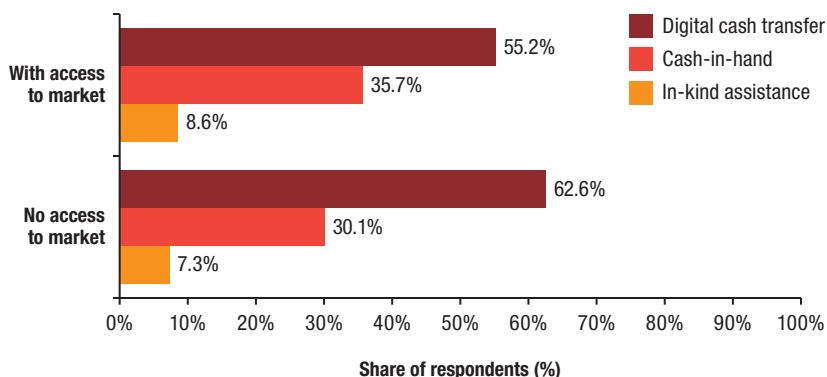
Source: Authors' calculations based on household phone survey data.

Market access, price information, and inflation

Access to markets and information about price dynamics can play an important role in shaping preferences for the modality of social assistance. Cash transfers may be preferred or effective in areas where markets are functioning and the commodity supply is not greatly constrained (Schwab 2020). However, inflation may shift preferences toward in-kind assistance (Hirvonen and Hoddinott 2021; Abay, Abdelfattah et al. 2023). Figure 12.7 shows that 63 percent of households that have no access to markets prefer digital cash transfers, compared to 55 percent among those with access to markets. Similarly, our results show that the preference for cash-in-hand is more common when market access is better. The preference for cash in well-functioning markets is consistent with previous evidence (Gentilini 2016), although large increases in prices of goods and services may reduce the purchasing power of cash transfers (Mercy Corps 2023). Inaccessibility of markets is likely to be correlated with insecurity, and thus higher demand for digital transfers can be expected in these contexts, as we discuss in the next subsection.

Armed conflict, insecurity, and preference for digital transfers

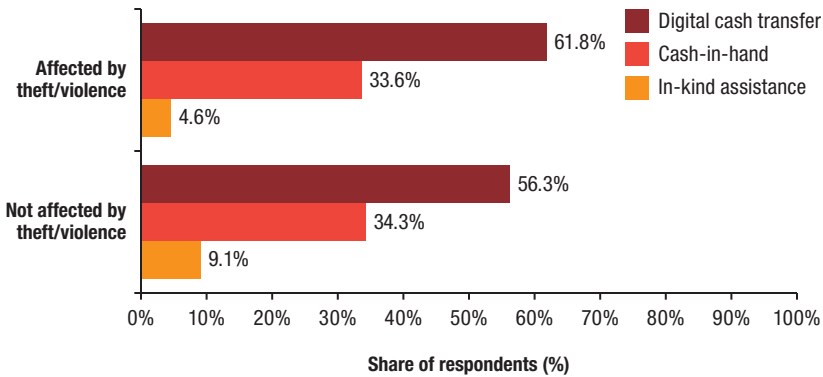
Armed conflict and associated insecurity present unique challenges for delivering humanitarian and social assistance. In situations of active conflict, potential beneficiaries may be inaccessible to humanitarian organizations and services, especially if they are in areas under the control of armed

FIGURE 12.7 Access to markets by preference for transfer modality

Source: Authors' calculations based on household phone survey data.

groups or when access routes and transportation infrastructure are not functioning. In these contexts, delivering humanitarian services through in-kind and cash-in-hand is not feasible, creating an urgent need for digital transfers. However, armed conflicts may also disrupt financial and banking systems and digital infrastructure (Idris 2024). Indeed, the armed conflict in Sudan has disrupted Sudan's banking system (Mercy Corps 2023) as well as regulatory mechanisms, which creates challenges for the delivery of digital and physical transfers. However, potential beneficiary households face some additional challenges that can shape their preference for cash, in-kind, or digital transfers. For example, the armed conflict in Sudan, like many such conflicts, is characterized by pervasive violence and vandalism and theft of assets and properties (Kirui et al. 2023; Amin 2023).

Given these insecurities and uncertainties, potential beneficiaries may prefer digital transfers over in-kind or cash transfers for two reasons. First, they are likely to understand that in-kind and physical cash transfers may not be feasible in their context and hence may not reach them. Second, even if they receive in-kind and cash transfers, such transfers may be vulnerable to theft and vandalism. To test these hypotheses, we asked about respondents' exposure to (1) street violence, theft, or robbery, (2) armed conflict associated with the recent SAF-RSF conflict, and (3) general insecurity associated with conflict. Figure 12.8 shows that those respondents experiencing street violence, theft, or robbery in the past two months were slightly more likely (5.5 percentage points higher) to prefer digital transfers than

FIGURE 12.8 Exposure to theft/violence by preference for transfer modality

Source: Authors' calculations based on household phone survey data.

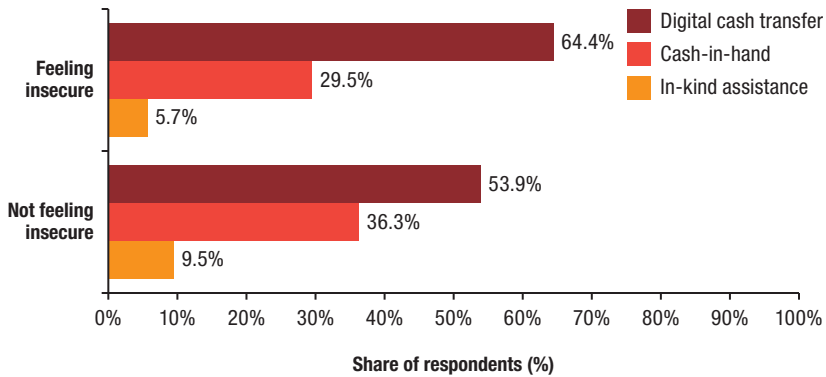
those not experiencing such violence. In contrast, those who had not experienced such violence show relatively higher demand for in-kind transfers (4.5 percentage points).

In Figure 12.9, we show similar patterns for respondents' exposure to general insecurity in the past two months. Among those households feeling insecure, 64 percent prefer to receive humanitarian and social assistance through digital transfers, while only about 6 percent prefer to receive social assistance in-kind. The corresponding shares among households not feeling insecure are 54 percent preferring digital transfers and 9.5 percent preferring in-kind transfers.

Finally, we asked about respondents' exposure to the SAF-RSF conflict and whether they had been affected by the ongoing conflict in the past two months. Consistent with the patterns shown in Figures 12.8 and 12.9, households affected by the SAF-RSF conflict exhibit slightly higher preference for digital transfers and lower preference for in-kind transfers. Overall, these findings clearly demonstrate that armed conflict and associated insecurity are likely to increase preference for digital transfers.

Trust in financial institutions and preference for digital transfers

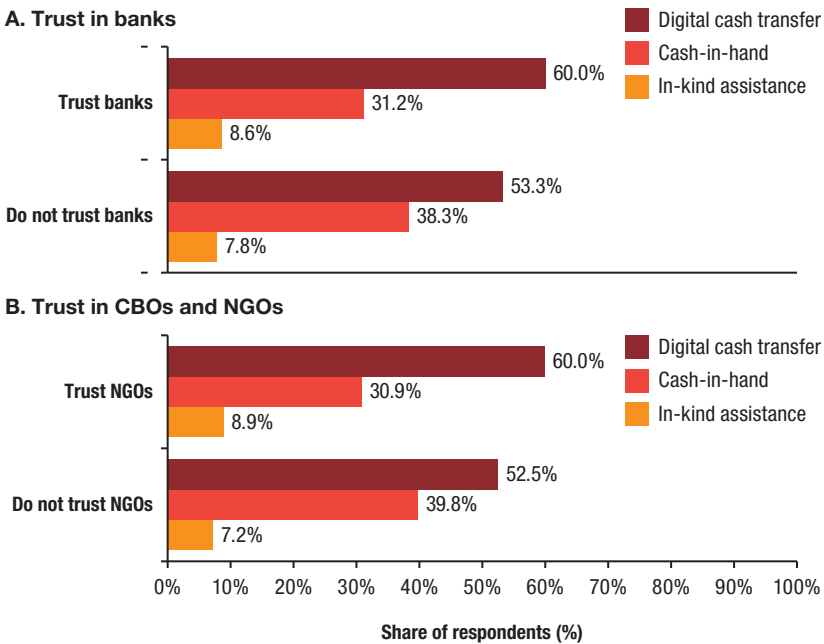
Respondents' trust in financial institutions and actors involved in digital transfers can shape beneficiaries' preference for digital transfers over cash-in-hand or in-kind transfers. This influence is likely to be more pronounced in contexts such as Sudan, where overall trust in institutions remains low. Even

FIGURE 12.9 General insecurity by preference for transfer modalities

Source: Authors' calculations based on household phone survey data

in stable settings, trust in financial institutions and associated social capital is crucial for delivering financial services as well as for development of the financial sector (Guiso et al. 2004; Singer et al. 2014; van der Crujisen et al. 2021). But trust in financial and other institutions evolves dynamically (Stevenson and Wolfers 2011) and tends to deteriorate in the aftermath of crises, including those triggered by armed conflict or financial or unemployment crises (Stevenson and Wolfers 2011; Guiso 2015; Sapienza and Zingales 2012; van der Crujisen et al. 2021). Building on this literature, we assess whether respondents' trust in financial and other local institutions shaped their preference for digital transfers. We asked about respondents' trust in financial institutions, particularly banks, CBOs, and NGOs, which are usually active in delivering humanitarian services.

Figure 12.10, panel A, shows that those respondents who trust banks are more likely to prefer digital transfers (60 percent) over cash transfers (31 percent). On the other hand, those respondents who lack trust are more likely to prefer cash-in-hand (38 percent) than are those who trust banks. Figure 12.10, panel B, shows similar patterns in relation to trust in CBOs and NGOs. These results are consistent with evidence from stable settings, where lack of trust in financial institutions is usually associated with preference for savings in cash outside of financial systems (Stix 2013; Singer et al. 2014; Shy 2023). These empirical patterns suggest that rebuilding trust in financial institutions and related local institutions involved with delivering digital transfers could improve adoption and willingness to use digital transfers.

FIGURE 12.10 Trust in banks and NGOs by preference for transfer modalities

Source: Authors' calculations based on household phone survey data.

Concluding remarks

The armed conflict in Sudan has dramatically increased demand for humanitarian and social assistance, while also complicating the delivery of assistance to vulnerable populations in areas under the control of warring armed groups. The large-scale disruption and destruction of infrastructure and associated inaccessibility of physical roads because of the ongoing armed conflict in Sudan necessitates unconventional methods to deliver social assistance. The advent of digital transfers and their potential to facilitate delivery of humanitarian services remains an active area of inquiry (Callen et al. 2025). With the objective of assessing the potential and feasibility of deploying digital transfers in conflict-affected settings, we examined beneficiaries' preference for alternative modalities of delivering social assistance. For this purpose, we surveyed potential beneficiaries about their preferences for in-kind, cash, and digital transfers. We administered a large CATI survey, focusing on urban households and covering more than 2,500 households across all the 18 states

in Sudan. These households face varying levels of insecurity and live in areas under the control of the two warring factions. Beyond eliciting preferences for different social assistance delivery modalities, we also explain these preferences empirically for different modalities. In particular, we examined whether and how households' exposure to armed conflict as well as respondents' trust in financial and local institutions shape their preference for digital transfers versus other modalities.

We find that about two-thirds of potential beneficiaries prefer digital transfers, while the remaining share prefers cash-in-hand or in-kind transfers. We show that access to markets and transaction costs associated with each type of transfer are important factors shaping preferences for different modalities. We also show that exposure to armed conflict, violence, and theft as well as resulting feelings of insecurity are significantly associated with higher demand for digital transfers over cash and in-kind transfers. Furthermore, trust in financial institutions, local CBOs, NGOs, and local government is strongly associated with preference for digital transfers.

Our findings offer important insights that can inform the design and delivery of humanitarian services in conflict-affected settings. The evidence that digital transfers are preferred in such settings, despite the challenges associated with delivering and regulating digital transfers in fragile settings, is worth noting. The fact that respondents experiencing some form of insecurity and violence prefer digital transfers strongly suggests that this mode of delivering social protection helps to reduce such insecurities and associated violence and theft. Finally, rebuilding trust in financial institutions and local institutions may facilitate the transition to digital ecosystems and platforms.

References

- Abay, K.A., N. Yonzan, S. Kurdi, and K. Tafere. 2023. "Revisiting Poverty Trends and the Role of Social Protection Systems in Africa during the COVID-19 Pandemic." *Journal of African Economies* 32 (Supplement_2):ii44–ii68. <https://doi.org/10.1093/jac/ejac041>
- Abay, K.A., L. Abdelfattah, M. Elkaramany, D. Elsabbagh, and S. Kurdi. 2023. "Nutrition-Sensitive Food Distribution Amidst Inflationary Shock: Evidence from a Randomized Intervention in Egypt." IFPRI Discussion Paper 02218. IFPRI. <https://hdl.handle.net/10568/135820>
- Abay, K.A., H. Abushama, S. Mohamed, and K. Siddig. 2025. *Rethinking Delivery Modalities in Conflict-Affected Settings: Why Beneficiaries in Sudan Prefer Digital Transfers*. FCA Policy Brief. IFPRI. <https://hdl.handle.net/10568/175477>
- Abd Elkreem, T., and S. Jaspars. 2025. "Digital Food Assistance in Sudan: Life-Saver, Risk, Political Tool in Situations of War." DFA Working Paper. DFA (Digitalising Food Assistance). <https://digitalisingfood.org/digital-food-assistance-in-sudan-life-saver-risk-political-tool-in-situations-of-war/>
- Abushama, H., D. Resnick, K. Siddig, and O.K. Kirui. 2023. "Political and Economic Drivers of Sudan's Armed Conflict: Implications for the Agri-Food System." Sudan SSP Working Paper 15. IFPRI. <https://hdl.handle.net/10568/137896>
- ACJPS (African Centre for Justice and Peace Studies). 2023. *The Booming Black Markets Amidst the Sudan Armed Conflict*. ACJPS. <https://web.acjps.org/the-booming-black-market-amidst-the-sudan-armed-conflict/>
- Aker, J.C. 2017. "Comparing Cash and Voucher Transfers in a Humanitarian Context: Evidence from the Democratic Republic of Congo." *The World Bank Economic Review* 31 (1):44–70. <https://doi.org/10.1093/wber/lhv055>
- Alderman, H., U. Gentilini, and R. Yemtsov, eds. 2017. *The 1.5 Billion People Question: Food, Vouchers, or Cash Transfers?* World Bank. <https://doi.org/10.1596/978-1-4648-1087-9>
- Amin, M. 2023. "Sudan Turmoil: Looting and Prison Break as Lawlessness Reigns in Conflict." *Middle East Eye*, April 23. <https://www.middleeasteye.net/news/sudan-turmoil-looting-prisonbreak-lawlessness-reigns-conflict>
- Amin, M., and O. Rickett. 2023. "Looted Goods for Sale in Sudan's 'Dagalo' Markets." *Middle East Eye*, July 15. <https://www.middleeasteye.net/news/sudan-dagalo-markets-shop-stolen-goods>
- Berkouwer, S.B., P.E. Biscaye, E. Hsu et al. 2021. "Money or Power? Financial Infrastructure and Optimal Policy." NBER Working Paper No. 29086. NBER (National Bureau of Economic Research). <https://www.nber.org/papers/w29086>
- Berkouwer, S.B., P.E. Biscaye, S. Puller, and C.D. Wolfram. 2022. "Disbursing Emergency Relief through Utilities: Evidence from Ghana." *Journal of Development Economics* 156:102826. <https://doi.org/10.1016/j.jdevco.2022.102826>

- Brück, T., and M. d'Errico. 2019. "Food Security and Violent Conflict: Introduction to the Special Issue." *World Development* 117:167–171. <https://doi.org/10.1016/j.worlddev.2019.01.007>
- Caldés, N., D. Coady, and J.A. Maluccio. 2006. "The Cost of Poverty Alleviation Transfer Programs: A Comparative Analysis of Three Programs in Latin America." *World Development* 34 (5):818–837. <https://doi.org/10.1016/j.worlddev.2005.10.003>
- Callen, M., M. Fajardo-Steinhäuser, M.G. Findley, and T. Ghani. 2025. "Can Digital Aid Deliver during Humanitarian Crises?" *Management Science* 71 (11):8995–9868. <https://doi.org/10.1287/mnsc.2024.06469>
- CCS (Cash Consortium of Sudan). 2024a. *Cash Works: Time to Act and Save Lives amid Starvation in Sudan*. CCS. <https://voiceeu.org/publications/cash-works-time-to-act-and-save-lives-amid-starvation-in-sudan-cash-consortium-of-sudan.pdf>
- CCS. 2024b. *From Feasible to Life-Saving: The Urgent Case for Cash at Scale in Sudan*. CCS. <https://reliefweb.int/report/sudan/cash-consortium-sudan-ccs-feasible-life-saving-urgent-case-cash-scale-sudan-april-2024>
- Corral, P., A. Irwin, N. Krishnan, D.G. Mahler, and T. Vishwanath. 2020. *Fragility and Conflict: On the Front Lines of the Fight against Poverty*. World Bank. <https://hdl.handle.net/10986/33324>
- Cunha, J.M. 2014. "Testing Paternalism: Cash Versus in-Kind Transfers." *American Economic Journal: Applied Economics* 6 (2):195–230. <https://doi.org/10.1257/app.6.2.195>
- Cunha, J.M., G. De Giorgi, and S. Jayachandran. 2019. "The Price Effects of Cash Versus in-Kind Transfers." *The Review of Economic Studies* 86 (1):240–281. <https://doi.org/10.1093/restud/rdy018>
- Currie, J., and F. Gahvari. 2008. "Transfers in Cash and In-Kind: Theory Meets the Data." *Journal of Economic Literature* 46 (2):333–383. <https://doi.org/10.1257/jel.46.2.333>
- Demircuc-Kunt, A., S. Ansar, L. Klapper, and D. Singer. 2022. *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. World Bank. <https://hdl.handle.net/10986/37578>
- Digital Rights Lab. 2024. "Starlink in Sudan: A Lifeline or War Facilitator?" *Advox Global Voices* (blog), August 20. <https://advox.globalvoices.org/2024/08/20/starlink-in-sudan-a-lifeline-or-war-facilitator/>
- Gadenne, L., S. Norris, M. Singhal, and S. Sukhtankar. 2024. "In-Kind Transfers as Insurance." *American Economic Review* 114 (9):2861–2897. <https://doi.org/10.1257/aer.20220822>
- Gentilini, U. 2007. "Cash and Food Transfers: A Primer." WFP Occasional Paper No. 18. Rome. https://cdn.wfp.org/wfp.org/publications/OP18_Cash_and_Food_Transfers_Eng%2007.pdf
- Gentilini, U. 2016. "Revisiting the "Cash Versus Food" Debate: New Evidence for an Old Puzzle?" *The World Bank Research Observer* 31 (1):135–167. <https://doi.org/10.1093/wbro/lkv012>

- Gentilini, U. 2023. "Why Does In-Kind Assistance Persist When Evidence Favors Cash Transfers?" *Brookings Commentary* (blog), June 30. <https://www.brookings.edu/articles/why-does-in-kind-assistance-persist-when-evidence-favors-cash-transfers/>
- Ghorpade, Y. 2017. "Extending a Lifeline or Cutting Losses? The Effects of Conflict on Household Receipts of Remittances in Pakistan." *World Development* 99:230–252. <https://doi.org/10.1016/j.worlddev.2017.05.024>
- Guiso, L. 2015. "Trust and Risk Aversion in the Aftermath of the Great Recession." *European Business Organization Law Review* 13 (2):195–209. <https://doi.org/10.1017/S1566752912000146>
- Guiso, L., P. Sapienza, and L. Zingales. 2004. "The Role of Social Capital in Financial Development." *American Economic Review* 94 (3):526–556. <https://doi.org/10.1257/0002828041464498>
- Guo, Z., H. Abushama, K. Siddig, O.K. Kirui, K. Abay, and L. You. 2024. "Monitoring Indicators of Economic Activities in Sudan Amidst Ongoing Conflict Using Satellite Data." *Defence and Peace Economics* 35 (8):992–1008. <https://doi.org/10.1080/10242694.2023.2290474>
- Hidrobo, M., J. Hoddinott, A. Peterman, A. Margolies, and V. Moreira. 2014. "Cash, Food, or Vouchers? Evidence from a Randomized Experiment in Northern Ecuador." *Journal of Development Economics* 107:144–156. <https://doi.org/10.1016/j.jdeveco.2013.11.009>
- Hirvonen, K., and J. Hoddinott. 2021. "Beneficiary Views on Cash and In-Kind Payments: Evidence from Ethiopia's Productive Safety Net Programme." *The World Bank Economic Review* 35 (2):398–413. <https://doi.org/10.1093/wber/lhaa002>
- Hoddinott, J., S. Sandström, and J. Upton. 2018. "The Impact of Cash and Food Transfers: Evidence from a Randomized Intervention in Niger." *American Journal of Agricultural Economics* 100 (4):1032–1049. <https://doi.org/10.1093/ajae/aay019>
- Idris, I. 2024. *Humanitarian Digital Transfers in Challenging Contexts*. K4DD Rapid Evidence Review 36. IDS (Institute of Development Studies). https://opendocs.ids.ac.uk/articles/report/Humanitarian_Digital_Transfers_in_Challenging_Contexts/26379823
- IFPRI (International Food Policy Research Institute) and UNDP (United Nations Development Programme). 2024. *The Socio-Economic Impact of Armed Conflict on Sudanese Urban Households*. IFPRI. <https://hdl.handle.net/10568/159599>
- Igoe, M. 2023. "USAID Pauses Food Aid to Ethiopia's Tigray Region Due to Theft." *Devex News* (blog), May 3. <https://www.devex.com/news/usaids-pauses-food-aid-to-ethiopia-s-tigray-region-due-to-theft-105457>
- Jaspars, S., C. Murdoch, and N. Majid. 2022. *Digital Feast and Famine: Digital Technologies and Humanitarian Law in Food Security, Starvation and Famine Risk*. WPF (World Peace Foundation). <https://worldpeacefoundation.org/publication/digital-feast-and-famine-digital-technologies-and-humanitarian-law-in-food-security-starvation-and-famine-risk/>

