284

Wealth creation, income distribution, and adaptation among Sahelian (agro)pastoralists in a shock-prone environment

Wane, A[1]; Touré, I[2]; Mballo, AD[3]; Ndiaye, A[4]; Souli, Z[2]; Botoni, EY[5]; Tankari, I[5]; Diao, MB[6]

[1] International Livestock Research Institute (ILRI), [2] French agricultural research and cooperation organization (CIRAD), [3] International Fund for Agricultural Development (IFAD), [4] Practical Action, [5] Permanent Interstate Committee for Drought Control in the Sahel (CILSS), [7]Regional Agency for Agriculture and Food (RAAF)

Abstract

Sahelian (agro)pastoralists face significant undervaluation of their livelihoods. A 2017-2021 comparative study across six Sahelian countries, involving 3,070 households initially and 2,216 later, examined income trends and coping strategies. Household incomes stabilized at around 2 million FCFA annually from 2017 to 2020, with notable disparities across countries. Burkina Faso, Mali, Mauritania, and Senegal saw income growth, while Chad experienced a decline. Livestock sales and reliance on subsistence farming influenced these differences. Despite challenges, livestock sales remained crucial, though declining in some areas. Adaptive strategies like destocking and mobility were employed, but limited capacity hindered stronger responses.

Introduction

In developing countries with large livestock sectors, the challenge is to promote efficient production systems that meet rising demand while minimizing environmental and health impacts and improving smallholder farmers' well-being. Pathways for growth include genetic improvements, better nutrition, disease control, environmental risk management, and infrastructure development. However, each country's livestock sector is shaped by its unique context. A critical issue for policymakers is the lack of reliable, up-to-date data (Alary et al., 2011; Wane et al., 2009a, 2009b, 2018, 2020, 2024). Incomplete data and improper economic modeling can hinder effective policymaking and overlook indirect contributions like draft power and manure (Pica-Ciamarra et al., 2014; Kebebe, 2019).

Method

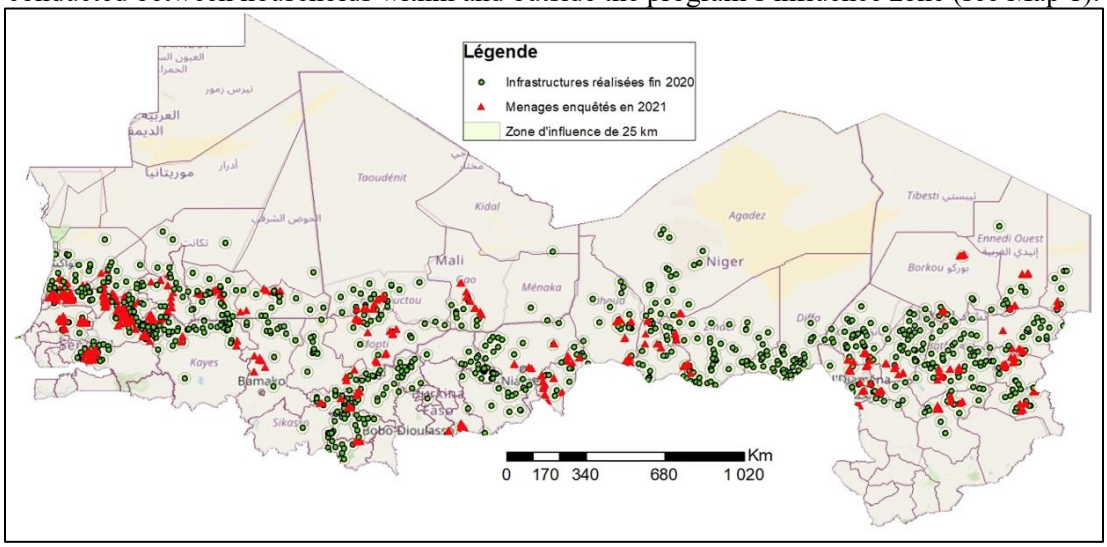
This study examines household income dynamics within Sahelian agro-pastoral communities, utilizing data from two survey periods (2016-2017 and 2020-2021) to enable both aggregated and disaggregated comparative analysis. The primary focus is on the evolution of income inequality, framed within Sustainable Development Goal (SDG) No. 10, which aims to reduce economic disparities. In addition, the study develops an approach to assess the multifaceted shocks experienced by pastoral households and the priority strategies they adopt to address threats to their income, assets, food security (including both production and

purchasing capacity), food stocks, and livestock holdings. The analysis draws on 3,070 agro-pastoral households surveyed in 2016-2017 and 2,352 households in 2020-2021 across six Sahelian countries.

