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AGRICULTURAL VALUE CHAINS IN SUDAN

An Annotated Bibliography

1 November 2023

A study commissioned by the SASAS Project, coordinated by CIMMYT

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AN ANNOTATED BIBLIOGRAPHY

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Contents

1. Introduction

The objective of the literature review is to provide partners with information to help them frame the SASAS project in Sudan. It is solely a desk review on recent literature, scientific journals as well as project documents and popular press gathering data about value chain analysis in Sudan and other comparable locations. The overarching goal is to build on both good and negative lessons acquired to avoid repeating unsuccessful strategies or duplicating work that has previously been done. Greater Khartoum, Blue Nile, and South Kordofan are the states being examined in this review. Priority crops in this review include groundnut, sesame, sorghum, wheat, millet, soybean, vegetables/horticulture. Livestock value chains were also part of this review. In addition, best practices and lessons learnt from other states in relation to value chain analysis are included in this section.

2. Methodology

This study was conducted in February 2023. For this study, we explored the internet, in particular google scholar and research gate for scientific papers, google for project documents and popular literature. Out of the 51 reviewed documents, 12 were from project documents (assessment or evaluation reports), 17 were from scientific journals, and 12 from the popular press including blogs, news bulletin, magazine and web pages with success stories of implemented projects, conference proceedings. EndNote was used for cataloguing and referencing. Each entry consists of the title and authors, data, an abstract and key words. Key words used in the search included: crop type, livestock, value chain analysis, actors, marketing efficiency, production, trading, marketing, best practices, lessons, post-harvest losses, gender, and Sudan.

The analysis of this paper was conducted before the change in government that occurred on April 15, 2023, and therefore that change has not been included.

3. Results: summary and key findings

The study concentrated on a number of commodities that the SASAS project in Sudan may find useful in regard to value chain. The 58 documents that were examined are divided into topics that are pertinent and fundamental with regard to basic concepts and commodities. Table 1 presents a summary of the analysis of the study with respect to states, livestock and livestock products, and crops.

Table 1. Number of documents reviewed, by crops, livestock and states.

Commodity	No. of documents reviewed	States explored
Basic concepts	4	Africa, internationally
Groundnuts	6	South and East Darfur, North Kordofan
Sesame	5	South, North, West Kordofan, Al Qatarif and Sinnar states
Cereal (millet, sorghum, wheat)	2	
Sorghum	4	Kassala, Gedarif and Sennar, Kassala, Blue Nile, West Kordofan, South Kordofan, White Nile and Darfur states
Wheat	4	White Nile, El-Gezira, entire Sudan
Millet	1	North Kordofan
Potatoes	2	River Nile State, entire Sudan
Soybean	3	River Nile, entire Sudan
Mixed (groundnuts, sesame, cereals, vegetables, livestock)	6	Entire Sudan
Vegetables and horticulture	4	Khartoum
Livestock and livestock products	6	Blue Nile, West Kordofan, North Kordofan, White Nile and Sennar

Mixed Livestock (crops value chains)	2	South Kordofan, White Nile
Socioeconomic aspects, gender and social inclusion in value	3	Darfur, North Kordofan, entire Sudan
Post-harvest losses management	4	Entire Sudan

Key findings:

- We found several studies on the value chains of groundnuts, sesame, and cereals, but few on other crops
- Most studies are on assessment of potential value chains and fewer on the actual value addition work done
- A challenge mentioned by several studies is poor storage facilities.
- Few studies focus on gender and inclusivity, with more studies on supporting women than on supporting youth.
- Most studies suggest capitalizing on the power of the private sector as key in value chain development
- Many studies focus on the enhanced of local value addition.
- Producer Associations play a vital role in promoting community collective action and in restoring trust and confidence among communities in post-conflict settings
- Adoption of Gender Action Learning System (GALS) is mentioned by one study.