- Jeong, D., and I. Trako. 2022. "Cash and In-Kind Transfers in Humanitarian Settings: A Review of Evidence and Knowledge Gaps." Policy Research Working Paper No. 10026. World Bank. <https://hdl.handle.net/10986/37369>
- Kipchumba, E., and M. Sulaiman. 2021. "Digital Finance and Intra-Household Decision-Making: Evidence from Mobile Money Use in Kenya." Working Paper. <https://www.researchgate.net/publication/352056256>
- Kirui, O.K., K. Siddig, H. Abushama, and A.S. Taffesse. 2023. "Armed Conflict and Business Operations in Sudan: Survey Evidence from Agri-Food Processing Firms." Sudan SSP Working Paper 11. IFPRI. <https://hdl.handle.net/10568/140193>
- Kurtzer, J.D. 2019. *Denial, Delay, Diversion: Tackling Access Challenges in an Evolving Humanitarian Landscape*. CSIS (Center for Strategic and International Studies). <https://www.csis.org/analysis/denial-delay-diversion-tackling-access-challenges-evolving-humanitarian-landscape>
- Lewis, A. 2023. "Aid Agencies in Sudan Grapple with Looting, Bureaucracy to Deliver Relief." *Reuters*, June 2. <https://www.reuters.com/world/africa/aid-agencies-sudan-grapple-with-looting-bureaucracy-deliver-relief-2023-06-02/>
- Maghsoudi, A., and A.H. Abakar. 2024. "Navigating the Digital Technology Behavior for the Distribution of Humanitarian Cash-Based Assistance: Aid Recipients Experience." Paper presented at the *International ISCRAM Conference*, May 25–29. <https://ojs.iscram.org/index.php/Proceedings/article/view/71/52>
- Mercy Corps. 2023. *Sudan Crisis Analysis: Humanitarian Action within a War Economy*. Mercy Corps. https://www.mercycorps.org/sites/default/files/2023-08/MC_Sudan_Humanitarian-action-within-a-war-economy.pdf
- Mobley, C. 2024. "Protecting Sudan's Looted Cultural Property." *University of Cincinnati Law Review* 93 <https://uclawreview.org/2024/10/10/protecting-sudans-looted-cultural-property/>
- Ravallion, M. 2022. "On the Gains from Tradable Benefits-in-Kind: Evidence For workfare in India." *Economica* 89 (355):770–787. <https://doi.org/10.1111/ecca.12413>
- Riley, E. 2024. "Resisting Social Pressure in the Household Using Mobile Money: Experimental Evidence on Microenterprise Investment in Uganda." *American Economic Review* 114 (5):1415–1447. <https://doi.org/10.1257/aer.20220717>
- Sabates-Wheeler, R., and S. Devereux. 2010. "Cash Transfers and High Food Prices: Explaining Outcomes on Ethiopia's Productive Safety Net Programme." *Food Policy* 35 (4):274–285. <https://doi.org/10.1016/j.foodpol.2010.01.001>
- Sabates-Wheeler, R., J. Lind, P. Harvey, and R. Slater. 2022. "Strengthening Responses at the Nexus of Social Protection, Humanitarian Aid and Climate Shocks in Protracted Crises: Basic Research Framing Paper." BASIC Research Working Paper 1. IDS (Institute of Development Studies). <https://hdl.handle.net/20.500.12413/17426>

- Sapienza, P., and L. Zingales. 2012. "A Trust Crisis." *International Review of Finance* 12 (2):123–131. <https://doi.org/10.1111/j.1468-2443.2012.01152.x>
- Schwab, B. 2020. "In the Form of Bread? A Randomized Comparison of Cash and Food Transfers in Yemen." *American Journal of Agricultural Economics* 102 (1):91–113. <https://doi.org/10.1093/ajae/aaz048>
- Schwab, B. 2019. "Comparing the Productive Effects of Cash and Food Transfers in a Crisis Setting: Evidence from a Randomised Experiment in Yemen." *The Journal of Development Studies* 55:29–54. <https://doi.org/10.1080/00220388.2019.1687880>
- Shy, O. 2023. "Cash Is Alive: How Economists Explain Holding and Use of Cash." *Journal of Economic Literature* 61 (4):1465–1520. <https://doi.org/10.1257/jel.20221632>
- Siddig, K., M. Raouf, and M.O.M. Ahmed. 2023. "The Economy-Wide Impact of Sudan's Ongoing Conflict: Implications on Economic Activity, Agrifood System and Poverty." Sudan SSP Working Paper 12. IFPRI. <https://hdl.handle.net/10568/140293>
- Singer, D., A. Demirguc-Kunt, P. Van Oudheusden, and L. Klapper. 2014. *The Global Findex Database 2014: Measuring Financial Inclusion around the World*. World Bank. <https://hdl.handle.net/10986/21865>
- Southworth, H.M. 1945. "The Economics of Public Measures to Subsidize Food Consumption." *Journal of Farm Economics* 27 (1):38–66. <https://doi.org/10.2307/1232262>
- SPARC (SPARC-KnowledgeSupporting Pastoralism and Agriculture, and in Recurrent and Protracted Crises). 2025. *Darfur's Long-Distance Trade: Impact of War and Rapid Support Forces' Trade Embargo*. SPARC. <https://www.sparc-knowledge.org/publications-resources/darfurs-long-distance-trade-impact-war-and-rapid-support-forces-trade>
- Stevenson, B., and J. Wolfers. 2011. "Trust in Public Institutions over the Business Cycle." *American Economic Review* 101 (3):281–287. <https://doi.org/10.1257/aer.101.3.281>
- Stix, H. 2013. "Why Do People Save in Cash? Distrust, Memories of Banking Crises, Weak Institutions and Dollarization." *Journal of Banking & Finance* 37 (11):4087–4106. <https://doi.org/10.1016/j.jbankfin.2013.07.015>
- Suri, T. 2017. "Mobile Money." *Annual Review of Economics* 9:497–520. <https://doi.org/10.1146/annurev-economics-063016-103638>
- Suri, T., J.C. Aker, C. Batista et al. 2023. "Mobile Money." *VoxDevLit* 2 (2). <https://voxddev.org/voxddevlit/mobile-money>
- Thomas, E., and A. de Waal. 2022. "Hunger in Sudan's Political Marketplace." WPF Occasional Paper No. 32. WPF (World Peace Foundation). <https://worldpeacefoundation.org/publication/hunger-in-sudans-political-marketplace/>

- TPRA (Telecommunications and Post Regulatory Authority). 2017. *Mobile Coverage and Internet Access in Sudan: Annual Sector Report 2017*. TPRA. [https://www.itu.int/en/ITU-D/LDCs/Documents/2017/Country Profiles/Country Profile_Sudan.pdf](https://www.itu.int/en/ITU-D/LDCs/Documents/2017/Country%20Profiles/Country%20Profile_Sudan.pdf)
- UNHCR (United Nations High Commissioner for Refugees). 2026. *Sudan Situation Map Weekly Regional Update – 02 February 2026*. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2024a. *Sudan Humanitarian Update (4 January 2024)*. UNOCHA. <https://www.unocha.org/publications/report/sudan/sudan-humanitarian-update-4-january-2024>
- UNOCHA. 2024b. *Sudan: Humanitarian Access Snapshot (November 2024)*. UNOCHA. <https://www.unocha.org/publications/report/sudan/sudan-humanitarian-access-snapshot-november-2024>
- UNOCHA. 2025a. *Sudan Humanitarian Needs and Response Plan 2025*. UNOCHA. <https://humanitarianaction.info/plan/1220#page-title>
- UNOCHA. 2025b. *Sudan: Humanitarian Access Snapshot (January 2025)*. UNOCHA. <https://www.unocha.org/publications/report/sudan/sudan-humanitarian-access-snapshot-january-2025>
- UNOCHA. 2025c. *Sudan: Humanitarian Response Dashboard (March 2025)*. UNOCHA. <https://reliefweb.int/report/sudan/sudan-humanitarian-response-dashboard-march-2025>
- van der Crujjsen, C., J. de Haan, and R. Roerink. 2021. “Financial Knowledge and Trust in Financial Institutions.” *Journal of Consumer Affairs* 55 (2):680–714. <https://doi.org/10.1111/joca.12363>
- van der Crujjsen, C., J. de Haan, and R. Roerink. 2023. “Trust in Financial Institutions: A Survey.” *Journal of Economic Surveys* 37 (4):1214–1254. <https://doi.org/10.1111/joes.12468>
- World Bank Group. 2020. *World Bank Group Strategy for Fragility, Conflict, and Violence 2020–2025*. World Bank. <https://hdl.handle.net/10986/34858>

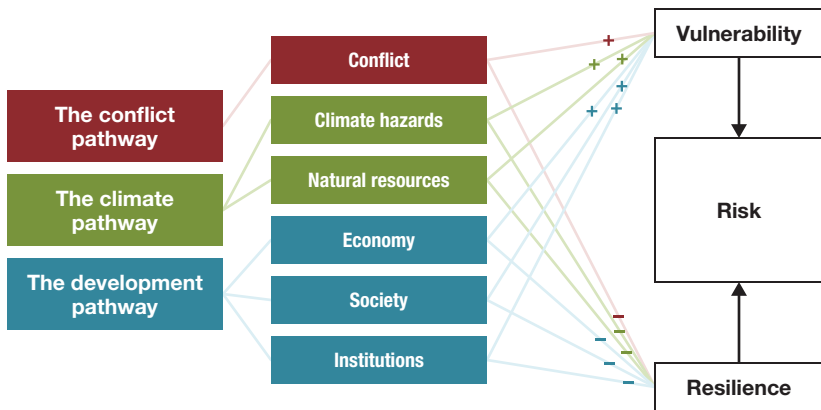
DRIVERS OF VULNERABILITY AND LOW RESILIENCE IN SUDAN

Youssef Chaitani and Hong Pum Chung

Sudan is currently facing one of the most severe crises in its modern history, with conflict, economic collapse, and climate disasters driving unprecedented levels of instability. Since April 2023, when the conflict erupted between the Sudan Armed Forces (SAF) and the Rapid Support Forces (RSF), the country has experienced a complete breakdown in governance and a near-total collapse of key economic and social structures, leading to one of the world's largest internal displacement crises and an escalating humanitarian emergency.

Risk-informed policymaking is not only essential to prioritize and tackle current challenges but also to foresee future risks and challenges and design policies to address them. To examine the main drivers of risk that exacerbate development challenges in conflict-affected Arab countries, the United Nations (UN) Economic and Social Commission for Western Asia (ESCWA) developed the Arab Risk Monitor (ARM), a comprehensive risk assessment framework to evaluate conflict-, climate-, and development-related risks in the Arab region. It provides quantitative risk indicators to help policymakers, international organizations, and humanitarian agencies understand vulnerability and resilience trends across Arab countries.

This chapter focuses on the main drivers of risk in Sudan. Using the ARM assessment for Sudan, the chapter presents a trend analysis that begins with 2013 and proceeds to 2023. The overarching regional and national analysis presents data for three years (2013, 2018, and 2023) during the 11-year period: 2013 was selected as the base year, after the separation of Sudan and South Sudan in 2011; 2018 was used as a midpoint for the analysis; and 2023 was the most recent year of data availability. Data for the most recent year were used in cases where 2023 data were not available. The chapter begins with an overview of risk vulnerability and resilience, then assesses the different risk pathways, domains, and drivers of risk.

FIGURE 13.1 Conceptual framework for the Arab Risk Monitor

Source: Authors, based on UNESCWA (2023).

Arab Risk Monitor

The ARM aims to identify key risks that could lead to conflict, instability, and humanitarian crises; assess vulnerability and resilience in Arab countries using data-driven analysis; track risk trends over time to provide early warnings and inform policymaking; and support risk-informed decision-making for national governments, UN agencies, and regional organizations. The ARM provides a structured methodology for assessing how different factors—such as political instability, economic fragility, and climate change—combine to increase the likelihood of crises.

The ARM provides measures of risk grouped into three risk pathways, which are associated with a greater risk of conflict, crisis, and instability in the Arab region (Figure 13.1).¹ Within each pathway, the Risk Monitor report provides one or more risk domains:

- The conflict pathway examines historical grievances, one of the strongest predictors of future conflict, as well as a country’s enabling security environment. It produces one risk domain (conflict risk).
- The climate pathway looks at the impacts of climate hazards, as well as the availability and management of natural resources. It produces two risk domains (climate hazard risk and natural resource risk).

¹ For more details on the conceptual framework, see ESCWA (2023).

- The development pathway represents all the complex dynamics that, in most cases, directly or indirectly cause risk in a country. It produces three risk domains (economic risk, social risk, and institutional risk).

The quantification of risk begins by collecting 45 relevant indicators from internationally comparable data sources. Then, the data are transformed and normalized, resulting in a score from 0 to 1 for 36 drivers of risk to ensure relative comparability across all countries and relevant time periods (from 2000 onward). The drivers of risk are further categorized into vulnerabilities, in which higher scores indicate a higher risk level. In contrast, for assessments of resilience, lower scores indicate higher risk.

The six risk domains are expressed as a combination of two elements: increasing vulnerability and decreasing resilience. Vulnerability is defined in terms of a country's likelihood to experience shocks—specific to violence and armed conflict—and its structural exposure to such shocks. Resilience is defined as a country's policy-driven capacity to absorb negative impacts. For each risk domain, an aggregate score is produced by ESCWA based on a composite model consisting of the 36 drivers that measure vulnerability and resilience (Figure 13.2). The monitor provides a structured methodology for assessing how different factors—such as political instability, economic fragility, and climate change—combine to increase the likelihood of crises.

Sudan: Overall risk

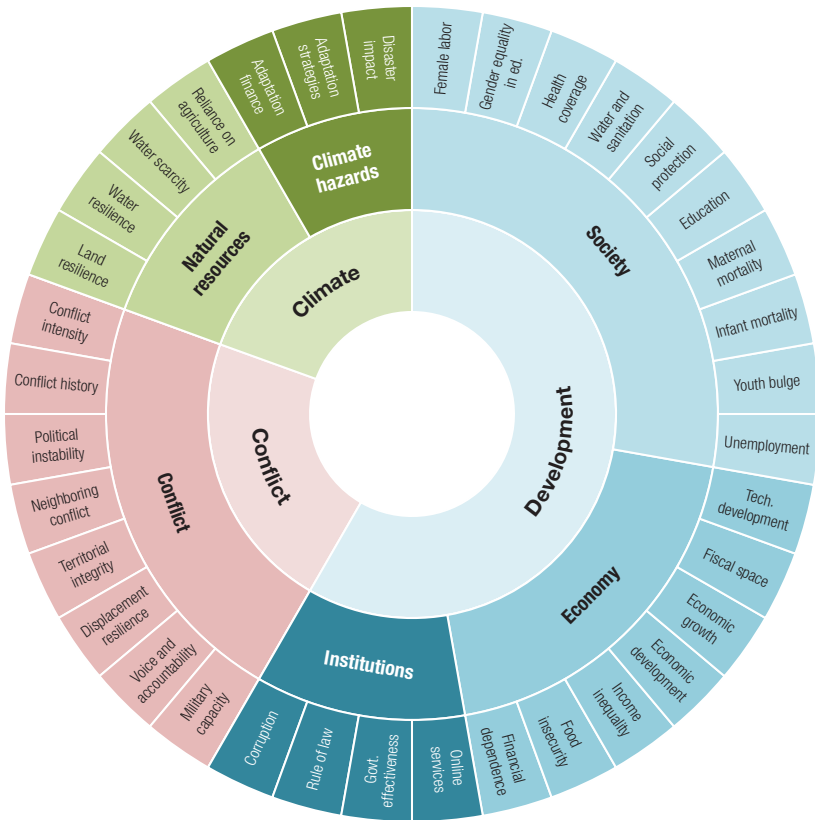
The ARM assessment for Sudan reveals severe vulnerabilities across conflict, climate, and development pathways, with critical weaknesses in resilience (Table 13.1). The overall risk score for Sudan is among the highest in the Arab region, indicating a multifaceted crisis that requires urgent intervention. All three pathways have a risk level of significant or higher, with conflict risk showing the highest risk rating.

TABLE 13.1 Overall risk, Sudan, 2023

Pathway	Vulnerability	Resilience	Overall Score
Conflict	Very High	Very Low	Severe
Climate	High	Low	Significant
Development	High	Low	Significant

Source: Authors, based on UNESCWA (2025).

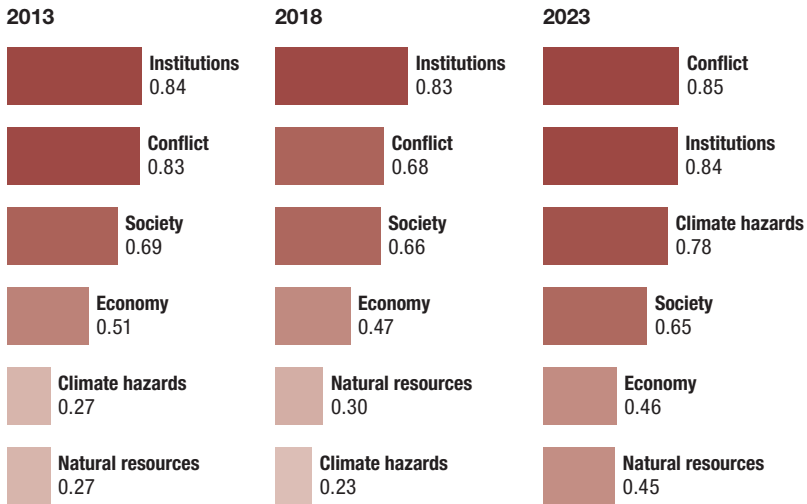
FIGURE 13.2 Measurement framework for the Arab Risk Monitor



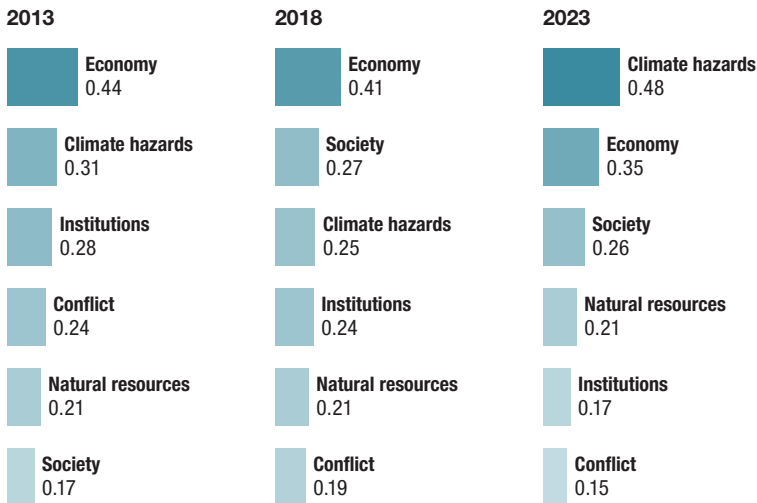
Source: Authors, based on UNESCWA (2025).

At the domain level, conflict and institutional risks are ranked as severe, the highest level of risk. Risks in the natural resources, climate hazards, economy, and society domains are significant. Figure 13.3 shows the trend in risk vulnerability across domains over the past decade. Institutional and conflict vulnerability have remained high over the 2013–2023 period, while vulnerability from climate hazards significantly increased in 2023.

Figure 13.4 shows the trends in risk resilience across domains over the past decade. Resilience to institutional and conflict risks have decreased over this period (levels of 0.20 and below), driving an overall weaker resilience.

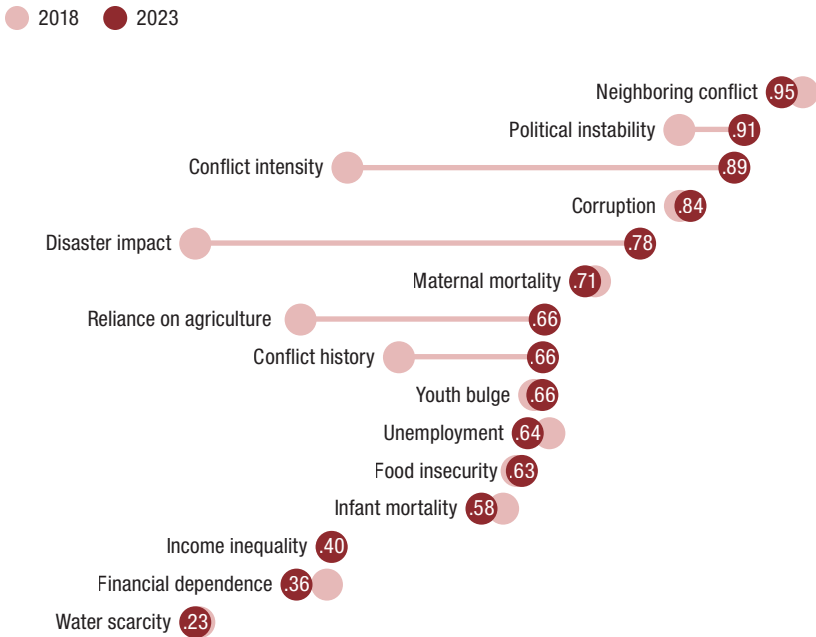
FIGURE 13.3 Risk vulnerability ranked by domain, Sudan

Source: Authors, based on UNESCWA (2025).

FIGURE 13.4 Risk resilience ranked by domain, Sudan

Source: Authors, based on UNESCWA (2025).