Table 1. Strategic Selection of Study Sample Sizes

	Survey sample 2016-2017	**Survey sample 2020-2021**
Mauritania	527	353
Senegal	948	359
Mali	579	360
Burkina Faso	513	404
Chad	503	359
Total (without Niger)	**3 070**	**1 835**
Niger	NC	517
Total (including Niger)	**n.a.**	**2 352**

This study analyzes income evolution by revisiting a sample of 350 households from a 2016-2017 survey in 2020-2021. During this period, the PRAPS1 program significantly invested in infrastructure (boreholes, vaccination parks, livestock markets, production routes, dairy units, etc.) and economic services (Support for agro-pastoral organizations, capacity building, etc.). A comparative analysis was conducted between households within and outside the program's influence zone (see Map 1).



Map 1 – Location of Surveyed Households in PRAPS Countries in 2021 marked with red triangles, and infrastructural investments marked with green circles.

Results and discussions

Impact of Multidimensional Shocks on Sahelian Agro-Pastoral Households: Income, Assets, and Livelihoods

Between the two survey periods, 27% of households in six Sahelian countries reported climate-related, 36% health-related, 26% economic, 8% security-related, and 3% social shocks. Analysis of shocks over the past three years reveals varied impacts on daily life. Climate shocks primarily involved droughts (71% of households), particularly in Mauritania (92%) and Burkina Faso (89%), with flooding reported in Chad (51%) and Mali (49%). Health shocks, notably animal diseases, affected 50% of households, with significant global disparities. The COVID-19 pandemic also had severe economic and health consequences. Economic shocks included rising food and livestock feed prices, while security shocks involved livestock theft and bushfires. Social shocks included reduced financial transfers (remittances from migrants across and outside Africa), notably in Mali and Niger.

Adaptation Strategies and Coping Mechanisms of Sahelian Agropastoral Households in Response to Multidimensional Shocks

Sahelian (agro)pastoralists have employed various strategies to safeguard their livelihoods amid multifaceted shocks. Key adaptive strategies include destocking (22%) and mobility (14%). However, a concerning 15% of households reported no response, reflecting limited coping options.

Table 2. Prioritized Strategies of Sahelian Households in Response to Multifaceted Shocks

Description	First priority	Secondary priority	Tertiary priority	Description	First priority	Secondary priority	Tertiary priority
Community Support	0%	1%	2%	Seasonal Migration	2%	2%	2%
NGO Assistance	2%	2%	2%	Permanent Migration	0%	0%	0%
Government Aid	2%	2%	2%	Long-Term Migration	1%	1%	1%
Help from Relatives	4%	6%	8%	Family Labor	7%	7%	6%
Alternative Income Activities	1%	2%	3%	Wage Labor	3%	4%	3%
Placing children with other families	0%	0%	0%	Mobility Strategies	14%	5%	4%
Destocking	22%	15%	10%	No Response/No Strategy	16%	17%	27%
Borrowing/Loans	5%	8%	8%	Meal Reduction	3%	3%	2%
Market Garden Fencing	2%	2%	2%	Reduced Food Portions	2%	3%	3%
Fodder Storage Enclosures	1%	1%	1%	Use of Food Substitutes	3%	3%	2%
Savings Strategies	4%	7%	4%	Selling Non-Productive Assets	1%	1%	1%
Adoption of Resilient Species	1%	1%	1%	Selling Productive Assets	0%	1%	1%
Additional Employment	2%	3%	2%	Selling Food Reserves	2%	2%	1%

The COVID-19 pandemic further exacerbated challenges by restricting mobility and market access, causing a decline in destocking (from 15% to 10%) and an increase in inaction (from 16% to 27%). Borrowing also rose from 5% to 8%. These trends indicate a weakening of adaptive capacity, emphasizing the need for targeted interventions to strengthen resilience. Country-specific responses varied, with notable increases in inaction and reliance on external support.