4. Results: annotated biography on value chains in Sudan

4.1. Basic *concepts*

1. Value chain and value chain development: definitions [1]
Reference: Donovan, J., Franzel, S., Cunha, M., Gyau, A., & Mithöfer, D. (2015). Guides for value chain development: a comparative review. *Journal of Agribusiness in Developing and Emerging Economies*, *5*(1), 2-23.
   - This paper reviews 11 guides for value chain analysis and development. It compares the guides' concepts, objectives, and method and identifies strengths, weaknesses, and gaps. The assessment characterizes the state-of-the-art for designing interventions and interactions that seek to build value chains with smallholders.
   - This review examines the guides to understand how they define chain-related concepts.[2]
   - According to the World Bank definition, "The term value chain describes the full range of value adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs" . The same definition or definitions similar in nature are offered by FAO, IIED, GTZ, ILO, and USAID.
   - As per the definition of the International Potato Centre (CIP), a value chain refers to all the actors, and the entirety of their productive activities, involved in the process of adding value to a specific crop or product.
   - Two general types of definitions for value chain development (VCD) can be drawn from the guides: an actor/chain type that focuses on strengthening certain actors and improving relations between smallholders and other actors in a chain; and a business-environment type that focuses on improving the business environment in which chain actors operate
   - The paper concludes with suggestions for the use of guides based on local needs and context, and recommendations for future guide development.

     Key words: Value chains, value chain development, guides, Rural economies, Small and medium-sized enterprises

2. Practical guidelines for post harvest value chains. [2]
Reference: FAO and World Bank, *FAO/World Bank workshop on reducing post-harvest losses in grain supply chains in Africa: Lessons learned and practical guidelines. FAO Headquarters, Rome, Italy, 18–19 March 2010*. 2010: Rome.

   - This report is a synthesis of deliberations that took place during the one and a half day workshop at the FAO Headquarters in Rome, Italy, from March 18 to 19, 2010. FAO's Rural Infrastructure and Agro-Industries Division (AGS) and the Agricultural and Rural Development Department (ARD) of the World Bank organised the workshop to bring together experts on the subject of Post harvest Harvest (PHL) reduction
   - Specifically, the workshop aimed to: 1) Review current knowledge on the magnitude and nature of grain PHL, identifying more clearly the scope of the problem 2) Summarize past and on-going activities with respect to PHL along the supply chain, highlighting available options for the achievement of on-farm and community level post-harvest improvements 3) Drawing on private sector input, identify best practices and institutional arrangements to promote reduced PHL, with a view to guide donors/governments in promoting appropriate interventions 4) Define the way forward for future collaboration
   - Ongoing PHL reduction activities of the various development partners were reviewed and supplemented by technical presentations on: i) technological options for grain storage in Africa; ii)

warehousing and its relationship to grain PHL reduction; iii) the African PHL Information System (APHLIS); and, v) new applications of hermetic storage for grain storage and transport.

- The value chain approach was considered a necessary tool for assessing PHLs. The report argues that reducing PHL along food chains can, in certain cases, provide a more cost-effective and environmentally sustainable means of promoting food and nutrition security than investments focusing on increasing production.
- There was consensus among all participants that the way forward includes knowledge management (definition of best practices and lessons learned), adaptive research (need to allocate resources) and the incorporation of social marketing approaches rather than Technology Transfer
- Specific recommendations are in addition made in regard to governments, Private warehousing, public warehousing, Farmer-focused approaches, MFIs with rural outreach and international agencies in regard with the subject matter.

Key words: post-harvest losses, grains, FAO, World Bank, Africa

3. Value chain definitions [3]

Reference: Roger Norton. (2014). *Agricultural value chains: A game changer for small holders*. Devex. https://www.devex.com/news/agricultural-value-chains-a-game-changer-for-small-holders-83981

- The article defines a value chain as a set of linked activities that work to add value to a product; it consists of actors and actions that improve a product while linking commodity producers to processors and markets.
- It highlights how value chains differ from supply chains, which refer to logistics: the transport, storage and procedural steps for getting a product from its production site to the consumer.
- Additionally, value chain encompasses the flow of products, knowledge and information, finance, payments, and the social capital needed to organize producers and communities.
- Value chains may include a wide range of activities, and an agricultural value chain might include: development and dissemination of plant and animal genetic material, input supply, farmer organization, farm production, post-harvest handling, processing, provision of technologies of production and handling, grading criteria and facilities, cooling and packing technologies, post-harvest local processing, industrial processing, storage, transport, finance, and feedback from markets.