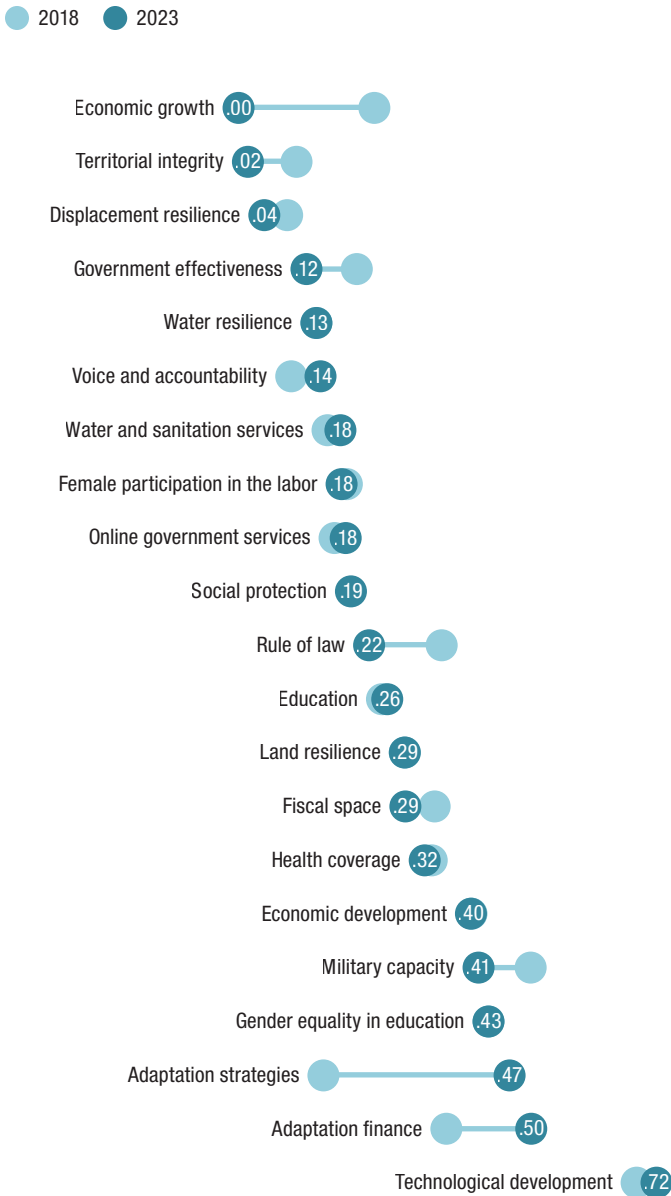
FIGURE 13.5 Drivers of vulnerability, Sudan, 2018 and 2023



Source: Authors, based on UNESCWA (2025).

Figures 13.5 and 13.6 compare the drivers of risk (from highest to lowest risk) between 2018 and 2023. Figure 13.5 shows a significant increase in vulnerability for the categories of conflict intensity, conflict history, disaster impact, reliance on agriculture, and political instability, with little to no improvement in other drivers of vulnerability. For 2023, only 4 of 15 drivers of vulnerability are ranked at medium risk or less, and 4 drivers are ranked at the highest risk level (above 0.80).

Figure 13.6 shows the drivers of resilience ranked from lowest (higher risk) to highest (lower risk) resilience. Risk drivers under the institutional domain, namely rule of law and government effectiveness, have experienced the most notable deterioration, while drivers of risk under the climate hazards domain, namely adaptation strategies and adaptation finance, have undergone notable improvements in resilience. With the collapse of the economy, drivers of resilience have deteriorated; most notable are economic growth, which records the lowest possible score of zero, and fiscal space.

FIGURE 13.6 Drivers of resilience, Sudan, 2018 and 2023

Sudan: Conflict risk

Sudan's conflict pathway is characterized by violent clashes, interethnic disputes, and regional spillovers. More than 30,000 conflict-related fatalities have been recorded since April 2023 (ACLED 2025), and more than 10 million people have been displaced (UNHCR 2025), leading to the largest internal displacement crisis worldwide. Both conflict vulnerability and resilience have deteriorated over the past decade (Table 13.2).

TABLE 13.2 Conflict risk, Sudan

Pathway	Domain	Vulnerability	Resilience	Overall Score
Conflict	Conflict	Very High	Very Low	Severe

Source: Authors, based on UNESCWA (2025).

Figure 13.7 presents the relationship between conflict risk vulnerability and resilience of the 22 Arab countries. Each circle represents an Arab country, with the size of the circle denoting the population size relative to the region.

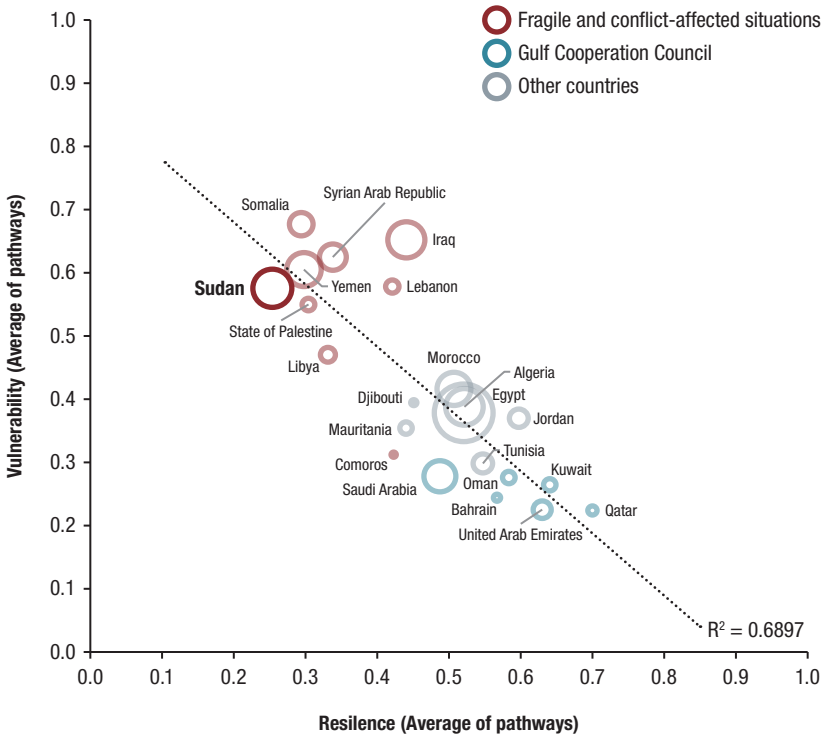
The figure shows that countries with high vulnerability also tend to have low resilience to risks. Countries in the Gulf Cooperation Council are relatively high in resilience and low in vulnerability, while countries in the fragile and conflict-affected situations category are low in resilience and high in vulnerability.

Compared to other Arab countries, Sudan has one of the highest levels of vulnerability and lowest levels of resilience for 2023, with risks that are the same as or similar to other conflict-affected countries in the region, including Palestine, Somalia, Syria, and Yemen.

As shown in Table 13.3, most of the drivers of conflict risk are at high levels (that is, high vulnerability or low resilience) and have generally deteriorated over the past decade. Most notably, conflict-related risks have escalated to dangerous levels over the past five years, including both internal conflict and conflict in neighboring countries (Figure 13.8). Drivers of resilience are also at very high levels (0.20 or below), apart from military capacity, though even this driver has deteriorated significantly over the past decade.

The struggle between the SAF and RSF has triggered additional violence among ethnic militias and armed groups, further fragmenting the security landscape and leading to a deterioration of already low territorial integrity. Political instability has worsened, with no effective governance or ceasefire agreements in sight. Neighboring conflicts in Chad, Ethiopia, and South Sudan are exacerbating cross-border violence (UNOCHA 2024).

FIGURE 13.7 Conflict vulnerability and resilience, Sudan, 2023

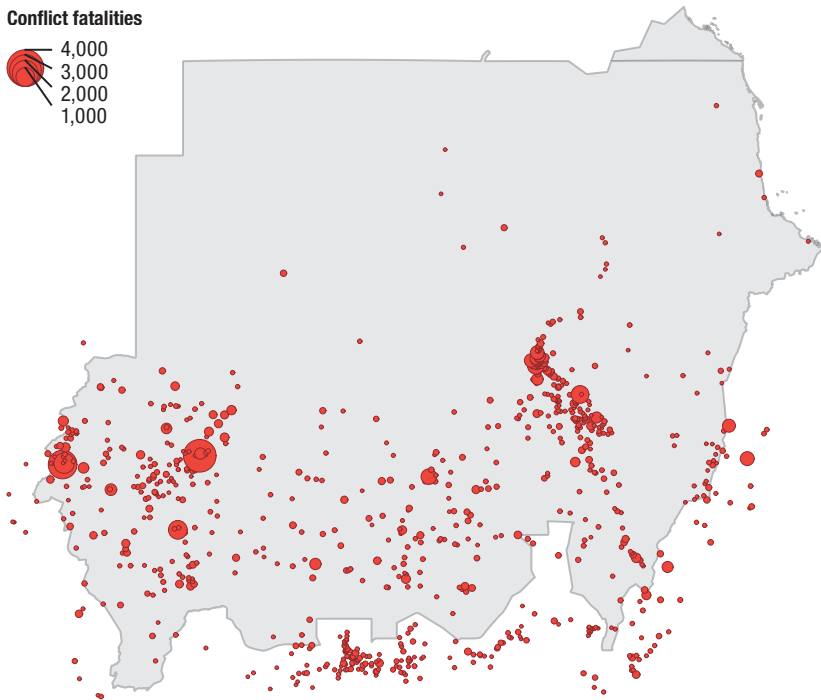


Source: Authors, based on UNESCWA (2025).

TABLE 13.3 Drivers of vulnerability and resilience for conflict risk, Sudan

Risk Levels:	Very High	High	Medium	Low	Very Low	
Driver	2013	2018	2023	Trend		
Vulnerability	Conflict intensity	0.77	0.42	0.89	[Bar chart showing increasing trend]	
	Conflict history	0.73	0.48	0.66	[Bar chart showing increasing trend]	
	Political instability	0.87	0.83	0.91	[Bar chart showing increasing trend]	
	Neighboring conflict	0.95	0.98	0.95	[Bar chart showing increasing trend]	
Resilience	Territorial integrity	0.06	0.10	0.02	[Bar chart showing decreasing trend]	
	Displacement resilience	0.09	0.08	0.04	[Bar chart showing decreasing trend]	
	Voice and accountability	0.10	0.09	0.14	[Bar chart showing decreasing trend]	
	Military capacity	0.73	0.50	0.41	[Bar chart showing decreasing trend]	

Source: Authors, based on UNESCWA (2025).

FIGURE 13.8 Conflict fatalities in Sudan and near Sudan (within 100 km), 2020–2024

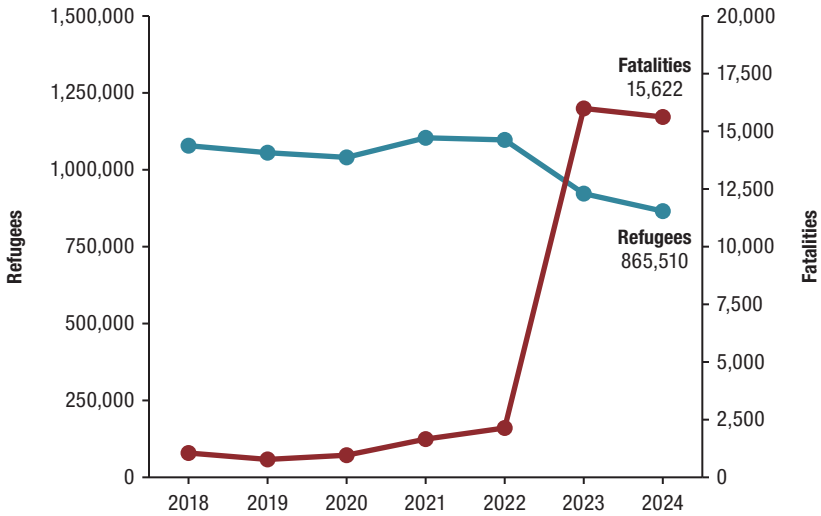
Source: Authors, based on ACLED (2025).

As shown in Figure 13.9, conflict-related fatalities have significantly increased over the past two years to total more than 30,000 deaths since the outbreak of conflict in 2023 (UNHCR 2025; ACLED 2025).

The number of refugees leaving the country has slightly decreased but remains high, at around 1 million people per year since 2018, as shown in Figure 13.10 (UNOCHA 2024; IDMC 2025).

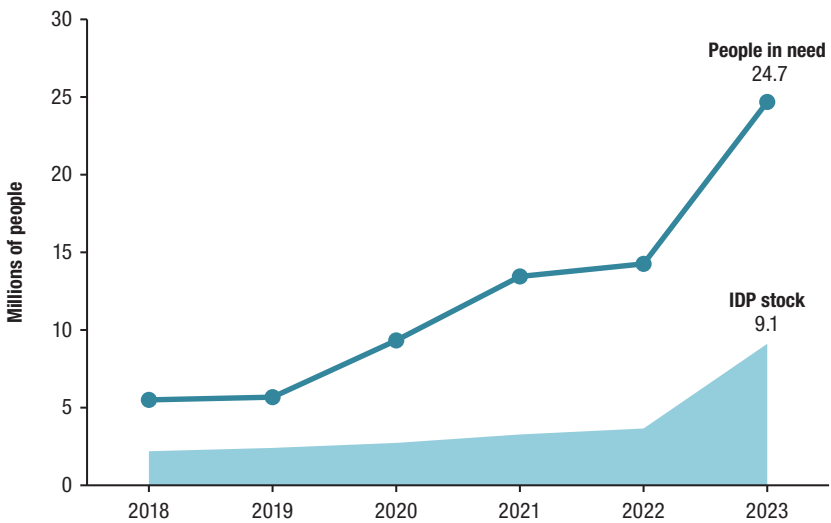
The slight decline in the number of refugees can be attributed to an increase in conflict in neighboring countries and a decrease in the number of people who can mobilize resources to leave the country. These factors may also explain why the number of internally displaced persons has quadrupled over the past five years and surged since the beginning of the conflict in 2023 (IDMC 2025). The combination of conflict and the deteriorating economy has also contributed to a rapid rise in the number of people in need of humanitarian assistance, who now constitute more than half of the entire country's

FIGURE 13.9 Conflict fatalities and refugees, Sudan, 2018–2024



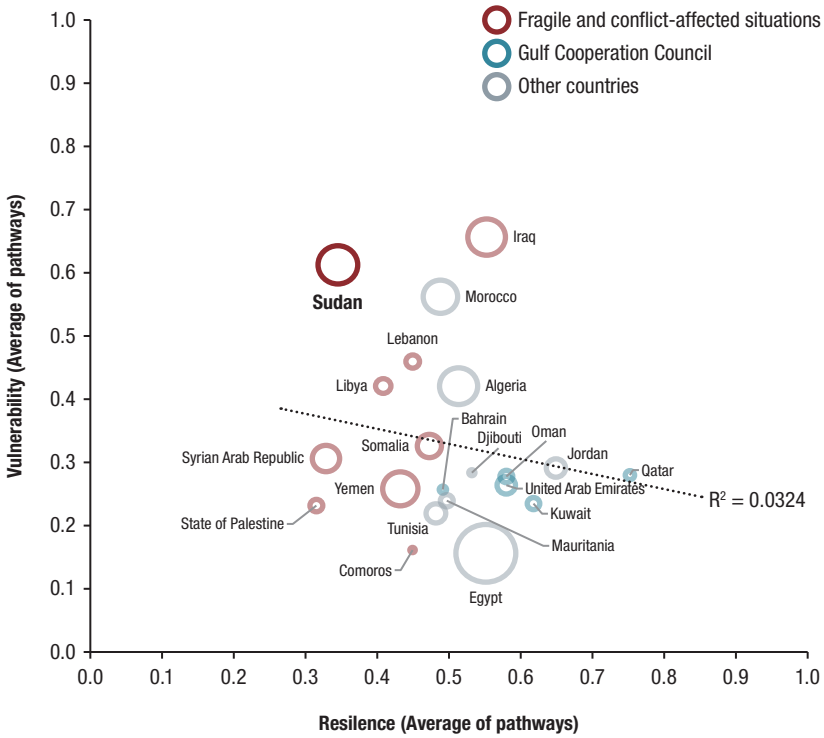
Source: Authors, based on UNHCR (2025) and ACLED (2025).

FIGURE 13.10 People in need and internally displaced people, Sudan, 2018–2023



Source: Authors, based on UNOCHA (2024) and IDMC (2025).

FIGURE 13.11 Climate vulnerability and resilience in various countries, 2023



Source: Authors, based on UNESCWA (2025).

population (UNOCHA 2024; IDMC 2025). Unfortunately, the continued fragmentation of Sudan’s security landscape indicates that conflict is likely to persist, exacerbating political instability and humanitarian suffering.

Sudan: Climate and natural resource risks

Sudan is one of the most climate-vulnerable nations globally, with frequent floods, droughts, and rising temperatures worsening food insecurity and displacement (Figure 13.11 and Table 13.4). The combination of extreme climate events and conflict-driven displacement has created a dual crisis, straining Sudan’s ability to adapt. Unless climate adaptation strategies are implemented, millions will remain at risk of food and water shortages.

TABLE 13.4 Climate risk

Pathway	Domain	Vulnerability	Resilience	Overall Score
Climate	Natural Resource	Medium	Low	Significant
	Climate Hazards	High	Medium	Significant

Source: Authors, based on UNESCWA (2025).

Both domains for the climate risk pathway—natural resources and climate hazards—are at significant risk levels. Sudan’s vulnerability to climate risk is among the highest in the Arab region, second only to Iraq, and resilience is the third lowest in the region after Palestine and Syria.

Natural resources

The combination of conflict and climate change has stressed the country’s already vulnerable water and land resources. Desertification is reducing available farmland, triggering land disputes and conflict. Sudan’s vulnerable population is more heavily reliant on agriculture, and the decline in crop yields in 2024 has exacerbated the already worsening food security.

TABLE 13.5 Drivers of vulnerability and resilience for natural resources risk, 2013–2023

Risk Levels:	Very High	High	Medium	Low	Very Low
	Driver	2013	2018	2023	Trend
Vulnerability	Reliance on agriculture	0.71	0.64	0.34	
	Water scarcity	0.75	0.76	0.77	
Resilience	Water resilience	0.13	0.13	0.13	
	Land resilience	0.29	0.29	0.29	

Source: Authors, based on UNESCWA (2025).

Climate hazards

In addition to conflict vulnerabilities, Sudan is exposed to myriad climate change impacts, including drought and flooding, which are likely to increase in both frequency and intensity in the coming decades.

As of October 2024, UN experts warned that the country was facing one of the “worst famines in decades,” adding that the beginning of the rainy season and associated flooding in eastern and northern Sudan was exacerbating the challenge by damaging agriculture and livestock losses, as well as negatively impacting water quality (OHCHR 2024). Regions such as Darfur have long suffered from intensifying drought conditions (UNEP 2021). Areas exposed to drought are also particularly vulnerable

TABLE 13.6 Drivers of vulnerability and resilience for climate hazards risk, Sudan

Risk Levels:		Very High	High	Medium	Low	Very Low
	Driver	2013	2018	2023	Trend	
Vulnerability	Disaster impact	0.27	0.23	0.78		
	Adaptation strategies		0.15	0.47		
Resilience	Adaptation finance	0.31	0.36	0.50		

Source: Authors, based on UNESCWA (2025).

to flooding when heavy rains do occur, as the ground is too dry to absorb excessive rainfall.

According to climate projections from the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR), by as early as 2025, Sudan’s mean temperate may increase by 1.1 degrees Celsius compared to the reference period (1981–2000). On average, the country’s mean temperature has increased by more than 0.07 degrees Celsius per decade, as shown in Figure 13.12.

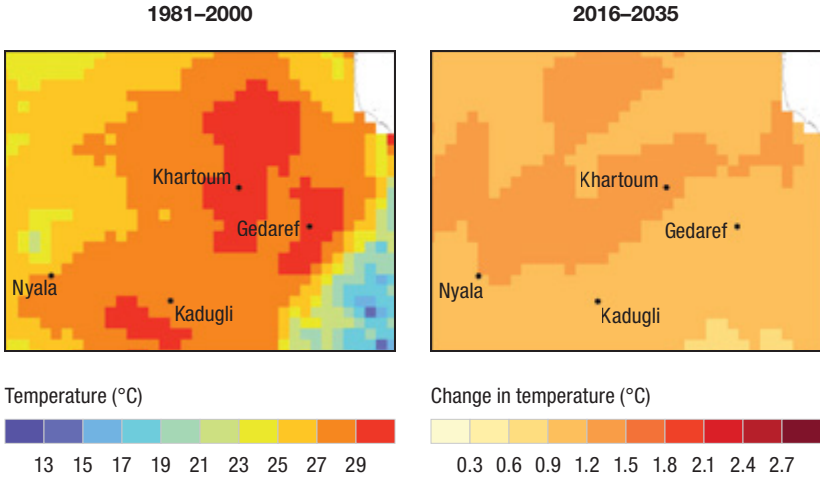
With respect to precipitation, RICCAR projections are more variable (Figure 13.13). In the Blue Nile Basin area, precipitation is generally decreasing, while in the Sahara, rainfall will become more sporadic. Combined, these projections indicate that drought conditions are likely to worsen in the northern Sahara, while the Sahel will be affected by elevated flood risks.

Sudan: Development risks

Sudan’s economic collapse is accelerating, with hyperinflation, skyrocketing food prices, and mass unemployment driving severe financial instability. The country’s institutions have collapsed, leaving millions without access to education, healthcare, or legal protections. Moreover, Sudan’s social fabric has been severely weakened, with high levels of displacement, gender-based violence, and collapsing public services. Institutions lack the capacity to enforce rule of law, deliver essential services, or coordinate humanitarian efforts.