Adapting Livelihoods: Income Generation in the Context of Multidimensional Shocks

In the context of multifaceted shocks, Sahelian (agro)pastoralists primarily generate income from livestock, with subsistence consumption playing a pivotal role in securing their livelihoods. Between 2017 and 2020, total income, including livestock sales, crop sales, foraging, transfers, and subsistence, remained stable at around 1.9 million FCFA annually per household. Income increased by 0.6% when including Niger and by

6% excluding Niger, although regional disparities persist. In countries like Burkina Faso, Mali, Mauritania, and Senegal, income grew (9%, 14%, 7%, and 13%, respectively), while Chad saw a 13% decline.

Table 3. Summary of income indicators and their variations over time

Country	Overall income 2016	Overall income 2021	Variation 2016-2021
Burkina Faso	1,501,293	1,647,793	10%
Mali	1,614,328	1,842,295	14%
Mauritania	1,438,813	1,533,146	7%
Senegal	2,864,303	3,248,213	13%
Chad	2,205,349	1,926,351	-13%
Niger	n.a.	1,426,062	n.a.
The Sahel	1,924,817	1,937,310	1%

Country	Crop income 2016	Crop income 2021	Variation 2016-2021
Burkina Faso	303,035	267,139	-12%
Mali	251,218	99,519	-60%
Mauritania	40,135	10,295	-74%
Senegal	125,894	297,042	136%
Chad	271,206	261,821	-3%
Niger	n.a.	975	n.a.

Country	Cash income 2016	Cash income 2021	Variation 2016-2021
Burkina Faso	1,138,591	1,409,818	24%
Mali	1,062,248	1,185,257	12%
Mauritania	617,846	1,156,604	87%
Senegal	1,892,967	1,919,769	1%
Chad	1,586,784	1,169,372	-26%
Niger	n.a.	711,731	n.a.

Country	Live-animal sales 2016	Live-animal sales 2021	Variation 2016-2021
Burkina Faso	505,863	1,409,818	179%
Mali	626,415	621,991	-1%
Mauritania	554,050	1,055,607	91%
Senegal	1,560,989	1,402,389	-10%
Chad	963,868	599,821	-38%
Niger	n.a.	379,051	n.a.

Country	Self-consumption 2016	Self-consumption 2021	Variation 2016-2021
Burkina Faso	362,701	215,541	-41%
Mali	552,080	657,037	19%
Mauritania	820,967	376,542	-54%
Senegal	971,336	1,328,444	37%
Chad	618,566	756,979	22%
Niger	n.a.	714,331	n.a.

Country	Dairy income 2016	Dairy income 2021	Variation 2016-2021
Burkina Faso	329,693	93,083	-72%
Mali	184,615	463,748	151%
Mauritania	23,660	90,703	283%
Senegal	206,084	220,338	7%
Chad	351,709	307,730	-13%
Niger	n.a.	331,705	n.a.

Country	Livestock income 2016	Livestock income 2021	Variation 2016-2021
Burkina Faso	835,556	1,142,679	37%
Mali	811,029	1,085,739	34%
Mauritania	577,710	1,146,310	98%
Senegal	1,767,074	1,622,727	-8%
Chad	1,315,578	907,551	-31%
Niger	n.a.	710 756	n.a.

The Role of Self-Consumption and Collective Investments in Reducing Income Inequality in Sahelian Agro-Pastoral Systems

Economic contributions of agro-pastoral households remain threatened by high levels of inequality despite slight reductions between survey periods. These inequalities stem from unequal access to productive resources. Little et al. (2001) and Wane et al. (2020) highlighted that high inequality in Sahelian pastoral and agropastoral systems is linked to limited access to economic resources such as infrastructure and land. A major challenge is addressing these disparities, measured through Gini monetary and total income indices. Between 2017 and 2020, PRAPS zone countries showed high-income inequality (Gini indices between 0.47 and 0.71) in the (agro)pastoral areas. However, Gini indices for monetary income generally decreased, reflecting improved economic conditions, especially in Mauritania (-25%). Total income inequality, including subsistence, also declined across all countries. In Niger, while income inequality remained high, areas influenced by PRAPS programs showed slightly less disparity. A key takeaway is that self-consumption (the equivalent income value of consuming what the agropastoralists produce themselves) significantly reduces income inequality, especially during disruptions like COVID-19. High inequality

often reflects unequal access to productive resources and poses a source of instability. Reducing inequality aligns with targeted investments in agropastoral economies, reinforcing the value of PRAPS initiatives.