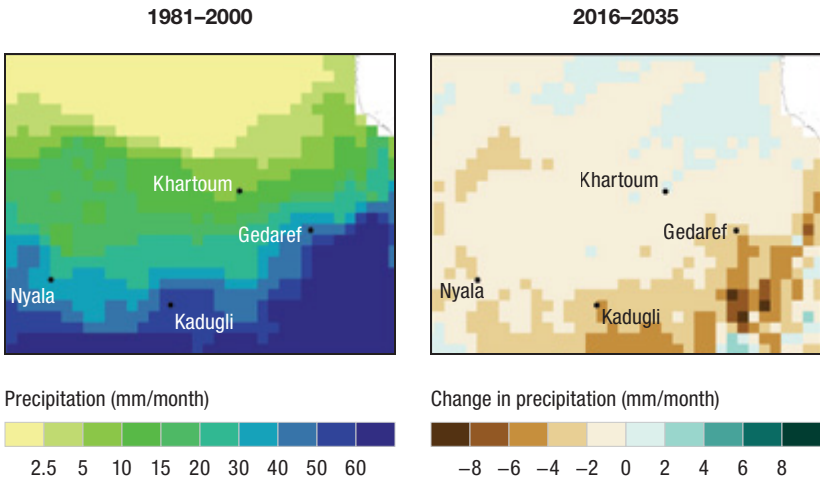
Thus, Sudan faces significant risks in all three development risk pathways (economy, society, and institutions) (Table 13.7). Regionally, the country’s development risk vulnerability is one of the highest and resilience one of the lowest, marginally surpassed only by conflict-entrenched Arab states (Figure 13.14).

FIGURE 13.12 Mean change in temperature by 2025 (2016–2035) compared to the reference period (1981–2000), RCP 8.5, Sudan



Source: Authors, based on RICCAR (2025).

FIGURE 13.13 Mean change in precipitation by 2025 (2016–2035) compared to the reference period (1981–2000), RCP 8.5, Sudan



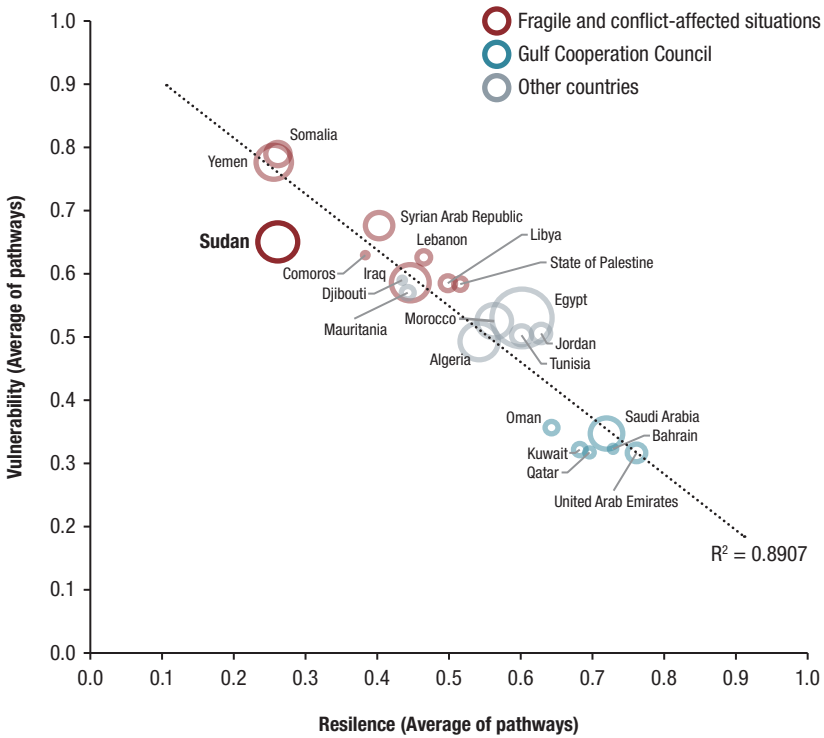
Source: Authors, based on RICCAR (2025).

TABLE 13.7 Development risk, Sudan

Pathway	Domain	Vulnerability	Resilience	Overall Score
Development	Economy	Medium	Low	Significant
	Society	High	Low	Significant
	Institutions	Very High	Very Low	Severe

Source: Authors, based on UNESCWA (2025).

FIGURE 13.14 Development vulnerability and resilience, various countries, 2023



Source: Authors, based on UNESCWA (2025).

Economic risks

Sudan’s economic collapse is one of the worst in the Arab region, with hyperinflation, rising poverty, and failing public services.

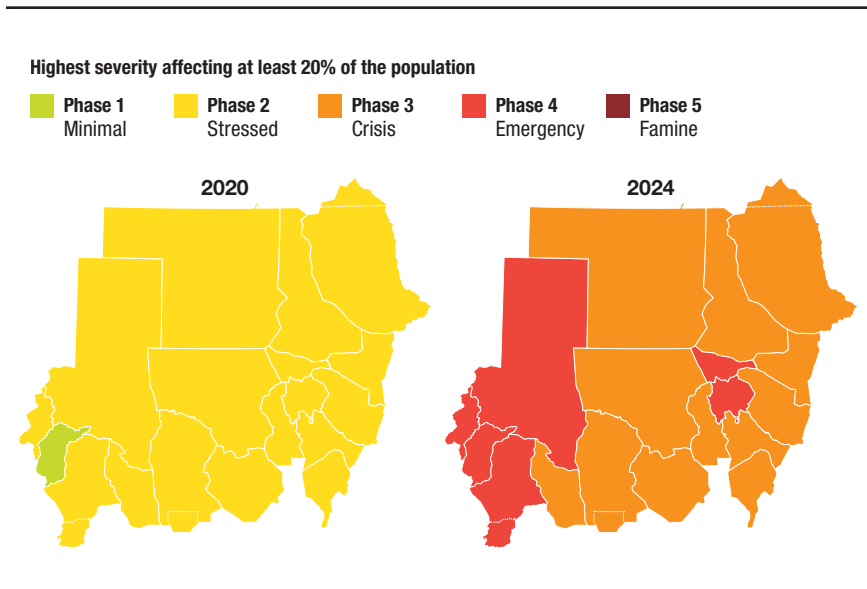
Economic vulnerability is primarily driven by food insecurity. However, due to the lack of data from Sudan’s government and reputable international sources, the true extent of food insecurity, which is rapidly accelerating toward

TABLE 13.8 Drivers of vulnerability and resilience for economic risk, Sudan

Risk Levels:		Very High	High	Medium	Low	Very Low
	Driver	2013	2018	2023	Trend	
Vulnerability	Financial dependence	0.42	0.39	0.36	[Bar chart showing decreasing trend]	
	Food insecurity	0.70	0.63	0.63	[Bar chart showing stable high risk]	
	Income inequality	0.40	0.40	0.40	[Bar chart showing stable medium risk]	
Resilience	Economic development	0.47	0.40	0.40	[Bar chart showing decreasing trend]	
	Economic growth	0.34	0.23	0.00	[Bar chart showing sharp decline to zero]	
	Fiscal space	0.50	0.34	0.29	[Bar chart showing decreasing trend]	
	Technological development		0.68	0.72	[Bar chart showing increasing trend]	

Source: Authors, based on UNESCWA (2025).

FIGURE 13.15 Acute food insecurity, Sudan, 2020 and 2024

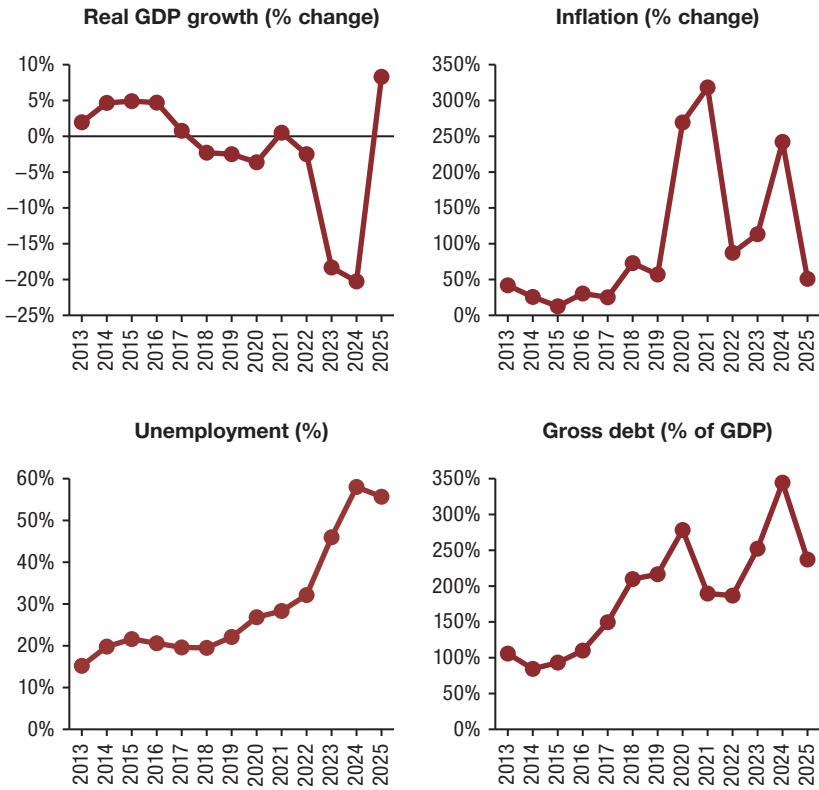


Source: Authors, based on IPC (2024).

a full famine, is examined through data and projections from the Integrated Food Security Phase Classification.

Over the past five years, acute food insecurity increased from phase 2 (stressed) in most of the country to phase 3 (crisis) or higher in all 17 states, as shown in Figure 13.15. With conflict and climate crises underpinned by overstressed natural resources and a lack of institutions, food insecurity is projected to increase further.

FIGURE 13.16 Real GDP growth and inflation, Sudan, 2013–2025



Source: Authors, based on IMF (2025).

Sudan’s economy is on a steep downward trajectory, with gross domestic product (GDP) contracting by 20 percent in 2024 and an additional 8.3 percent decline expected in 2025 (Figure 13.12). The Sudanese pound has lost more than 200 percent of its value, leading inflation to surpass 242 percent in 2024 and making food and basic goods unaffordable, especially given that more than 58 percent of the working population is unemployed.

Risks to society

Sudan’s social risk domain is driven by high levels of vulnerability in employment and health, as well as low levels of resilience in basic services, including education, water and sanitation, and social protection (Table 13.9).

TABLE 13.9 Drivers of vulnerability and resilience for social risk, Sudan, 2013–2023

Risk Levels:		Very High	High	Medium	Low	Very Low
		Driver	2013	2018	2023	Trend
Vulnerability	Unemployment	0.74	0.67	0.64		
	Youth bulge	0.63	0.65	0.66		
	Infant mortality	0.64	0.61	0.58		
	Maternal mortality	0.74	0.72	0.71		
	Education	0.22	0.25	0.26		
Resilience	Social protection			0.19		
	Water and sanitation services	0.11	0.15	0.18		
	Health coverage		0.33	0.32		
	Gender equality in education	0.17	0.43	0.43		
	Female participation in labor	0.18	0.19	0.18		

Source: Authors, based on UNESCWA (2025).

While both infant and maternal mortality have slightly decreased over the past decade, weak governance, food insecurity, and the collapse of public infrastructure such as hospitals will likely have significant negative impacts. High unemployment, combined with a large youth bulge and ongoing conflict, is also leading to further destabilization through even higher risks of conflict and political violence.

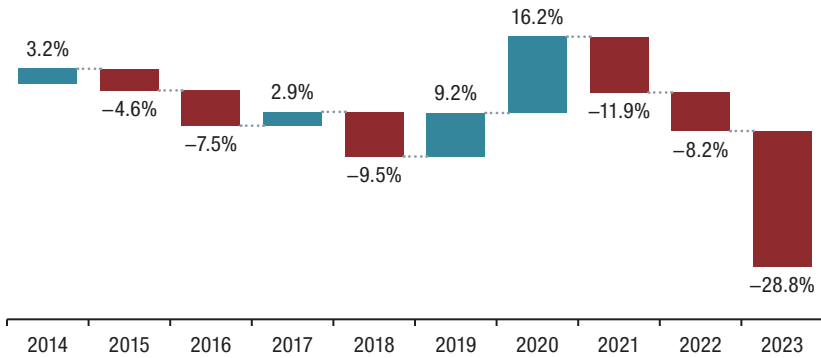
Risks to institutions

The conflict has caused major disruptions to basic service delivery, which have been further compounded by the collapse of public institutions. Institutional vulnerability and risk are being exacerbated through the fragmentation of public institutions and their human resources.

TABLE 13.10 Drivers of vulnerability and resilience for institutional risk, Sudan, 2013–2023

Risk Levels:		Very High	High	Medium	Low	Very Low
		Driver	2013	2018	2023	Trend
Vulnerability	Corruption	0.84	0.83	0.84		
	Rule of law	0.32	0.35	0.22		
Resilience	Government effectiveness	0.24	0.20	0.12		
	Online government services	0.29	0.16	0.18		

Source: Authors, based on UNESCWA (2025).

FIGURE 13.17 Changes in institutional resilience, Sudan, 2013–2023

Source: Authors, based on UNESCWA (2025).

Corruption remains unchecked, further weakening public institutions. The steep decline in institutional resilience is notable through the marked deterioration of the rule of law, as well as government effectiveness, which fell significantly in 2023.

Conclusion and policy recommendations: Strengthening drivers of resilience in Sudan

The interconnected crises of conflict, economic failure, climate shocks, and governance collapse are driving Sudan toward a protracted humanitarian catastrophe. With the ongoing warfare between the SAF and RSF, increased violence in Darfur, and regional spillovers, this escalation in conflict poses an immediate threat to many lives. Climate vulnerability, including severe flooding, drought, and desertification, reduces food and water security. Largely due to these factors, Sudan's economic situation is grim, with steep declines in GDP, hyperinflation, and soaring unemployment. Weak governance is reflected in the country's institutional collapse, which has led to a breakdown in law, service delivery, and social protection, and has greatly limited options for improvement.

These overlapping crises of conflict, economic collapse, and climate shocks have eroded state capacity and left millions highly vulnerable. Addressing these challenges requires a multidimensional approach to tackle the conflict, climate, and development pathways simultaneously, while also prioritizing

resilience-building at every level to reduce the humanitarian crisis and build national peace assets.

First, political will must be matched with targeted interventions that strengthen resilience. National, regional, and international actors should commit to risk-informed strategies that not only respond to immediate humanitarian needs but also address the structural drivers of fragility, such as weak governance, deteriorating institutions, and reliance on climate-stressed agriculture.

Second, operationalizing the humanitarian-development-peace nexus is essential. Efforts should go beyond parallel interventions to focus on integrated action around shared priorities: protecting livelihoods, expanding access to basic services, and enhancing social cohesion. Coordinated programming can reduce duplication, increase efficiency, and amplify impact, particularly in highly vulnerable areas affected by displacement and food insecurity.

Third, resilience-building should be mainstreamed across all actors at the local, national, regional, and multilateral levels. Local institutions, civil society, and community organizations must be empowered as frontline partners, while international and multilateral agencies align their investments to reinforce, rather than substitute, local capacity.

Finally, strengthening peacebuilding assets is critical. Inclusive governance, rule of law, and equitable access to resources should be prioritized as foundations for sustainable recovery. Integrating climate adaptation and conflict prevention into development planning can help mitigate future risks while creating pathways for long-term stability.

In sum, Sudan requires a comprehensive, coordinated, and resilience-centered strategy that bridges humanitarian relief with development and peacebuilding. Without such an approach, the cycle of crisis and fragility will deepen, undermining prospects for recovery and stability.

References

- ACLED (Armed Conflict Location & Event Data). 2025. "Conflict Data." Accessed February 10, 2025. <https://acleddata.com/conflict-data>
- IDMC (Internal Displacement Monitoring Centre). 2025. "Global Internal Displacement Database." Accessed February 10, 2025. <https://www.internal-displacement.org/database/displacement-data/>
- IMF (International Monetary Fund). 2025. "Sudan | Country Data." Accessed February 10, 2025. <https://www.imf.org/en/countries/sdn#countrydata>
- IPC (Integrated Food Security Phase Classification). 2024. "Sudan: Acute Food Insecurity Situation - Updated Projections and FRC Conclusions for October 2024 to May 2025." <https://www.ipcinfo.org/ipc-country-analysis/details-map/en/c/1159433/>
- OHCHR (Office of the United Nations High Commissioner for Human Rights). 2024. "Sudan Faces One of the Worst Famines in Decades, Warn UN Experts." OHCHR. Press release. October 17, 2024. <https://www.ohchr.org/en/press-releases/2024/10/sudan-faces-one-worst-famines-decades-warn-un-experts>
- RICCAR (Regional Initiative for the Assessment of Climate Change). 2025. "Regional Knowledge Hub Data Portal." Accessed February 10, 2025. <https://gis.riccar.org/index.html?domain=arab>
- UNEP (United Nations Environment Programme). 2021. "Rebuilding Relationships over Natural Resources in Darfur." *UNEP News and Stories* (blog), August 19. <https://www.unep.org/news-and-stories/story/rebuilding-relationships-over-natural-resources-darfur>
- UNESCWA (United Nations Economic and Social Commission for Western Asia). 2023. "Arab Risk Monitor: Quantifying the Drivers of Risk of Conflict, Version 1.0." UNESCWA. <https://www.unescwa.org/publications/arab-risk-monitor-drivers-conflict>.
- UNESCWA. 2025. "Arab Risk Monitor Database." Accessed February 10, 2025.
- UNHCR (United Nations High Commissioner on Refugees). 2025. "Refugee Data Finder." Accessed February 10, 2025. <https://www.unhcr.org/refugee-statistics>.
- UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2024. "Global Humanitarian Overview 2025." UNOCHA. <https://humanitarianaction.info/document/global-humanitarian-overview-2025>.

A SUDANESE STRATEGY FOR POSTCONFLICT, AGRICULTURE-LED TRANSFORMATIVE GROWTH

Ibrahim Elbadawi

The intense factional war between the Sudanese Armed Forces (SAF) and the paramilitary Rapid Support Force (RSF) that erupted in April 2023 has devastated Sudan. This war is a tragic legacy of the kleptocratic regime of General Omar Al-Bashir, which ruled the country from 1989 until it was deposed by the leadership of the two armies in 2019, following a massive popular uprising in December 2018 (see Chapter 2 for details). The presence of a divided military institution in Sudan has been attributed to the coup-proofing strategy of “coup-fearing” autocrats, who were willing to undermine the state’s military effectiveness to extend their own tenure (Powell 2014).¹

Sudan’s current internal conflict resembles an interstate war in terms of the intensity of violence, destruction, and death, as well as the immense humanitarian crisis it has created. The death toll is estimated to be more than 44,000 as of September 2025 (ACLED 2025), though some assessments suggest fatalities could exceed 150,000 when accounting for deaths from violence, starvation, and disease (Sampson 2025). Even using the low estimate, the conflict ranks as the fourth-deadliest ongoing conflict in the world, according to the Conflict Index produced by the Armed Conflict Location and Event Data Project (ACLED), an organization that collects conflict and crisis data.² It has left more than half of Sudan’s population in need of humanitarian aid, and nearly 12 million people have been displaced. Of these, 7 million people are displaced internally, while 4.5 million have sought refuge in neighboring countries, making Sudan the largest displacement crisis in the world (UNOCHA 2025; UNHCR 2026). Moreover, because this war has been fought in the capital and other major cities, it has substantially damaged the country’s industrial base, education, and health

1 See Elbadawi and Fiuratti (2024) for an extensive discussion of the rift between the leadership of the two armies and the ensuing conflict.

2 <https://acleddata.com/conflict-watchlist-2025/sudan/>

facilities. It has also caused the collapse of critical services—including commercial, financial, and information and communications technology (ICT) services—and eroded state capacity, with detrimental impacts on food security and livelihoods.

This chapter aims to inform Sudan’s national renewal and reconstruction, once peace is achieved. Obviously, the most urgent need for Sudan, and a prerequisite for economic revival, is ending the current destructive war and building a genuine, sustainable peace. This will require a broad-based peace process in which civilian stakeholders, such as political parties, civil society, and local communities, all have seats at the table as part of a national peace conference. Peace initiatives have been mounted previously by several regional and international actors, including the African Union, the Intergovernmental Authority on Development (IGAD), and the Jeddah Forum, but these have met with limited success. Unfortunately, in the absence of a credible peace process for ending this war or a decisive win by either of the two armies, the worst is yet to come. Already, the high-intensity violence is evolving into a large-scale, long-duration ethnic and regional war.

Throughout this chapter, we treat peacebuilding and national renewal as elements of the “enabling environment” for transformative agriculture-led growth that is the best hope for securing peace for the long term. In other words, ending the war, rebuilding institutions, and restoring social cohesion are not parallel goals; they are growth-critical public goods that will make input markets, value chains, and investment in agro-industry possible at scale. This framing guides our discussion of Sudan’s future in this chapter.

In the following section, we argue that even if regional efforts succeed in ending the war, Sudan will still need a hybrid UN/regional multidimensional peacekeeping operation (PKO). In addition to enforcing and keeping the peace, a PKO would support several critical components of a transition agenda, such as meaningful security reforms commensurate with accepted international norms, capacity building, and institutional development. However, experience shows that, while such comprehensive UN-led missions have been successful in enhancing the *quality* of peace, they usually fail in sustaining it after the United Nations (UN) withdraws, especially in ethnically divided societies such as Sudan. Maintaining peace requires transformative economic growth that addresses interethnic grievances and promotes interethnic cooperation. We review available evidence on this thesis to make the case for embedding the envisaged PKO in a national renewal and development agenda, anchored around the goal of sustained, transformative economic growth.

Unfortunately, most of the scholarship community and most country experiences suggest that elites will choose growth-depressing, inefficient policies and institutions over growth-promoting policies in order to maintain their political power and hence their continued ability to access rents. In the next section, we review the main debates about why some elites chose to “gamble” on development by tying their legitimacy and accession to power to their success in achieving tangible economic improvements, especially sustained economic growth that transforms lives and enhances the social welfare of the broad population. In the subsequent section, we contrast the strategies of the elites of the Sudan Bashir regime to those of the Ethiopian Peoples’ Revolutionary Democratic Front (EPRDF) and ask why the Ethiopian elites chose economic legitimacy as an instrument for maintaining political power, while the Sudanese regime opted for kleptocracy fueled by rent distribution as the main tool for holding onto power. Using the insights from these two case studies, we glean some lessons for promoting pro-growth coalitions in postconflict Sudan.

In the penultimate section, we argue that Sudan’s diverse and richly endowed agriculture sector could be both the main driver of growth and a magnet for attracting the foreign direct investment (FDI) needed for financing the envisaged transformative agriculture-led economic growth. Sudan’s agriculture sector has long been seen as a potential breadbasket, with potential to attract large-scale FDI associated with regional food security initiatives, especially from the capital-surplus Gulf Cooperation Council (GCC) countries. Recent global supply chain disruptions have significantly enhanced the drive toward re-localization and regional cooperation, especially for food security, and would undoubtedly generate renewed interest in Sudan’s agriculture sector, once the current war is ended and the country manages to embark on deep economic reforms that anchor positive expectations about the future. The final section offers conclusions.

Building peace for reconstruction and national renewal for Sudan

As we look toward the postconflict era, we identify peace, reconstruction, and national renewal as the “enabling environment and critical public goods” for food security, agrifood system development, and inclusive growth. Within a multistakeholder approach, UN/regional PKOs are external facilitators with unique skills in civilian protection, de-escalation, and institutional support—functions that lower transaction costs, reduce risk, and crowd-in private and donor investments along food and agriculture value chains.

As a prerequisite for reconstruction and transformative development, the envisaged peace must go beyond just ending the war. A peace process that only aims to end the conflict and is primarily confined to the military protagonists in civil wars and anchored around power-sharing agreements (PSAs) has been called a “negative” peace. Sudan has experienced this kind of peacebuilding efforts, including four PSAs, supported by the international and regional communities, but these all failed to achieve sustainable peace and some led to disastrous outcomes. This disappointing history is consistent with predictions from the peacebuilding literature, which suggests that peace agreements confined to the military protagonists in a civil war, such as the Sudanese PSAs, are unlikely to lead to inclusive postconflict democratic transitions (Elbadawi 2008).

Sudan needs a broad-based peace process in which civilian stakeholders, such as political parties, civil society, and local communities, have seats at the table as part of a national peace conference. Such a comprehensive approach to peacebuilding would encompass building the economic, political, and social institutions and attitudes required not only for the peaceful settlement of the current conflict but also the prevention of future conflicts. Doyle and Sambanis (2006) call this approach “participatory peace,” which includes not only an end to war but also ensures no significant residual violence, undivided sovereignty, and a minimum level of political openness. Their empirical model of peacebuilding specifies the probability of success as proportional to the area of a “peacebuilding triangle,” with the three sides determined by (1) the prevalence of hostilities/social cohesion, (2) local capacities for postwar recovery and development, and (3) international capabilities to support peacebuilding. A high level of hostilities reduces the area of the triangle, as does a low level of local capacity; the area can be expanded by robust international capabilities. Thus, international capacity can ameliorate the negative impacts of limited social cohesion and local capacity in peacebuilding efforts.

Based on this model, achieving participatory peace in Sudan is likely to be extremely challenging. As we have shown elsewhere,³ even by the standard of postconflict societies, Sudan is characterized by low intercommunal trust and social cohesion as well as low local competency. Compared to previous civil wars in Sudan and elsewhere, the death, displacement, and destruction caused by this war are unprecedented, and there are signs that the war has further hardened the country’s social divisions. In turn, this has fueled aggressive

3 See Elbadawi and Fiuratti (2024) for detailed review of the evidence.

recruitment campaigns—largely along ethnic and regional lines—by both factions in the war, further depreciating the country’s already low social capital. The Global Social Capital Index, which comprises indicators of societies’ capacity to generate social cohesion and a certain level of consensus, ranked Sudan at 176 out of 192 countries in 2024.⁴

Moreover, while the main protagonists in the conflict remain the SAF and RSF, there is mounting evidence of increasing foreign meddling and social fragmentation. According to ACLED’s 2025 watchlist on Sudan, “several armed groups, often seeking foreign backing, are positioning themselves to fill power vacuums across the country and establish themselves as security providers. Popular Resistance Forces [dominated by followers of the so-called Islamic Movement]—armed militias consisting of civilians in arms—have emerged in several regions with support from SAF, opening the door for the proliferation of armed groups and small arms. Eritrea opened its borders and established training camps for SAF-allied forces in the east, bolstering its influence along the Red Sea coast. These moves have raised fears that ethnic conflicts in the region may reignite” (Birru 2024). On the other hand, “the RSF’s decentralized and horizontally organized structure, which builds on existing communal social networks, could also lead to fragmentation and exacerbate violence.”

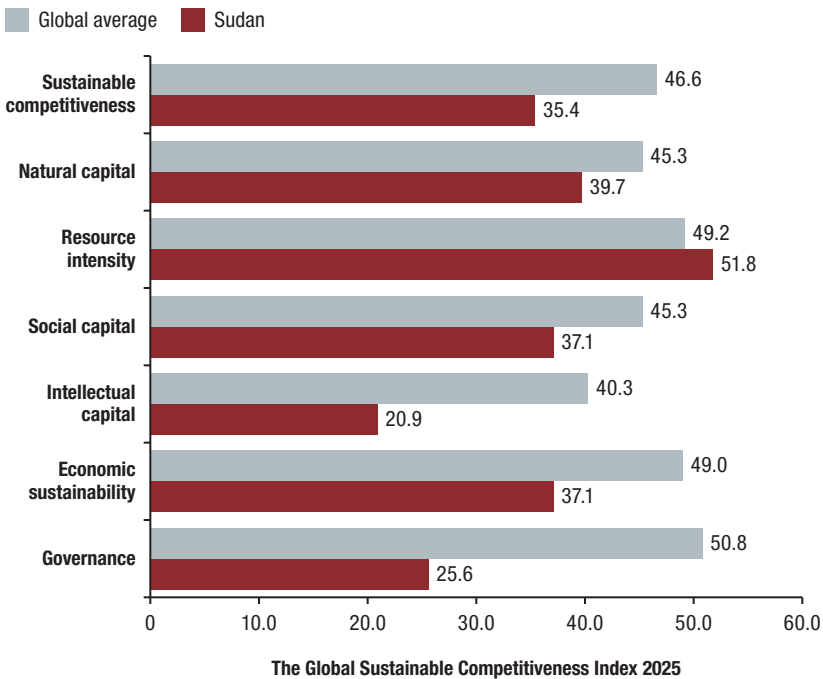
In terms of local competency, Sudan ranks very low on the multifaceted Global Sustainable Competitiveness Index relative to the global averages (Figure 14.1).⁵ It was also among the 10 African countries with the largest population without access to electricity in 2021.

The case for a multidimensional UN PKO

In terms of the Doyle and Sambanis peacebuilding triangle, Sudanese political and civil society actors must address two sides of the triangle: the country’s war-ravaged social capital and depleted institutional capabilities. This would require building a broad-based coalition for civil democratic peace. However, in view of the massive destruction and the evolving military contest between the two armies, it appears virtually impossible to end this war, much less to build sustainable peace, without external support. In particular, we argue that to secure a real chance for peace, the third side of the peace triangle must be

4 Countries ranked lowest by SolAbility’s Global Social Capital Index are characterized by frequency of crimes, violent conflict, low availability of healthcare services and child mortality, limited freedom of expression, and unstable human rights situations. <https://solability.com/the-global-sustainable-competitiveness-index/social-capital-index>

5 <https://solability.com/the-global-sustainable-competitiveness-index>

FIGURE 14.1 Sudan's domestic capabilities relative to the global average

Source: Data on global sustainable competitiveness index are from SolAbility (n.d.). <https://solability.com/the-global-sustainable-competitiveness-index>

Note: The Global Sustainable Competitiveness Index measures competitiveness of countries based on measurable, quantitative indicators derived from reliable sources, such as the World Bank, the International Monetary Fund, and various United Nations agencies. These indicators are grouped into six sub-indices: Natural Capital, Resource Efficiency and Intensity, Social Cohesion, Intellectual Capital, Economic Sustainability, and Governance Efficiency.

provided by an adequately mandated and fully equipped multidimensional, transformative UN/regional PKO. Such a hybrid operation, undertaken by a joint UN and African PKO, could not only help enforce and maintain peace but also support the much-needed security reforms for rebuilding a professional armed force that is apolitical and totally divorced from dealings in commercial activities or any form of economic interest. It is pertinent to stress that, unlike unilateral, nonneutral external interventions by individual countries, UN PKOs are conducted in accordance with, and in deference to, the sovereignty of the host state.⁶

6 See, for example, <https://peacekeeping.un.org/en/mandates-and-legal-basis-peacekeeping>

How successful have UN PKOs been?

The literature provides robust evidence on the positive impact of essentially all types of UN missions, especially those with strong, multidimensional mandates.⁷ Using an updated version of Doyle and Sambanis's dataset and applying different estimation strategies to analyze the short- and long-term effects of UN peace missions, Sambanis (2008) corroborated the findings of the earlier literature and produced further results, some with far-reaching implications for the case of Sudan.

First, he finds that a ceasefire treaty between the two warring parties is a precondition for a UN or hybrid UN/regional multidimensional PKO. A ceasefire treaty was the key objective of regional peace initiatives in Sudan, such as the Jeddah Forum and the IGAD initiatives. Unfortunately, such a treaty remains elusive, and if anything, more death, destruction, and humanitarian catastrophe may be required before it can be achieved. As rational choice models of war predict, it takes time for the warring parties in lethal conflicts to recognize the limited utility of continuing the war and appreciate the benefits of a peaceful settlement. However, Sambanis finds that the very same factors that eventually make a peace treaty possible tend to have a strong negative impact on the probability of success of participatory peace. It is precisely in these circumstances that the UN is useful: it can help parties implement peace when it is in their interest, despite a high degree of hostility.

Second, the above findings are particularly important for Sudan's peacebuilding strategy. In view of the high stakes for the two warring military protagonists, both might opt for a PSA-type settlement that would guarantee their continued dominance of politics and the economy postconflict. For regional peacebuilding actors, such a settlement might appear expedient, but a PSA is bound to reproduce the failed legacy of previous PSAs. To guard against this type of "negative" peace, a full-fledged, sufficiently mandated UN PKO is critical for Sudan.

Third, while UN missions are effective in implementing agreements and promoting broad-based participatory peace and democracy, their influence tends to fade in the longer run after the operation is concluded. However, Sambanis finds that sustained, transformative growth helps countries avoid postconflict relapses and maintain peace in the long run. Strikingly, he finds that despite the negative effects of lingering postwar hostility, countries with higher levels of income and fast-growing, more diversified postconflict economies are far more likely to experience longer-lasting peace.

7 See, for example, Doyle and Sambanis (2000; 2006); Fortna (2004; 2008); Gilligan and Sergenti (2008); and Sambanis (2008).

Therefore, the benefits of sustained, transformative growth are particularly high for a country like Sudan, where intense wartime interethnic hostilities are likely to persist for some time in the aftermath of the war. This is compounded by the fact that Sudan has long suffered from the resource curse—even before the current war—while illicit gold mining has since become one of the principal sources of financing for the war.⁸

How could sustained, transformative economic growth promote long-lasting peacebuilding?

It has been argued that transformative economic growth can effectively improve interethnic cooperation by increasing nationwide economic progress and welfare across ethnic groups, thus mollifying interethnic hostilities. In socially fragmented societies, growth-promoting interethnic cooperation would, therefore, support “sustainable peace,” which is defined by the UN Security Council as “an attempt after peace has been negotiated or imposed, to address the sources of present hostility and build local capacities for conflict resolution.” This concept of peace hinges on the “capacity of a sovereign state to resolve the natural conflicts to which all societies are prone by means other than war” (Doyle and Sambanis 2000, 3).

Growth is not only a major driver of sustainable peace but also a major determinant of sustainable democracy.⁹ Modernization theory argues that as countries develop through economic growth, social structures become more complex and labor more active, technological advances empower producers, civil society is also empowered, and dictatorial controls become less effective; growth thus fuels the transition from autocracy to democracy (Lipset 1959; Elbadawi and Makdisi 2017). In socially fragmented societies, growth-propelled processes of modernization, such as industrialization, accelerated urbanization, universal education, and access to mass media, promote interethnic deliberation, interaction, and ultimately supra-ethnic cooperation and national identification, as ethnic and other communal forms of subnational group identification diminish.

However, some scholars have argued that the rapid transformations associated with modernization can create uncertainties that strengthen the need for ethnic solidarity as well as opportunities that can best be captured by exploiting network externalities within social groups. As a result, ethnic group identification may not

8 See, for example, a recent study by the Sudan Transparency and Policy Tracker (STPT 2024): <https://mcusercontent.com/b3101ea3866029414729ab5e5/files/c8f448d8-cfac-5e67-9571-f8635d4b632c/GoldSectorEN.pdf>

9 See Rodrik and Wacziarg (2005); Collier and Rohner (2008); Epstein et al. (2005); Elbadawi and Makdisi (2011; 2016).

wane immediately and may even grow stronger (Robinson 2014). Nonetheless, to the extent that modernization has a stronger positive impact on national relative to ethnic identification, nation-building is still feasible. In the words of Paul Collier, “A society can function perfectly well if its citizens hold multiple identities, but problems arise when those subnational identities arouse loyalties that override loyalty to the nation as a whole” (Collier 2010, 52). Robinson (2014) tested this hypothesis about group identification using individual-level survey data on national versus ethnic identification from a representative sample of citizens in 16 African countries. The results lend support to the classic modernization theories by showing that living in urban areas, having more education, and being formally employed in the modern sector are all positively correlated with identifying more strongly with the nation than with one’s ethnic group.¹⁰

However, in Robinson’s study, though the focus on “the role of large-scale social transformations—economic modernization and colonialism—rather than on political agency in explaining patterns of group identification in Africa today” is justified, the case of Tanzania is an outlier, which could be explained by neither modernization nor by colonial legacy, making it clear that national policy has an important role to play. The data showed Tanzania was the best performer in terms of national identification due to highly effective nation-building policies consistently pursued since the country’s independence, such as “the widespread use of a single common language (Kiswahili), the nationalist content of primary school education, and the equitable distribution of state resources in the early post-independence” (Robinson 2014, 737–738).

The political economy of growth: An overview of the theory

In this section, we review political economy considerations that shape outcomes postconflict, such as *de jure* versus *de facto* power and ideas versus interests. These determine whether elites will “bet” on development and accept policy designs that channel rents toward productivity. Examples include competitive allocation of foreign exchange for inputs and competitive exchange rate policies for exports, secure land-user rights, and impartial regulation of food safety and export standards. Without this support, agriculture-led growth cannot scale up and peace dividends will dissipate.

10 Robinson also tested the “African colonial legacy” hypothesis and found that the “purported obstacles to national unity in Africa—highly diverse states and partitioned ethnic groups—are actually associated with higher levels of national versus ethnic identification” (Robinson 2014).

The achievement of transformative, widely shared growth is clearly a worthwhile national project in its own right, but it is also critically important for sustainable peacebuilding, especially in socially fragmented societies. Yet most incumbent elites, including those ruling over conflict-prone, fragile societies, rarely espouse growth-promoting policies and institutions, such as strong property rights, measured and effective regulation, or competitive real exchange rates. The evidence suggests that elites will likely choose inefficient policies (broadly defined to include institutions) in order to maintain their political power and hence their ability to access rents in the future.¹¹ For example, in their analysis of the limited industrialization in 19th century Europe, Acemoglu and Robinson (2006) explain that the incumbent elites in some European countries reckoned that growth-oriented industrialization and the ensuing expansion of the urban middle class was bound to undermine their entrenched rural-based political power and, hence, their capacity to expropriate economic rents.

To begin the analysis for Sudan, we focus on three contributions to the literature that ask highly relevant questions for building a national agenda for transformative economic growth in postconflict Sudan.

Why are political transformations sometimes not sufficient to achieve better economic outcomes?

This question was addressed in another paper by Acemoglu and Robinson (2008), who used a theoretical model composed of two groups: elites and citizens. They show that economic outcomes are determined by the interaction between *de jure political power*—which is controlled by political institutions, such as constitutions, elections, and parliaments—and *de facto political power*—which is determined by the elites rather than by institutions. The elites are assumed to be more capable and more interested than the general public in investing in *de facto* political power because of their “wealth, weapons, or ability to solve the collective action problem.” The key insight from this model is that, “a change in political institutions that modifies the distribution of *de jure* power need not lead to a change in equilibrium economic institutions if it is associated with an offsetting change in the distribution of *de facto* political power (e.g., in the form of bribery, the capture of political parties, or use of paramilitaries)” (Acemoglu and Robinson 2008, 268).

11 The political economy literature is dominated by this interest-oriented view. See for example, Bates (2014), Acemoglu and Robinson (2006; 2012), and the literature cited therein.

Sudan's 2018 December Revolution was a massive popular uprising that toppled a long-entrenched authoritarian regime and produced major political transformation. The military elite who seized the opportunity to remove the Bashir regime subsequently became partners with the revolutionary civilian leaders. However, they were able, through the exercise of *de facto political power*, to frustrate one of the key economic reforms intended to fight the legacy of decades-long corruption and to eradicate the so-called *tamkeen* system.¹² Using this instrument of kleptocracy, most notably the vast economic assets controlled by the military, the leaders of the military and the remnants of the deposed regime were able to co-opt the top brass of the armed forces and militias and to finance a large-scale counter-revolutionary movement (Elbadawi and Alhelo 2023). Thus, in terms of the Acemoglu and Robinson thesis, the *de facto* political power of the military elite enabled them to partially or even entirely offset the changes in *de jure* power brought about by the December Revolution.

How can we explain divergent economic outcomes in essentially similar political regimes?

In an insightful paper, Rodrik (2014) challenged the dominant strand of political economy literature that held that vested interests are the ultimate determinant of economic performance. Rodrik argues that “new ideas about policy—or policy entrepreneurship—can exert an independent effect on equilibrium outcomes even in the absence of changes in the configuration of political power” (Rodrik 2014, 190). In this context, he argues that (1) elites can creatively devise strategies that allow them to take advantage of improved economic opportunities without losing power and (2) that the “restriction on feasible strategies is often relaxed in practice” by innovation in the area of political ideas, and he likens such “political innovation” to technological innovation, which is commonly thought to relax resource constraints.

To corroborate his theory, Rodrik reports a few examples where elites were able to pursue creative political ideas to relax political constraints in order to “make themselves (and possibly the rest of society) better off without undermining their political power” (Rodrik 2014, 199). Perhaps the most compelling such experience is that of China, where the Communist Party’s “state-directed industrialization, gradual concessions to the rising industrial classes, diversification into commerce and industry, alliance with industrial

¹² *Tamkeen*—an Arabic word for “empowerment”—was used to mean exclusive empowerment for the narrow popular base of the Bashir regime.

interests, and similar choices ensured elites could benefit from industrialization while retaining much of their power” (Rodrik 2014, 199). Another example of an innovative political strategy adopted in China is the dual-track trade reform implemented through special economic zones, where, “rather than liberalize its trade regime in the standard way, which would have decimated the country’s inefficient state enterprises, China allowed firms in special economic zones to operate under near-free-trade rules while maintaining trade restrictions elsewhere until the late 1990s. This enabled China to insert itself in the world economy while protecting employment and rents in the state sector. The Chinese Communist Party was strengthened and enriched, rather than weakened, as a result” (Rodrik 2014, 200).

What influences elites to bet, even to gamble, on development through growth?

With a view similar to Acemoglu and Robinson (2008), Dercon (2023) argues that, while institutions (broadly understood to include the formal and historical informal rules of the game) are important in shaping economic policies, how those rules are “interpreted, followed, used, or abused” by the incumbent elites is equally or more important. Elite groups, he argues, “have substantial agency, which significantly impacts present outcomes. The starting point is then to view the prevalent or dominant set of actions and behaviours by key players in an economy as a collective action equilibrium, whereby some places seem to be stuck in low-level equilibria and others in better ones... These equilibria are expectations equilibria: the actions of each player can be understood as rational in view of what they expect others to do (or what they expect a dominant coalition of others to do). A ‘better’ equilibrium in terms of growth and development is present if there is a consensus that other influential players will behave broadly consistent with such an outcome. In other words, there is an elite bargain for growth” (Dercon 2023, 4).

However, Dercon argues, the choice of elites to favor growth-promoting over economically inefficient but rent-enabling policies is always a gamble, because there is no sure recipe for achieving transformative growth, only generally principles such as investing in physical and human capital and institutions (Dercon 2022). A key question to ask, therefore, is what development partners can do to minimize the uncertainty of such a gamble in order to improve the odds of an elite commitment to growth-oriented policies.

In the following section, we first review the growth performance of Sudan during the last 30 years of the Bashir regime, which opted for economically inefficient kleptocratic policies and institutions. Second, we contrast this

regime's strategy with the case of the EPRDF elite in Ethiopia, who were able to pursue "creative political ideas to relax political constraints" in the sense used by Rodrik, enabling them to adopt growth-promoting policies while maintaining power. Third, drawing on insights from the above political economy discussion, we address the key question of how the postconflict transition in Sudan could be designed so that it underpins an elite bet on transformative economic growth. In response to this question, we discuss programs that the international development community could adopt to increase the chance of success and reduce risks of failure for the growth-promoting elites, while reducing the gains from rent-seeking practices.