Conclusion

The analysis of income among Sahelian agropastoral households, though partial due to the lack of data for Niger in 2016, reveals significant trends. Between 2017 and 2020, total household income remained relatively stable at around 2 million FCFA. However, disparities were observed: incomes rose in Burkina Faso, Mali, Mauritania, and Senegal, while a decline occurred in Chad. Subsistence consumption played a crucial role in reducing income inequalities. Regarding shocks, 27% of households reported climate-related, 36% health-related, and 26% economic shocks, with varied coping strategies. Security-related shocks were less reported, likely due to inaccessible regions for investments and surveys. The COVID-19 pandemic worsened uncertainty, emphasizing the need for regular surveys and targeted aid programs.

Acknowledgments

CILSS unwaveringly supported these surveys and the subsequent syntheses through the World Bank-funded Regional Sahel Pastoralism Support Project, ensuring comprehensive and sustained assistance.

References

Alary V, Corniaux C, Gautier D (2011) Livestock's contribution to poverty alleviation: How to measure it? World Development, 39 (9): pp. 1638-1648

Kebebe E. (2019) Bridging technology adoption gaps in the livestock sector in Ethiopia: an innovation system perspective. *Technol. Soc.* 57, pp. 30-37. doi: 10.1016/j.techsoc.2018.12.002

Little PD, Smith K, Cellarius BA, Coppock DL, Barrett C (2001) Avoiding Disaster: Diversification and Risk Management Among East African Herders. Development and Change, 32 (3): pp. 401-433. http://hdl.handle.net/11858/00-001M-0000-0011-9EE2-4

Pica-Ciamarra U (2005) Livestock policies for poverty alleviation: theory and practical evidence from Africa, Asia and Latin America. Working Paper n. 27. FAO, Pro-Poor Livestock Policy Initiative

Pica-Ciamarra U, Baker D, Morgan N, Zezza A, Azzarri C, Ly C, Nsiima L, Nouala S, Okello P, Serugga J (2014) Investing in the livestock sector. Why good numbers matter. A sourcebook for decision-makers on how to improve livestock data. World Bank Report n.85732 – GLB. Washington DC: World Bank.

Thornton PK (2010) Livestock Production: Recent Trends, Future Prospects. Philosophical Transactions of The Royal Society B: Biological Sciences, 365 (1554): pp. 2853–2867. https://doi:10.1098/rstb.2010.0134

Wane A, Touré I, Mballo AD, Ndiaye A, Souli Z, Ramde P, Ba Diao M, Yaro Botoni E (2024) Analyse des évolutions des revenus et des réactions des ménages agro-pastoraux sahéliens face aux chocs dans la zone d'intervention du PRAPS. Note Technique. ILRI-CIRAD-CILSS co-edition

Wane A, Touré I, Ancey V (2009a) Pastoralisme et Recours aux marchés - Cas du Sahel sénégalais (Ferlo). Cahiers de l'Agriculture, vol. 1, n. 1, Octobre 2009, pp. 14-20.

Wane A, Ancey V, Touré I (2009b) Assets of the Market, Assets of the Rural World – Pastoral Market Income Distribution in the Senegalese Sahel (Ferlo). Journal of Income Distribution, vol. 18, n. 3–4, September-December 2009, pp. 232–248

Wane A, Boureima F, Ndlovu F, Morton J (2018) Beef Value Chain Analysis in eSwatini. Report for the European Union, DG-DEVCO. Value Chain Analysis for Development Project (VCA4D CTR 2016/375-804), 127 p.

Wane A, Cesaro JD, Duteurtre G, Touré I, Ndiaye A, Alary V, Juanès X, Ickowicz A, Ferrari S, Velasco G. (2020) The economics of pastoralism in Argentina, Chad and Mongolia. Market participation and multiplelivelihood strategies in a shock-prone environment. FAO Animal Production and Health Paper No. 182. Rome. FAO & CIRAD co-edition. https://doi.org/10.4060/cb1271en