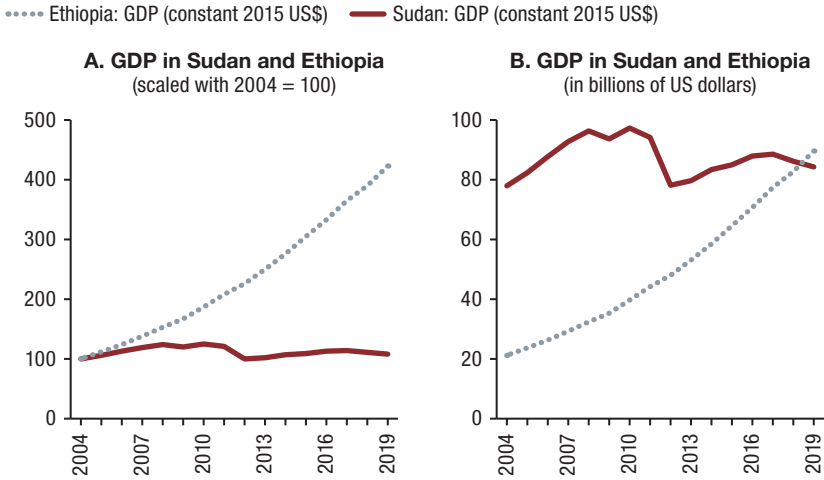
The political economy of growth: A tale of two countries

Ethiopia's growth experience illustrates how policy innovations (industrial parks, logistics upgrades, targeted foreign exchange allocation, and performance compacts) can mobilize agrifood value chains when political elites seek economic legitimacy. For Sudan, a UN/regional PKO that secures major transport corridors, protects critical infrastructure, and supports rule-of-law would reduce risks for investors and enable a similar policy package to take hold, provided that the transition design levels the political playing field and curbs extra-constitutional vetoes.

The similarities and differences between Ethiopia and Sudan are aptly characterized by Sarkar and de Waal (2023, 1): "These two large multi-ethnic developing countries share a common border, the Blue Nile, and a host of political and economic challenges from separatism to chronic food insecurity, and both faced scenarios of imminent state failure at the cusp of the 1990s. For a generation thereafter, the respective governments in Addis Ababa and Khartoum pursued radically divergent political and economic policies, each guided by its endowment and history, but also by leadership decisions. In the policymakers' caricature, Ethiopia became a model for an African developmental state while Sudan reproduced a pathological rentierism that foretold intractable crisis."

Our analysis corroborates this characterization, highlighting the two countries' extremely divergent growth experiences and shedding light on their very different governing elites. While the Sudanese economy stagnated for 15 years, the Ethiopian economy more than quadrupled. In less than one generation, the Ethiopian economy closed the gap of more than US\$60 billion that separated it from the Sudanese economy in 2004 (Figure 14.2), and

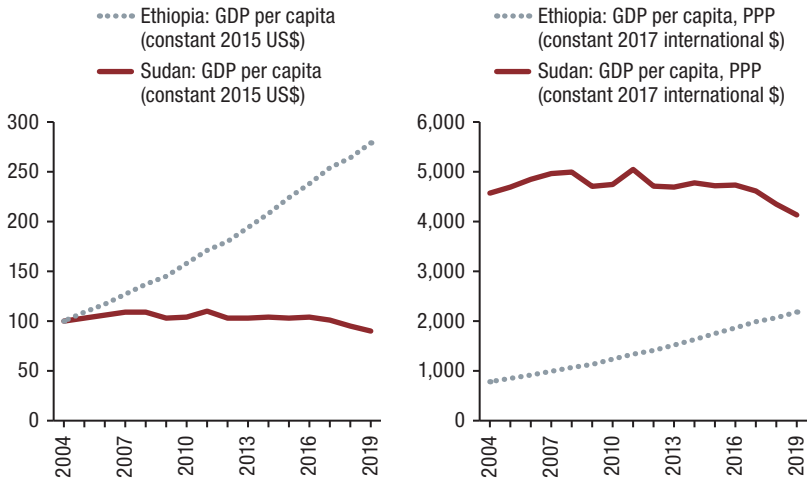
FIGURE 14.2 Ethiopia's and Sudan's divergent growth paths



Source: Data from World Development Indicators (World Bank 2025).

Note: In panel A, GDP for both countries was converted to an index using 2004 as a base year; we divided GDP for both countries during the 2004–2019 period by GDP in 2004 and multiplied by 100. Therefore, GDP equals 100 in 2004 for both countries. In panel B, constant GDP in 2015 US dollars is used for both countries.

FIGURE 14.3 Ethiopia's per capita income is catching up to Sudan's



Source: Data from World Development Indicators (World Bank 2025).

while per capita income in Sudan remained stagnant for 15 years, in Ethiopia it nearly tripled, increasing from less than a fifth of the Sudanese per capita income in 2004 to about half in 2019 (Figure 14.3).

Ethiopia achieved an average annual growth rate of per capita income of about 7 percent for a period of 15 years.¹³ In Sudan, however, growth was modest and unstable, and almost collapsed in the aftermath of the secession of South Sudan and the consequent loss of most of the country's oil resources.

Most scholars share the view that states emerge as a result of agreement by the elites to share the rent available under the existing power, no matter how small it is. However, only in a few cases do ruling elites gamble on development, meaning they are willing to sacrifice available rent for future growth and development. This is always a gamble, which raises the question, why would some elites take the risk, if success is not guaranteed?

Ruling elites might choose to gamble on development if they think economic stagnation poses an imminent risk to the incumbent regime, as was the case of the Chinese Communist Party (CCP) elites in the wake of the Cultural Revolution. Under Chairman Deng Xiaoping, who assumed power in 1976 following the death of Mao Zedong, the CCP leadership radically restructured the party's ideology and public policy and transformed China through phenomenal growth. In other cases, such as countries emerging from devastating civil wars, choosing to bet on development depends on the ability of elites to learn from mistakes and engage in course corrections. In Ethiopia, the ruling elites under Prime Minister Melees Zenawi decided to undertake major economic transformation in 2004 after a decade pursuing an extreme version of Marxism.

In view of their apparent economic success, the Ethiopian elites, therefore, decided to build "economic legitimacy" as a basis for the regime's power. In Sudan, however, the elites of the Bashir regime continued to rely on the oil- and gold-financed kleptocracy to hold on to power, at their own peril. The lessons from the experiences of the Ethiopian EPRDF and the Sudanese regimes suggest that developmental authoritarianism¹⁴ has a better chance of survival than does outright kleptocracy. However, equally important are the lessons

13 The Growth Commission report (<https://www.growth-commission.com/>) identifies "growth miracle" developing countries as those that achieved or exceeded a threshold of 7 percent annual average growth for 25 years—meaning that Ethiopia achieved more than half a miracle.

14 **Developmental authoritarianism** refers to a political system in which an authoritarian regime justifies limits on political pluralism, civil liberties, and electoral competition on the grounds that centralized control is necessary to achieve rapid economic growth, structural transformation, and national development.

from the failure of the former to maintain peace in the highly socially fractionalized Ethiopia, with looming risks of civil war and political instability threatening to undo two decades of spectacular economic achievement.

The equally divided Sudan, still reeling from 30 years of dysfunctional kleptocracy, severe political instability, and more recently the devastating factional conflict within its army, requires a genuine democratic transition. To sustain peace and democracy in the longer run, democratically elected elites emerging after the establishment of peace must also choose to “gamble on development” and seek economic legitimacy, rather than settling for electoral political legitimacy.

How could a pro-growth coalition be built in postconflict Sudan?

A key question is why the Ethiopian EPRDF elites were able to build a pro-growth coalition that gambled on development through transformative economic growth, while the Sudanese Bashir elites did not? Or to put it in terms of Rodrik’s political innovation theory, why did the EPRDF political system benefit from a greater abundance of political innovation than the Bashir regime?

As explained by Rodrik (2014, 202), “...policy ideas that relax political constraints can be thought of as the consequence of both idiosyncratic processes and purposive behaviour.” Contrasting the experiences of the two elites in terms of their relationships with China reveals that both idiosyncratic processes and purposive factors were at play. Though both regimes had strong economic and political ties with China, the EPRDF elites were most interested in emulating China’s success in using special economic zones to promote economic diversification. The Sudanese elites, however, focused on harnessing their partnership with China to develop the oil sector, which eventually became the sole driver of Sudan’s economy to the detriment of the vast potential of Sudanese agriculture. In addition, the strong ideological affiliation of the EPRDF elites with the CCP was perhaps another factor that explains why they took the Chinese development model more seriously.

The elites of the Bashir regime, who were not ideologically in tune with communism, were more concerned about exploiting their economic and political ties with China to overcome the elaborate sanctions imposed by the United States and other Western countries. These ties allowed them to access Chinese technology and finance to develop a new viable resource base for financing the regime’s “political marketplace” and keeping the regime afloat. According to Alex de Waal (2016, 1), a political marketplace is “a system of governance run on the basis of personal transactions in which political services and allegiances

are exchanged for material reward in a competitive manner. A ruler bargains with members of the political elite over how much he needs to pay—in cash, or in access to other lucrative resources such as contracts—in return for their support. They exert pressure on him using their ability to mobilize votes, turn out crowds, or inflict damaging violence.”¹⁵ It could be argued, therefore, that both oil rents and political ideology might be idiosyncratic factors that set the two elites apart in terms of how they exploited their close ties with China and why the EPRDF elite drew beneficial lessons from the Chinese development model, while those of the Bashir regime did not.

In Sudan, where the Bashir regime came to power through a military coup, the dominance of the military and its pervasive business interests was an additional factor contributing to the regime’s failure to adopt an efficient, growth-promoting strategy. The leaders of the Sudanese army and other uniformed forces were the main beneficiaries and actors in the political marketplace of the Bashir regime, which was the central institution for political settlement, and had little impetus toward political innovation. The complicity of the armed forces leadership in such corrupt practices not only degraded the professionalism of this critical national institution but also turned the army into a potent impediment to stable civilian democratic rule. In contrast, the EPRDF elite came to power following a successful rural insurgency in which the army was largely under the control of the civilian leadership of the ruling coalition.

In addition to learning from other countries’ experiences, crises provide lessons for elites to learn from past mistakes and reconsider prevailing strategies as well as to better understand what needs to be done (Blyth 2007).¹⁶ The EPRDF elites responded to the Ethiopian famine crises by targeting food security as a central tenet of its development strategy, including reversing a decade-long policy of pervasive controls on agricultural land and providing land tenure security to farmers, as part of a comprehensive agricultural transformation agenda; they also introduced a productive safety net program aimed at reducing dependency on emergency food aid and building community resilience through provision of food or cash transfers to millions of food-insecure households in exchange for participation in public works projects.¹⁷ In contrast, the response of the Bashir elites to the loss of most oil

15 See also de Waal (2019).

16 Cited in Rodrik (2014).

17 However, despite these efforts, Ethiopia continues to face food security challenges due to recurrent droughts, conflict, locust invasions, and global economic pressures.

rents following the partitioning of Sudan and the major crisis that ensued was to search for new sources of rents rather than pursue political innovation (Elbadawi et al. 2023).

While finding compelling answers to the general question as to why some political systems have enjoyed a greater abundance of political innovation than others may be challenging, coming up with ideas for enhancing the interest and capacity of elites to pursue growth-promoting policies may be more straightforward. In this context we discuss a homegrown strategy for a Sudanese postconflict transition as well as external measures that could be considered by the international development community.

How can the political playing field be levelled for the Sudanese postconflict transition toward building and sustaining growth coalitions?

The Sudanese political transition in the aftermath of the December 2018 popular uprisings was built around constitutional power-sharing between the military and the civilian leadership. This allowed the military establishment to continue wielding strong influence in shaping the political, security, and economic landscape during the transitional period, including protecting its vast economic interests built up during the former regime. As a result, the military leadership showed little interest in moving forward with security reforms, nor were they willing to enable the Ministry of Finance to exercise control over their massive commercial companies and other economic interests (Elbadawi and Alhelo 2023).

According to Acemoglu and Robinson (2008, 287), it takes deep democratic reform to “create a sufficiently level political playing field so that it becomes no longer profitable for the elite to invest heavily in their de facto political power. Such democratization will lead to significant changes in equilibrium outcomes. In contrast, more moderate steps toward democracy may lead to little or no change in economic outcomes.” It is not surprising, therefore, that the Sudanese political transition sparked by the December 2018 event was insufficient to enable the liquidation of the kleptocratic institutions of the *tamkeen* system.

For the envisaged Sudanese postconflict transition, the key lesson from this experience should be the need to ensure that the military’s role in the transition is strictly “functional participation,” not a “constitutional partnership,” as was the case under the prior transition. Such participation is necessary for ending the commercial activities and liquidating the nonmilitary economic assets of the military and other uniformed forces. This constitutes

a fundamental departure from the dysfunctional broad-based “constitutional partnership” established between the military and the civilian leaderships in the past.

How can the international development community encourage elites to gamble on growth-promoting policies?

First, the international development community could increase the incentives for forming and sustaining growth coalitions in developing countries. For example, the development community could support countries in better responding to external shocks, such as the debt crisis that ensued in the aftermath of the recent global shocks. It is estimated that in 2022 about 25 developing countries paid more than 20 percent of total government revenue in external debt service—a share not seen since the year 2000, when the Heavily Indebted Poor Countries (HIPC) Initiative was launched. That crisis revived initiatives aimed at separating risks under direct or indirect control of the debtor from those exogenous to the contract, such as natural disasters or global supply chain disruptions and consequent shocks to commodity prices. For example, the International Monetary Fund (IMF) proposed instruments for so-called state-contingency debt (IMF 2017).

These crises also triggered several proposals for reforming the international financial architecture. For example, the UN Secretary-General’s report on *Sustainable Development Goals (SDGs) Stimulus to Deliver Agenda 2030* put forward three areas for immediate action: (1) “tackle the high cost of debt and rising risks of debt distress, including by converting short-term high interest borrowing into long-term (more than 30 year) debt at lower interest rates,” (2) “massively scale up affordable long-term financing for development, especially through public development banks, including multilateral development banks, and by aligning all financing flows with the SDGs,” and (3) “expand contingency financing to countries in need” (UN 2023, 2).

Sudan has been grappling with a substantial external debt burden, which has significantly affected its economic stability and development. As of 2021, Sudan’s external debt was approximately \$62.4 billion, a significant portion of which is owed to the IMF and the World Bank. In 2023, the government debt stood at 256 percent of the country’s GDP, indicating severe debt distress. The country was on course to receive significant debt relief during the transitional government (2019–2021) as part of the HIPC Initiative. Unfortunately, this process was halted after the army staged a coup in October 2021, which sent the country into grave economic and political crises that eventually led to the outbreak of the ongoing civil war.

Therefore, in the postconflict transition, resuming the process for major debt relief and rehabilitation of Sudan as a bona fide member of international financial institutions (IFIs) would allow the international development community to incentivize the postconflict Sudanese ruling elites to opt for pro-growth policies.

Second, the international development community could make it harder for elites to conceal and appropriate state resources under their control for their own private enrichment. Beyond the loss of resources that could be used to finance growth and social welfare, there is ample evidence on the negative externality of this common practice by elites in most failed states. The ability of elites to enrich themselves at the expense of their countries and get away with it also has a second, perhaps more profound effect on growth. As argued by Dercon (2023, 13), "...elites often collude not to generate growth and stability, but instead to steal and control resources that can be used to maintain their power (through patronage) or set themselves up for a life of luxury either at home or abroad. This is more likely if they believe that others in the elite behave similarly (contributing to a low-investment, low-growth local equilibrium), and even leads to ordinary citizens who cannot launder money being less committed to basic tax collection (breakdown of fiscal contract)."

Sudan has long struggled with illicit financial flows and challenges in asset recovery. These problems are linked to more than three decades of the kleptocratic rule of the Bashir regime, which presided over widespread corruption, with state resources siphoned off by elites. Gold smuggling remains a major issue, with large quantities illegally exported, depriving the country of much needed revenue.¹⁸ The exact amount stolen during the Bashir regime is difficult to determine due to the secretive nature of these financial flows. However, various estimates suggest that billions of dollars were siphoned from Sudan through corruption, embezzlement, and illicit financial activities. Sudan's transitional government stated that Bashir and his network stole at least \$64 billion over his 30-year rule, which included illicitly acquired real estate, bank accounts, and businesses linked to his inner circle, including at least \$9 billion acquired as Bashir's personal assets.

Following the ouster of the Bashir regime, Sudan's transitional government attempted to recover stolen assets by freezing bank accounts and confiscating properties linked to corrupt officials. However, progress was slow due to legal and political hurdles and recovery efforts were completely abandoned following the coup in 2021.

18 See, for example, Patey (2024).

In the aftermath of the current war and the hoped-for democratic transition, supporting Sudan's efforts to recover these assets would not only provide much needed funds for the country's reconstruction but also promote the building of a pro-growth coalition. For Sudan to effectively combat illicit financial dealings and recover stolen assets, a high priority for the transition should be to build strong anticorruption institutions with enforcement power, improved financial transparency and regulation, and continued international cooperation to trace and repatriate stolen funds.

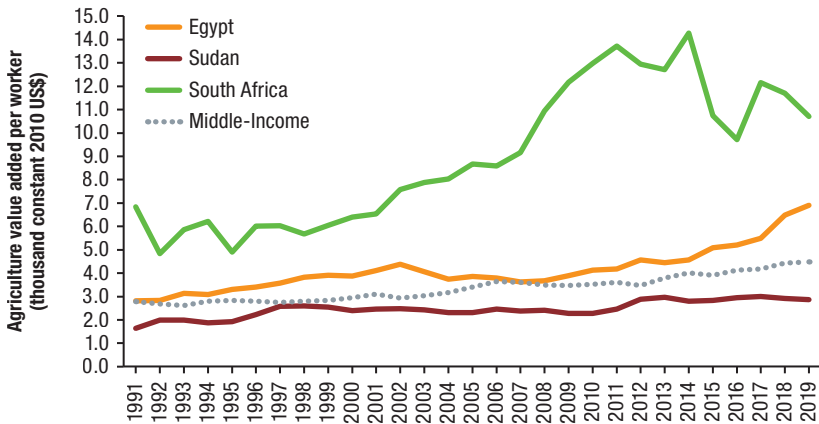
Sudanese agriculture: An investment magnet and driver of growth¹⁹

The agriculture sector is the backbone of Sudan's economy, is the source of almost all non-oil and mineral exports, and contributes more than 35 percent of the country's GDP and 47 percent of employment (Elbadawi et al. 2022). Moreover, the sector has long been seen as a potential "breadbasket" that could attract substantial FDI associated with the Pan-Arab Sudan Breadbasket Strategy, which is financed primarily by the capital-surplus countries of the GCC. This initiative was developed during the 1970s oil boom, which also coincided with the 1972 Addis Ababa Agreement that ended the first civil war in Sudan. The inflow of FDI and the peaceful resolution of the long war combined to fuel an impressive annual growth rate of about 10 percent for about a decade. However, this remarkable growth could not be maintained because complementary growth drivers did not develop, and it eventually came to a grinding halt in 1983, when the second phase of the first civil war plunged the country into conflict and political instability.

The recent global supply chain disruptions associated with the COVID-19 pandemic and the Russia-Ukraine war have significantly boosted the drive toward re-localization and regional cooperation, especially regarding food security. This will undoubtedly generate renewed interest in Sudan's agriculture sector once the current war is ended and if the country manages to embark on transformative economic reforms that support positive expectations about the future.

Yet despite its importance and immense potential, the agriculture sector remains underdeveloped, beset by low productivity and weak linkages to

19 This section draws from Elbadawi and Fiuratti (2024), Elbadawi et al. (2023), Elbadawi et al. (2022), and Elbadawi and Ismail (2021).

FIGURE 14.4 Agricultural labor productivity

Source: Elbadawi and Ismail (2021).

Note: This figure presents the evolution of agriculture labor productivity over the 1991-2019 period for Sudan, Egypt, South Africa, and the global middle-income median.

modern agro-industry, while most of the farming community lives in poverty and has poor access to basic services. To illustrate, agricultural labor productivity rates in South Africa and Egypt were, respectively, more than 3.7 and 2.4 times that of Sudan in 2019 (Figure 14.4).

In the same vein, while the average return to a *feddán* (slightly more than a hectare) of cultivated agricultural crop ranges between \$600 and \$700 globally, it was an appalling \$20 for Sudan (Mahgoub 2023). This is not surprising in view of the acute undercapitalization of the sector, as can be seen in the low levels of fertilizer use. For example, though Sudan's arable land area is more than six times that of Egypt, Sudan's total fertilizer consumption in 2010 was only about 15 percent of Egypt's consumption. At the farm level, Egypt's fertilizer consumption was about 0.47 metric tons per hectare of arable land, while Sudan consumed only 0.01 tons per hectare (Elbadawi and Ismail 2021). Given the low productivity of Sudanese agriculture, its dominance of the economy is more a reflection of Sudan's poverty than of the vitality of its agriculture sector.

In this context, we propose an agriculture-led development model that combines inclusive agricultural production, tight linkages to industry, and strategies to rapidly improve productivity over time through education, new technologies, and investments in infrastructure. The envisaged development

program aims to bring about profound structural transformations in the Sudanese economy that will spark rapid, sustainable, and broad-based growth to expand job opportunities for youth, combat poverty, and make major strides toward achieving the SDGs.

Agricultural growth corridors and investment transitions

The proposed development model for Sudan is anchored in developing economic corridors to strengthen the agriculture sector's linkages with industry. The economic corridor model uses socioeconomic policies and investment in physical infrastructure to promote economic activities and thus economic growth along a transportation corridor (Healey 2004). Agro-industrial growth corridors, the model proposed for Sudan, combine agricultural policies with investments in agro-industrialization, agribusiness, and infrastructure. Such corridors are usually planned and managed as strategic private–public partnerships that can bring together expertise, funding, and coordination and benefit from multiple synergies that arise (Brüntrup 2019). This large-scale approach has several advantages: by pooling risks, corridors can attract many investors. The concentration of agribusiness allows economies of scale, lowers costs per unit of production, and facilitates the diffusion of technology. Various supportive markets are likely to form to serve the corridor. Unlike mega projects, which tend to create a hub-and-spoke style of development, corridors are spread out, thus promoting balanced regional development and shared economic growth across the country.

Articulating this development model for Sudan, Elbadawi and colleagues (2022) have proposed 14 agro-industrial development corridors around productive cities. This plan is built around the overall richness and diversity of Sudan's agricultural resource base and the particular strengths and opportunities of each area, bearing in mind the need to stimulate growth, reduce poverty, and improve food security across the different regions of the country. The proposed agro-industrial development corridors knit together distinct regional endowments with market access and existing institutions to create diversified growth poles. Each corridor pairs a comparative advantage in agriculture (irrigation, rainfed cereals/oilseeds, livestock, and fisheries) with adjacent industries (mills, oils, textiles, feedlots, leather, and cold chains). For details on the features and supportive interventions proposed for each corridor, see the appendix at the end of this chapter.

The common set of “enablers” for these corridors—feeder roads, storage and warehousing, sanitary and phytosanitary (SPS) and veterinary systems,

TABLE 14.1 Financial requirements to cover basic food commodities deficit in the Arab world

Operating capital = US\$14.6 billion		Fixed cost = US\$141.9 billion		
Industrialization: \$3.9 billion	Agriculture: \$10.7 billion	Land reclamation: \$58 billion	Irrigation: \$22.7 billion	Manufacturing: \$61.2 billion
Total cost = US\$165.5 billion				

Source: Mahgoub (2023), translated from Arabic.

Note: (1) Cost of total investment (with enhanced productivity) is US\$156.5 billion; (2) cost of total investment (with current productivity) is US\$321.2 billion.

finance, and research and extension—are “no-regrets” investments that can convert Sudan’s resource diversity into export-ready value chains and broad-based jobs. However, we must stress that these enablers for successful transformative development corridors can only be realized *if* improved security and governance reduce logistics and contract risks. In high-endowment settings like Sudan, multidimensional PKOs can support investment in the enabling physical and institutional infrastructure by (1) securing trunk roads and storage to reduce spoilage and informal taxation, (2) supporting customs and SPS standards compliance to unlock export markets, and (3) coordinating with donors on feeder infrastructure that complements private agri-business investment.

Financing this ambitious development model will require substantial investment over an extended period to achieve “miracle” growth in the first decade following the achievement of credible peace. Using a popular empirical growth model, Elbadawi and Fiuratti (2024) estimate that the aggregate investment needed to finance fast agriculture-led growth (10 percent growth per year) would be about \$186 billion (in real 2021 dollars) for the first 10 years. The proposed agro-industrial corridors would absorb most of the required investment. With renewed interest in investing in Sudan as a breadbasket for Arab countries and Africa, domestic and FDI flows could provide an estimated \$160 billion of the \$186 billion total to finance the modernization and structural transformation of the agriculture sector, with the remainder expected from donors (Table 14.1).

Given the critical role of infrastructure as a main catalyst for development and economic growth, transforming Sudan’s agriculture sector would also require further economywide investments in transport, renewable and nonrenewable energy, and information and communication technologies. Sudan’s infrastructure, especially in the energy and transport sectors, is in great need of new construction, rehabilitation of decaying installations, and preventive maintenance if it is to support vibrant and integrated growth corridors. Improved telecommunications coverage and introduction of advanced

ICT are also needed to propel efficiency and productivity. For example, the Transitional Government's Ministry of Transportation presented an infrastructure investment plan to donors and investors totaling almost \$30 billion for rehabilitation, maintenance, and new projects in seaports, river navigation, railways, highways, and air transport (EEAS 2021).

In view of the immense potential of Sudan's agriculture sector, such a hefty investment should be possible to mobilize during the first decade after peace is achieved. A World Bank report (2020) suggests three factors that could make the agriculture sector attractive to foreign investors. First, Sudan's agro-ecological characteristics are suitable for both a wide variety of crops and animal husbandry, with 74 million ha of cultivable land, 110 million animals, marine and freshwater fisheries resources, underground and surface water supplies, biodiversity, and a broad genetic pool. Second, Sudan is home to a diverse basket of agriculture products, some of which offer a unique advantage. The country's favorable location at the crossroads of sub-Saharan Africa and the Middle East places it closer to some of the largest sesame-importing countries (China, Iran, and Turkey) and meat (goat and sheep)-importing countries (China, France, the Middle East, and the United Kingdom) compared with competing exporters. It also has notable strength in gum arabic, a key input in food and industrial products worldwide. A wide range of oilseeds—cottonseed, groundnuts, sesame seed, and sunflower seed—gives Sudan relatively better resilience against imports of cheaper oils than those countries that face an edible oil deficit and do not produce palm oil. Third, there is a significant room for agricultural production growth. With less than 23 percent of arable land under cultivation and the yield levels of most crops currently below Sudan's previous heights, the potential to raise production is high.

Conclusions

This paper takes the view that Sudan's national renewal and reconstruction after this devastating war will require a broad-based participatory peacebuilding process, with the Sudanese democratic forces and other civilian stakeholders at its center. This concept of peacebuilding requires "an end to war, no significant residual violence, undivided sovereignty, and a minimum level of political openness" (Doyle and Sambanis 2006). Indeed, Sudan can ill-afford to repeat the tragic legacy of the PSAs that emerged from earlier peace processes, which allowed the military and insurgency forces to dominate the transitional governments that followed. This narrowly focused approach to

peacebuilding not only failed to achieve sustainable peace in Sudan but also led to disastrous outcomes.²⁰

However, the scale of destruction and the depletion of the already limited national capabilities by more than 30 years of the Bashir kleptocracy, coupled with the collapse of social cohesion due to strained interethnic relations, leave little hope for ending the war, much less rebuilding sustainable peace, without external support. We argue that achieving peace is highly unlikely without shoring up these two sides of the national “peace triangle”—social cohesion and capacity—with credible external competency. In this context, an adequately mandated and fully equipped multidimensional, transformative UN/regional PKO is needed. The proposed hybrid UN/regional PKO is deemed essential to enforce peace and provide civilian protection and humanitarian assistance as well as to support meaningful security reforms, a democratic transition, and economic development programs. Importantly, such a PKO should not only secure peace in the narrow sense but also create an enabling environment for agriculture-led transformation. By securing transport corridors, protecting rural communities, and lowering risks along value chains, a PKO could directly increase the viability of investment in Sudan’s agriculture and agro-industry sectors. In this way, peace operations can serve as catalysts for the very growth coalitions that can sustain peace.

To this end, the proposed PKO must be embedded in a serious national renewal and development agenda, anchored around the achievement of sustained, transformative economic growth. As the evidence from the received literature and a growing number of country experiences suggests, while such comprehensive UN-led missions have been successful in enhancing the *quality* of peace, they usually fail in sustaining it after the mission is ended, especially in ethnically divided societies such as Sudan. *Sustainable* peace hinges on the achievement of transformative economic growth that promotes interethnic cooperation by modernizing the economy, accelerating urbanization, and expanding the middle class. In Sudan’s case, agriculture must be the central driver of this growth. Without PKO-secured peace and governance, the proposed agro-industrial corridors and FDI in farming, processing, and logistics will not materialize—that is, PKOs and agricultural transformation are not parallel tracks but mutually reinforcing pillars of Sudan’s renaissance project.

20 These PSAs not only failed to sustain peace. The PSA in 2005 between the Bashir regime and the Sudanese Peoples Liberation Movement/Army (SPLM/A) also led to the partitioning of the country in 2011 and the creation of the Republic of South Sudan, and the 2021 PSA between the Sudanese military and the rebel movements of Darfur contributed to preempting the constitutional path to democracy and, arguably, to the build-up to the current tragic factional military war.

The achievement of transformative, widely shared growth is clearly a worthwhile national project in its own right, but it is also critically important for sustainable peacebuilding, especially in socially fragmented societies. Yet, most incumbent elites, including those ruling over conflict-prone, fragile societies, do not espouse growth-promoting policies and institutions, such as strong property rights, measured and effective regulation, or competitive real exchange rates. Elites often choose inefficient policies and institutions to maintain their political power and hence their future access to rents.

To promote the formation of pro-growth coalitions, we argue that the peacebuilding process must ensure that the political playing field is sufficiently level to guard against special interest groups, including the military and other uniformed forces, gaining political clout that would allow them to undermine the envisaged growth-promoting agenda. While the political settlement may democratize *de jure* power, the influential elite may still retain *de facto* power through formal political institutions, allowing them to divorce economic outcomes from the progress at the political front. Probing further, we compare the elites of Sudan's Bashir regime and their EPRDF counterparts in Ethiopia and ask why the latter chose "economic legitimacy" as an instrument for maintaining political power, while the Sudanese elites opted for kleptocracy, fueled by rent distribution, as the main rationale for holding onto power. With insights drawn from this comparison, we argue that both oil rents in Sudan and political ideology in Ethiopia may be idiosyncratic factors that set the two elites apart in terms of how they exploited their close ties with China and explain why the EPRDF elites drew useful lessons from the Chinese development model, while those in Sudan did not. Moreover, the dominance of the military and its pervasive business interests in the case of Sudan was another factor impeding the emergence of a pro-growth coalition.

In addition to home-grown design of peacebuilding institutions that compel elites to be accountable for economic legitimacy, the international development community could also help. First, resuming the process for major debt relief as part of the HIPC Initiative and restoration of the country as a bona fide member of the IFIs would provide a potent incentive for the postconflict Sudanese ruling elite to opt for pro-growth policies. Second, assisting the country in recovery of the massive assets that have been taken illicitly would provide much needed funds for the country's reconstruction and also promote the building of a pro-growth coalition.

Finally, we argue that when the country's political economy is sufficiently aligned toward creating stable growth coalitions in the aftermath of this war, the prospects for fast, sustained agriculture-driven growth will be strong.

The richly endowed and diversified agriculture sector could be both a driver of growth and a magnet for attracting much-needed FDI. In this context, we propose a development model for Sudan anchored by agro-industrial growth corridors to strengthen the agriculture sector's linkages with industry and services. Recent global supply chain disruptions have significantly increased the drive toward re-localization and regional cooperation, especially as part of the food security agenda of the capital-surplus countries of the GCC. These countries invested heavily in Sudan's agriculture sector in the 1970s and continued to be engaged, despite the challenging conditions under the Bashir regime. We can therefore expect renewed interest in the sector, once the current war ends and the country manages to embark on transformative economic reforms that support positive expectations about the future. Sudan's agriculture sector offers a range of potential opportunities for FDI that is largely unrivalled by other African or Arab countries.

A PKO-driven peace and security are the indispensable foundation for mobilizing these agricultural opportunities. Only by linking peacekeeping to transformation can Sudan shift from fragility to a virtuous cycle of peace, growth, and national renewal.

References

- Acemoglu, D., and J.A. Robinson. 2006. "Economic Backwardness in Political Perspective." *American Political Science Review* 100 (1):115–131. <https://doi.org/10.1017/S0003055406062046>
- Acemoglu, D., and J.A. Robinson. 2008. "Persistence of Power, Elites, and Institutions." *American Economic Review* 98 (1):267–293. <https://doi.org/10.1257/aer.98.1.267>
- Acemoglu, D., and J.A. Robinson. 2012. *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. Crown Currency.
- ACLED (Armed Conflict Location & Event Data). 2025. ACLED Explorer, September 19, 2025 update. <https://acleddata.com/explorer/>
- Bates, R.H. 2014. *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*. University of California Press.
- Birru, J.G. 2024. *Foreign Meddling and Fragmentation Fuel the War in Sudan*. ACLED. <https://acleddata.com/report/foreign-meddling-and-fragmentation-fuel-war-sudan>
- Blyth, M. 2007. "Powering, Puzzling, or Persuading? The Mechanisms of Building Institutional Orders." *International Studies Quarterly* 51 (4):761–777. <https://doi.org/10.1111/j.1468-2478.2007.00475.x>

- Brüntrup, M. 2019. "Agricultural Growth Corridors in Sub-Saharan Africa – New Hope for Agricultural Transformation and Rural Development? The Case of the Southern Agricultural Growth Corridor of Tanzania." In *Transforming Agriculture in Southern Africa*, eds. R.A. Sikora, E.R. Terry, P.L.G. Vlek, and J. Chitja, Chapter 29. Routledge.
- Collier, P. 2010. *Wars, Guns, and Votes*. Harper Perennial.
- Collier, P., and D. Rohner. 2008. "Democracy, Development, and Conflict." *Journal of the European Economic Association* 6 (2-3):531–540. <https://doi.org/10.1162/JEEA.2008.6.2-3.531>
- de Waal, A. 2016. *Introduction to the Political Marketplace for Policymakers*. JSRP Policy Brief No. 1. London School of Economics and Political Science. <https://www.gov.uk/research-for-development-outputs/jsrp-policy-brief-1-introduction-to-the-political-marketplace-for-policymakers>
- de Waal, A. 2019. "Sudan: A Political Marketplace Framework Analysis." WPF Occasional Paper No. 19. WPF (World Peace Foundation). <https://worldpeacefoundation.org/publication/sudan-a-political-marketplace-framework-analysis/>
- Dercon, S. 2022. *Gambling on Development: Why Some Countries Win and Others Lose*. Hurst.
- Dercon, S. 2023. *Development through Economic Growth*. Unpublished manuscript, July 7. https://www.openphilanthropy.org/wp-content/uploads/Development-through-Economic-Growth_report.pdf
- Doyle, M.W., and N. Sambanis. 2000. "International Peacebuilding: A Theoretical and Quantitative Analysis." *American Political Science Review* 94 (4):779–801. <https://doi.org/10.2307/2586208>
- Doyle, M.W., and N. Sambanis. 2006. *Making War and Building Peace: United Nations Peace Operations*. Princeton University Press.
- EEAS (European External Action Service). 2021. "The Paris Conference to Support the Sudanese Transition." EEAS. Last updated May 18, 2021. https://www.eeas.europa.eu/eeas/paris-conference-support-sudanese-transition_en
- Elbadawi, I.A. 2008. "The Security Challenge in Conflict-Prone Countries." Paper presented at *Copenhagen Consensus 2008*, May 26–30. <https://www.jstor.org/stable/resrep25499>
- Elbadawi, I.A., and A. Alhelo. 2023. "The Sudan Syndrome: State-Society Contests and the Future of Democracy after the December 2018 Revolution." ERF Working Paper No. 1644. ERF (Economic Research Forum). <https://erf.org.eg/publications/the-sudan-syndrome-state-society-contests-and-the-future-of-democracy-after-the-december-2018-revolution/?tab=undefined&c=undefined>
- Elbadawi, I.A., M. Amin, A.H. Elobaid, A. Alhelo, A. Osman, and K. Suliman. 2023. "Post-Conflict Reconstruction, Stabilization and Growth Agenda for Sudan." ERF Working Paper No. 1622. ERF. <https://erf.org.eg/publications/post-conflict-reconstruction-stabilization-and-growth-agenda-for-sudan/?tab=undefined&c=undefined>

- Elbadawi, I.A., A. Elbashir, A. Osman et al. 2022. *Sudan's Challenges and Opportunities: A Renaissance Project for Sudan: From Poor Agriculture to Agro-Industrial Growth and Sustainable Development*. ERF Policy Research Report No. 40. ERF. <https://erf.org.eg/publications/sudans-challenges-and-opportunities-a-renaissance-project-for-sudan/?tab=undefined&c=undefined>
- Elbadawi, I.A., and F. Fiuratti. 2024. "Sudan's Future between Catastrophic Conflict and Peaceful Renaissance Growth Trajectories: Long-Term Growth Model Simulations." ERF Working Paper No. 1708. ERF. <https://erf.org.eg/publications/sudans-future-between-catastrophic-conflict-and-peaceful-renaissance-growth-trajectories-long-term-growth-model-simulations/?tab=undefined&c=undefined>
- Elbadawi, I.A., and S. Ismail. 2021. "Conditional Convergence in Agricultural Productivity: The Case of Sudan." ERF Working Paper No. 1494. ERF. <https://erf.org.eg/publications/conditional-convergence-in-agricultural-productivity-the-case-of-sudan/?tab=undefined&c=undefined>
- Elbadawi, I.A., and S. Makdisi, eds. 2011. *Democracy in the Arab World: Explaining the Deficit*. Routledge.
- Elbadawi, I.A., and S. Makdisi, eds. 2017. *Democratic Transitions in the Arab World*. Cambridge University Press.
- Epstein, D., R. Bates, J.A. Goldstone, I. Kristensen, and S. O'Halloran. 2006. *Democratic Transitions*. Unpublished manuscript, July 31. <https://doi.org/10.2139/ssrn.920180>
- Gilligan, M.J., and E.J. Sergenti. 2008. "Do UN Interventions Cause Peace? Using Matching to Improve Causal Inference." *Quarterly Journal of Political Science* 3 (2):89–122. <https://doi.org/10.1561/100.00007051>
- Healey, P. 2004. "The Treatment of Space and Place in the New Strategic Spatial Planning in Europe." *International Journal of Urban and Regional Research* 28 (1):45–67. <https://doi.org/10.1111/j.0309-1317.2004.00502.x>
- IMF (International Monetary Fund). 2017. "State-Contingent Debt Instruments for Sovereigns." IMF. <https://www.imf.org/en/publications/policy-papers/issues/2017/05/19/pp032317state-contingent-debt-instruments-for-sovereigns>
- Lipset, S.M. 1959. "Some Social Requisites of Democracy: Economic Development and Political Legitimacy." *American Political Science Review* 53 (1):69–105. <https://doi.org/10.2307/1951731>
- Mahgoub, W.M. 2023. "An Economic Vision from the Sudanese Private Sector." PowerPoint Presentation, March.
- Patey, L. 2024. "Oil, Gold, and Guns: The Violent Politics of Sudan's Resource Re-Curse." *Environment and Security* 2 (3):412–430. <https://doi.org/10.1177/27538796241272367>
- Powell, J.M. 2014. "Trading Coups for Civil War: The Strategic Logic of Tolerating Rebellion." *African Security Review* 23 (4):329–338. <https://doi.org/10.1080/10246029.2014.944196>

- Robinson, A.L. 2014. "National Versus Ethnic Identification in Africa: Modernization, Colonial Legacy, and the Origins of Territorial Nationalism." *World Politics* 66 (4):709–746. <https://doi.org/10.1017/S0043887114000239>
- Rodrik, D. 2014. "When Ideas Trump Interests: Preferences, Worldviews, and Policy Innovations." *Journal of Economic Perspectives* 28 (1):189–208. <https://doi.org/10.1257/jep.28.1.189>
- Rodrik, D., and R. Wacziarg. 2005. "Do Democratic Transitions Produce Bad Economic Outcomes?" *American Economic Review* 95 (2):50–55. <https://doi.org/10.1257/000282805774670059>
- Sambanis, N. 2008. "Short- and Long-Term Effects of United Nations Peace Operations." *The World Bank Economic Review* 22 (1):9–32. <https://doi.org/10.1093/wber/lhm022>
- Sampson, E. 2025. "Disaster by the Numbers: The Crisis in Sudan. Assessing the Devastation From Sudan's Long Civil War." *The New York Times*, Section A, Page 6. <https://www.nytimes.com/2025/01/07/world/africa/sudan-genocide-numbers.html#>
- Sarkar, A., and A. de Waal. 2023. "Thinking Politically About Money: The Changing Role of Political Finance in the Political (Un-) Settlements in Ethiopia and Sudan." ERF Working Paper No. 1625. ERF. <https://erf.org.eg/publications/thinking-politically-about-money-the-changing-role-of-political-finance-in-the-political-un-settlements-in-ethiopia-and-sudan/>
- SolAbility. n.d. *The Global Sustainable Competitiveness Index*. SolAbility. Accessed February 23, 2026. <https://solability.com/the-global-sustainable-competitiveness-index>
- STPT (Sudan Transparency and Policy Tracker). 2024. *Fueling Sudan's War: How Gold Exports and Smuggling Are Prolonging Sudan's War*. STPT. <https://mcusercontent.com/b3101ea3866029414729ab5e5/files/c8f448d8-cfac-5e67-9571-f8635d4b632c/GoldSectorEN.pdf>
- UN (United Nations). 2023. *United Nations Secretary-General's SDG Stimulus to Deliver Agenda 2030*. UN. <https://unctad.org/publication/united-nations-secretary-generals-sdg-stimulus-deliver-agenda-2030>
- UNHCR (United Nations High Commissioner for Refugees). 2026. Sudan Situation Map Weekly Regional Update – 02 February 2026. UNHCR. <https://data.unhcr.org/en/documents/details/120945>
- UNOCHA (United Nations Office for the Coordination of Humanitarian Affairs). 2025. "The Sudan Conflict: What's Really Going On." *UNOCHA News* (blog), February 21. <https://www.unocha.org/news/sudan-conflict-whats-really-going>
- World Bank. 2020. *Sudan: Agriculture Value Chain Analysis*. World Bank. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/731741593616746051>
- World Bank. 2025. "World Development Indicators." Accessed February 1, 2025. <https://databank.worldbank.org/source/world-development-indicators>

Chapter 14 Appendix

TABLE 14.A1 Proposed agro-industrial growth corridors

Corridors	Strengths and opportunities	Prospective industries
1 Merawi-Dongla-Halfa	<ul style="list-style-type: none"> • Weather suitable for production of wheat, pulses, forages, fruits (citrus, mango, dates) • Potential to produce different crops in two seasons (summer/winter) • Major reservoirs and rivers for fishing • Proximity to Egyptian market with population of 100 million; expected to reach 180 million by 2050 • Established research, educational institutions, and banking services • Two main airports and more than 1,000 km paved road (from Egyptian border to Khartoum) • Presence of several tangible surface and ground water resources and vast land areas for agricultural investment • Presence of historical processing facilities 	<ul style="list-style-type: none"> • Wheat mills • Slaughterhouses • Fruit processing • Animal feeds industry • Fishery industry development (mainly on Lake Nubia and Merawi dam)
2 Khartoum-Shendi-El-Dammer	<ul style="list-style-type: none"> • Government headquarters and Investment Administration • Proximity to services and government authorities and institutions • Large market for vegetable, fruits, dairy and poultry market • Available wage labor • Established research and education institutions • Established expanded public and private banking system • Relatively adequate basic infrastructure, in terms of roads, electricity, water, communications, and markets • Potential for expanding the irrigated agricultural area, such as the Hawad Project with more than 1.5 million ha • Existence of many projects in food and related industries • Khartoum international airport 	<ul style="list-style-type: none"> • Cereals milling • Meat industry (beef, sheep, poultry, fish) • Dairy industry • Vegetable oils • Agricultural input procuring and or manufacturing • Processing of fruits and vegetables • Leather industries
3 Aj Jazirah-Managil	<ul style="list-style-type: none"> • Established large irrigation production schemes with more than 0.90 million ha of irrigated land and relative stability in production • High government and international community attention to investing and rehabilitating the irrigated schemes. • Presence of historical good processing activities (ginning and textile, vegetable oil, milling, leather) • Available finance from public and private banks • Established farmers' organizations and contract farming models • Proximity to Khartoum market • Large livestock population • Presence of infrastructure such as roads, communications, input services, markets, and government institutions • Presence of agricultural research headquarters, several well-established research stations and agricultural colleges 	<ul style="list-style-type: none"> • Textile industries • Wheat and sorghum mills • Vegetable oil mills • Fruits and vegetable processing factories • Feed factories • Feedlots for livestock fattening • Manufacturing of agricultural inputs • Dairy industry • Aquaculture

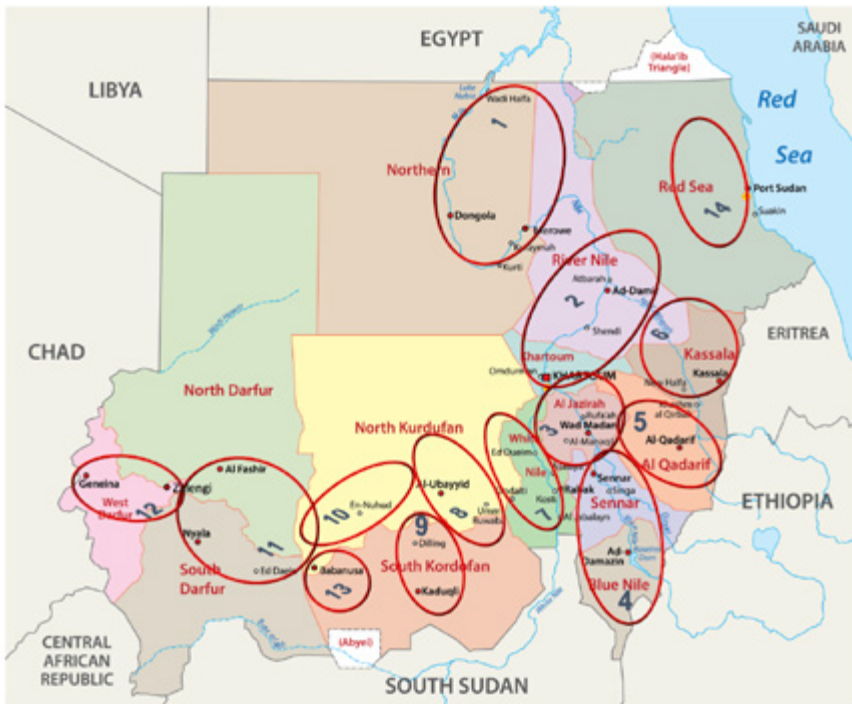
Corridors	Strengths and opportunities	Prospective industries
4 Senmar-El-Suki-El-Dinder-El-Damazin	<ul style="list-style-type: none"> • Vast underutilized agricultural lands and diverse production systems (mechanized, traditional rain-fed and irrigated, livestock, horticulture, and fishing) • Large areas of banana, fruits, vegetables, cotton, sugar cane, sesame, and sorghum production • Large diverse livestock population • Strategic location, rich resources, and access to all states • Potential of new irrigation schemes in Rosaries and El-Dinder • Availability of different water sources and water infrastructure (dams) and a hierarchical controlled irrigation system of water distribution • Dinder wildlife reserve park • Presence of historical processing activities (sugar, vegetable oil, textiles) • Presence of several research stations and agricultural colleges 	<ul style="list-style-type: none"> • Sorghum mills • Ginning and textile factories • Vegetable oil mills • Fruits processing • Animal feed industries • Feedlots for animal fattening • Sugar factories • Development and promotion of tourism in Dinder reserve park
5 Gedaref-Rahad	<ul style="list-style-type: none"> • More than 2 million ha of semi-mechanized farming and about 150,000 ha under irrigation • Largest market for sorghum and sesame crops • Wealth of animal resources and the presence of vast rangelands (Butana) • Largest grain silo in the country • High potential for oil crops, livestock, and horticulture crops industry (raw material) • Presence of historical processing activities (vegetable oils, ginning) • Industries (oils, soap, sweets) in the city of Gedaref • Presence of infrastructure such as roads communications, storage facilities, input services, markets and government institutions, research and well-established specialized financial institutions • Close proximity to Port Sudan by paved road and neighboring several countries (markets) 	<ul style="list-style-type: none"> • Sorghum milling • Vegetable oil (sesame) industry • Animal feeds • Ginning and textile factories • Feedlots for livestock fattening
6 New Halfa-Kassala	<ul style="list-style-type: none"> • More than 200,000 ha under irrigation (Gash and Halfa irrigation project) • New Half Sugar Scheme and industry • Fruit production in Kassala • Contract farming experience with cotton growers • New Upper Atbara irrigation project in the pipeline • Wealth of animal resources • Presence of industries (oils, soap and sweets) • Presence of infrastructure such as roads; communications; storage facilities; input services; markets and government institutions; research and financial services • Close proximity to Port Sudan and neighboring several countries (markets) 	<ul style="list-style-type: none"> • Sugar industry • Wheat milling • Vegetable oil processing • Animal feed factories • Textile industry • Fruit processing • Feedlots for livestock fattening

Corridors	Strengths and opportunities	Prospective industries
7 Kosti-Ed-Duieim	<ul style="list-style-type: none"> • Vast agricultural land, including mechanized and traditional rainfed and irrigated • High production diversity in crop, fishing, horticulture, and livestock production • About 200,000 ha of underutilized irrigated land • Large livestock population • Presence of historical good processing activities (sugar, oil, fish, milk, textiles, milling) • Established sugar factories including Kenana and Asalya • Ginning factories • Largely dominated by traditional fishing and milk product industries • Established financial institutions • Proximity to the capital and port through railway lines and roads • Connected to Khartoum and neighboring states by paved road 	<ul style="list-style-type: none"> • Textile industry • Sugar industry • Feeds factories • Meat and dairy industry • Fishing industry (taking, culturing, processing, preserving, storing)
8 El-Obeid-Rahad-Umrawaba-Bara-Sodari	<ul style="list-style-type: none"> • Strategic location (center of the country) with airport and road connection to several states and established major crop and livestock markets • Important producer of sesame and hibiscus • World largest market for gum arabic and other gums (covers large part of Gum Arabic Belt) • Presence of traditional vegetable oil industry • Main producer of the famous Kabashi sheep • Production of fruits and vegetables, mainly at Bara • Elobeid-Bara-Omdurman Road reduces the time and cost of transportation. • Well-established agricultural research station and university • Financial and banking institutions established across the state • Presence of infrastructure such as roads, communications, markets, and government institutions 	<ul style="list-style-type: none"> • Production of vegetable oils • Processing of gum arabic • Slaughterhouses for livestock • Processing of fruits and vegetables • Processing of hibiscus • Leather industry
9 Dilling-Kadugli-Abassya	<ul style="list-style-type: none"> • Important area for production of rainfed cotton • Eight ginning factories • Important area for fruit production, especially at Abassya and Abugebeha • Large livestock population • High potential for oil crops, livestock, and horticulture crops • Presence of historical agricultural research stations • Kadugli airport and roads connection with West and North Kordofan • Potential for using contract farming models 	<ul style="list-style-type: none"> • Textile industry, which is labor intensive and could contribute to poverty reduction • Vegetable oil processing • Fruit processing

Corridors	Strengths and opportunities	Prospective industries
10 Einuhud-Gobiesh	<ul style="list-style-type: none"> • Main sheep-producing area for domestic and export markets • Main producing area for gum arabic, covers the largest part of Gum Arabic Belt • Main groundnut production area • Presence of traditional vegetable oil industry • Presence of infrastructure such as roads, communications, markets, and government institutions 	<ul style="list-style-type: none"> • Slaughterhouses for export of sheep meat • Groundnut oil production • Animal feeds • Leather industry • Gum arabic processing
11 Fashir-Nyala-Edien	<ul style="list-style-type: none"> • Comparative advantage in production of livestock, oil crops, and gum arabic • Major source of beef for the domestic and export markets • Major producing area for groundnuts and millet • Large, underutilized tracts of rainfed semi-mechanized land • Potential markets in neighboring countries • Agriculture, veterinary, and animal production colleges and agricultural research stations constitute good research system • Roads and airports at the main cities (Nayala and Fashir) • Presence of developed groundnut processing plants 	<ul style="list-style-type: none"> • Meat industry • Leather industry • Vegetable oil industry • Production of honey • Cereal milling
12 Genena-Zalengi	<ul style="list-style-type: none"> • Production of livestock, oil crops, and gum arabic • Important source of high-quality oranges (Jebel Marra) • Good vegetation cover of various tree species • Potential markets in neighboring countries • Agriculture, veterinary, and animal production colleges and research stations • Roads and airport at the main cities (Genena) • Jebel Marra is an important tourist center (investment opportunities in tourism) • Presence of several NGOs working on livelihood issues and rural development 	<ul style="list-style-type: none"> • Animal feed factories • Meat industry • Leather industry • Vegetable oil industry • Fruit processing industry • Honey production • Cereals milling • Tourism (Jebel Marra)
13 El-Fula-Babamusa-Lagawa	<ul style="list-style-type: none"> • Important area for production of millet, groundnuts, gum arabic, hibiscus • Large livestock population, especially cattle, depending mainly on natural rangelands • Important area for field watermelon production • Road connecting El-Fula with Kadugli and El-Obeid • Center for petroleum extraction • Presence of agricultural college and research station • Presence of historical processing facilities (hibiscus processing and dairy) • Potential for using contract farming models • Vast underutilized agricultural lands 	<ul style="list-style-type: none"> • Meat and dairy industry • Leather industry • Vegetable oil industry • Hibiscus processing • Honey production • Cereals milling • Gum arabic processing

Corridors	Strengths and opportunities	Prospective industries
14 Red Sea	<ul style="list-style-type: none"> • Extends along the Red Sea coast, with more than 800 km of coastline • Great possibilities for tourism, with marine islands, coral reefs, and natural reserves, many kinds of marine life, and mangrove forests • Proximity to the main ports, handles the majority of the country's international trade and trade with neighboring several countries (markets) • Infrastructure in Port Sudan such as roads, communications, railway lines, storage facilities, government institutions, and financial institutions • Recent political attention to rehabilitating and developing the area • Investment opportunities in mining, fisheries, cross-border trade, and tourism • Delta Tokar, with cultivated area (about 150,000 ha) has very fertile soil, offers significant growth opportunities in agricultural production • Livestock estimate in the state is 1.7 million head of cattle 	<ul style="list-style-type: none"> • Animal feeds factories • Textile industry • Marine aquaculture industry (offshore fishing, aquaculture, pearl oyster farming) • Tourism

FIGURE 14.A1 Proposed growth corridors



Source: Elbadawi et al. (2022).

SECTION IV

The Way Forward

TOWARD A PROSPEROUS AND SECURE SUDAN: A WAY FORWARD

Khalid Siddig, Oliver K. Kirui, and Paul Dorosh

As Sudan's ongoing conflict enters its third year, the scale of human suffering and economic devastation continues to escalate. The brutal war between the Sudanese Armed Forces (SAF) and the Rapid Support Forces (RSF) has devastated livelihoods, shattered infrastructure, and crippled the country's agrifood systems and broader economy. Nearly 12 million people—one-fourth of Sudan's population—have been displaced, including more than 4 million refugees who have fled to neighboring countries such as Egypt, Chad, South Sudan, and Ethiopia (UNHCR 2026). The death toll is estimated to be more than 44,000 as of September 2025 (ACLEDD 2025), though some assessments suggest fatalities could exceed 150,000 when accounting for deaths from violence, starvation, and disease (Sampson 2025). Children have borne the brunt of this devastation: 16 million are in urgent need of humanitarian assistance, and more than 17 million school-age children are currently out of school. The widespread destruction of hospitals, schools, and essential services continues to deepen the crisis, threatening to reverse decades of development and push the country toward systemic collapse.

As of early 2026, the international environment is also daunting, as prospects of a possible trade war have shaken international equity, capital, and currency markets, and threatened a major recession in many countries. Major donor countries are reducing foreign aid to focus resources on their domestic and regional needs, making it likely that concessional financing for Sudan and most other developing countries will be severely curtailed in the future. In this context, Sudan needs to make major changes to avoid a continued downward trajectory in its people's welfare. Major obstacles must be overcome to achieve goals in three broad areas: restoring peace and security, achieving broad-based economic growth, and meeting the food security needs of all households.

Restoring peace and security

Without peace and security, sustained economic growth is not possible. Parts of eastern Sudan were less affected by the fighting in 2023 and 2024, but even there, the risks of a spillover of hostilities discouraged private investment and lowered economic output. Prior to the recent war, Khartoum was the center of economic activity and an important transport hub; unless its infrastructure is restored, growth prospects for the country will be severely limited. Western Sudan has suffered from various wars for decades, and without the establishment of peace and security, the region will likely remain very poor. Satellite-based monitoring of economic activity reinforces these patterns. Sharp declines in NO₂ emissions and nightlight intensity between 2022 and 2023 are observed in Khartoum, Khartoum North, and Omdurman, while increases in parts of eastern Sudan reflect the relocation of internally displaced populations (Chapter 4). These spatial shifts underscore the need for region-specific approaches to stabilization and recovery.

To begin to solve these problems, the root causes of conflict must be addressed, including ethnic and regional divisions, competition over resources, and efforts by the ruling elite to capture control of natural resources (Chapter 2). Ensuring a more equitable political landscape to foster sustainable development and peace, and building pro-growth coalitions (Chapter 14) can aid this process. However, economic growth will continue to be hampered unless public sector funds support private sector development. This entails reducing the role of the military and the RSF in the economy, the former of which built significant commercial holdings during Al-Bashir's tenure, with military corporations receiving 82 percent of the budget prior to 2019. Reducing the military's influence on the economy will be critical for funding healthcare, education, and agriculture, in addition to other social and economic services (D'Silva et al. 2023).

Achieving broad-based economic growth

Massive public investments are needed to repair damaged transport, power, and other infrastructure and rebuild the foundations for growth, along with substantial private (or parastatal) investment in factories, office buildings, and other private (parastatal) infrastructure. Investments that decrease marketing costs for products produced in western Sudan could help reverse the decline in exports from that region (Chapter 6). All of these investments compete for funds with private consumption, however, as well as with programs that transfer resources to food-insecure households.

Thus, investments in agriculture, particularly those targeting small farmers, must be incorporated into integrated recovery packages that also include policies to promote revitalization of enterprises and provide household income support (Chapter 7). It is also important to avoid major distortions in foreign exchange markets, such as those experienced before the economic reforms of the early 2020s, to maintain adequate price incentives for domestic production and trade of major tradable commodities, such as wheat, cotton, livestock, and oilseeds (Chapter 5). Building inclusive financial infrastructure could enable the expansion of private sector investments long stifled by the lack of access to capital (Chapter 15) and competition with commercial interests controlled by the SAF and RSF (Chapter 3).

Household food security, healthcare, and education

Yet, in many cases, efforts to address the needs of Sudan's poor cannot wait for growth to be restarted. Household incomes have fallen sharply, particularly in western Sudan (Chapter 14), dietary diversity has declined (Chapter 8), and self-reported household food insecurity has risen sharply (Chapter 9). Households have increasingly resorted to asset sales, borrowing, and migration as coping strategies (Chapter 11). Conflicts such as the ongoing warfare between the SAF and RSF, increased violence in Darfur, and regional spillovers pose significant risks of worsening these problems in the future (Chapter 13).

To help address these problems, increased funding for safety nets is urgently needed. Innovative instruments, such as digital transfers to the accounts of program participants, may reduce costs and enable wider coverage (Chapter 12). Likewise, resources to restore and improve healthcare and education are also required, particularly in western Sudan. Healthcare access and school dropout rates, particularly of girls, should be regularly monitored, with additional resources allocated to problem areas (Chapter 10).

Restarting interrupted development plans

Under the Hamdok government from August 2019 to October 2021, substantial new development efforts were initiated with support from international donors. Written in May 2021, the *Sudan Poverty Reduction Strategy Paper (2021–2023)* (World Bank 2021) outlined a wide-ranging set of policies and investments, organized along five pillars: (1) promoting macroeconomic

stability; (2) fostering inclusive and sustainable economic growth; (3) boosting human and social development; (4) promoting peace and providing equal opportunities for all Sudanese; and (5) strengthening governance and institutional capacity. The growth strategy (Pillar II) focused on growth in agriculture and livestock and the promotion of private sector growth, with four sub-pillars: enhancing productivity and growth in agriculture; developing an enabling environment for private sector growth; strengthening infrastructure services for recovery and growth; and protecting natural resources and the environment.

The findings in this book support the broad approach outlined in the poverty reduction strategy. Unfortunately, few of the investments proposed in the strategy have been implemented. Moreover, official development assistance (ODA) to Sudan for investments and relief declined after 2021. ODA increased from US\$1.7 billion¹ in 2019 to US\$3.9 billion in 2021, before falling again to only \$US1.4 billion in 2023.² If Sudan is to meet the urgent needs of its people, significantly more resources will be needed.

Conclusions

Sudan continues to face daunting problems of violent conflict between warring factions, major hindrances to investment growth and economic development, and urgent humanitarian needs. The situation is not hopeless, though, and as outlined above, much can be done to improve the welfare of the Sudanese people in both the short and medium term. The longer necessary changes are delayed, however, the greater the losses will be of income, assets, and, indeed, lives. Urgent action is needed to improve welfare now and to avoid creating a lost generation of youth for the future.

¹ All figures are in constant 2023 US dollars.

² Official Development Assistance (ODA) data is from OECD (2025). The U.S. Consumer Price Index (CPI) is used as a deflator in these calculations.

References

- ACLED (Armed Conflict Location & Event Data). 2025. "ACLED Explorer." Accessed September 19, 2025. <https://acleddata.com/platform/explorer>
- D'Silva, B., R. Hassan, A. Hutur et al. 2023. "Political Constraints and Opportunities for Agricultural Investment in Sudan." Sudan Strategy Support Program Policy Note 4. IFPRI. <https://doi.org/10.2499/p15738coll2.136628>
- OECD (Organisation for Economic Co-operation and Development). 2025. "DAC2A: Aid (ODA) Disbursements to Countries and Regions." OECD Data Explorer. Accessed May 8, 2025. [https://data-explorer.oecd.org/vis?fs\[0\]=Topic%2C1%7CDevelopment%23DEV%23%7COfficial%20Development%20Assistance%20%28ODA%29%23DEV_ODA%23&pg=0&fc=Topic&bp=true&snb=19&lc=en&df\[ds\]=dsDisseminateFinalDMZ&df\[id\]=DSD_DAC2%40DF_DAC2A&df\[ag\]=OECD.DCD.FSD&dq=.SDN%2BDPGC.206.USD.Q&om=LASTNPERIODS&lo=5&to\[TIME_PERIOD\]=false&vw=tb](https://data-explorer.oecd.org/vis?fs[0]=Topic%2C1%7CDevelopment%23DEV%23%7COfficial%20Development%20Assistance%20%28ODA%29%23DEV_ODA%23&pg=0&fc=Topic&bp=true&snb=19&lc=en&df[ds]=dsDisseminateFinalDMZ&df[id]=DSD_DAC2%40DF_DAC2A&df[ag]=OECD.DCD.FSD&dq=.SDN%2BDPGC.206.USD.Q&om=LASTNPERIODS&lo=5&to[TIME_PERIOD]=false&vw=tb)
- Sampson, Eve. 2025. "Disaster by the Numbers: The Crisis in Sudan." *The New York Times*, January 7. <https://www.nytimes.com/2025/01/07/world/africa/sudan-genocide-numbers.html>
- UNHCR (United Nations High Commissioner on Refugees). 2026. "Sudan Situation Data Portal." Accessed February 6, 2026. <https://data2.unhcr.org/en/situations/sudansituation>
- World Bank. 2021. *Sudan – Joint IDA-IMF Staff Advisory Note on the Poverty Reduction Strategy Paper (2021–2023)*. World Bank Group. <http://documents.worldbank.org/curated/en/545101625104854489>

WAR AND RESILIENCE

The Multifaceted Impacts of Sudan's Conflict and Pathways to Recovery

Sudan is facing one of the most severe humanitarian and economic crises in its modern history. The current civil war has displaced millions and severely damaged livelihoods, markets, and institutions, causing a rapid deterioration in the economy, agrifood systems, and population welfare.

War and Resilience: The Multifaceted Impacts of Sudan's Conflict and Pathways to Recovery situates the current conflict within Sudan's longer historical trajectory, explaining how structural factors contributed to the war's progression and scale. Drawing on recent household and enterprise surveys, satellite indicators, market price data, and economywide modeling, the book documents the crisis's impacts and identifies realistic entry points for stabilization and recovery.

Written by leading IFPRI researchers and colleagues, *War and Resilience* highlights how Sudan's population has shown remarkable resilience through social networks, remittances, informal support systems, and adaptation across rural and urban settings. Its final chapters offer decision-makers a forward-looking assessment of pathways toward recovery.



INTERNATIONAL
FOOD POLICY
RESEARCH
INSTITUTE

IFPRI

IFPRI is a CGIAR Research Center

1201 Eye Street, NW, Washington, DC 20005 USA

T. +1-202-862-5600 | F. +1-202-862-5606

Email: ifpri@cgiar.org | www.ifpri.org | www.ifpri.info