Key words: Value chain analysis, agricultural value chain, definitions

4. Guide to value-chain analysis and capacity building [4]

Reference: Collins, R., Dent, B., & Bonney, L. (2016). A guide to value-chain analysis and development for overseas development assistance projects.

- Chapter 1 begins with an explanation of the differences between 'supply chains' and 'value-chains'. Part 1.2 describes the systemic nature of value-chains, including improving chain performance, the value perspective of chains as systems, how value-chains work and value-chain thinking. Part 1.3 provides a literature review of the four theoretical perspectives in value-chain improvement—strategic management, economic, relational and technological. It also summarises the different value-chain research perspectives, and Part 1.4 explains how these have led to diverse methodological approaches across many international development agencies. Part 1.5 explains the importance of

'value-chain innovation' and what drives and enables this key goal of value-chain projects. Finally, Part 1.11 presents the model of value-chain analysis (VCA) and development used in this manual.

- Chapter 2 details on value chain analysis and development. Part 2.1 introduces VCA in greater detail—its objectives, themes and processes. It sets out the nature and structure of successful value-chain research teams, explains the context of VCA, including its connection with biophysical, economic, social and institutional baseline studies. Part 2.7 recommends how to select value-chains for research, development and extension (RD&E) projects, including the role of market research. Part 2.8 explains the processes for project initiation, including creating stakeholder groups and undertaking awareness-raising workshops. Part 2.11 provides advice on identifying and implementing interventions. Part 2.12 explains the monitoring and evaluation of project outcomes.
- Chapter 3 provides Lessons from the field and case studies. Part 3 provides five case studies of value-chain research drawn from ACIAR research projects and PhDs: * Case study 3.1: Philippine papayas * Case study 3.2: Pakistan mangoes * Case study 3.3: Peri-urban vegetables in Nairobi, Kenya * Case study 3.4: Nepalese tomatoes * Case study 3.5: Value-chain thinking training in Eastern and Southern Africa.
- Chapter 4 outlines Training activities. Part 4 offers some training activities for research and value-chain members. The structure is flexible so that it can be adapted to local circumstances, including the capacity of trainers and trainees. It details on the nine activities that can be combined to prepare an action plan for participants.

  Key words: guidance, value chain analysis, case studies

5. Gender and value chain analysis [5]

   Reference: Mutua, E. N., Njuki, J., & Waithanji, E. M. (2014). Review of gender and value chain analysis, development and evaluation toolkits. *ILRI Manual*.

   - This study constitutes a review of existing literature and tools on gender and value chain analysis. It is intended to inform researchers and practitioners undertaking gendered value chains analysis and development in crops and livestock on tools that have been used in gender and value chain analyses.
   - The review starts with brief descriptions of value chains and value chain analysis. The next section covers the rationale for gendered value chain analysis and integrating gender in value chain development, analysis and evaluation. A summary of the documents reviewed is also presented.
   - The review ends with two rapid assessment tools for evaluating gender in livestock and crop value chains. The tools are suitable for individual and group interviews with producers and other actors in livestock and crop value chains. Outcomes of these rapid assessment tools may be used to inform projects on existing and potential gender gaps along the value chains that would need attention and deeper investigation during a more detailed value chain analysis.
   - The two tools differ from those discussed in the reviewed documents in that they focus entirely on either a crop or livestock value chain. This review concludes with three broad recommendations for consideration in the design and use of value chain analysis tools.

     Key words: guidance/gender, guidance/value chain analysis, value chain/crops, value chain/livestock

4.2. Analysis of agricultural value chains in Sudan

4.2.1. *Cash Crops*

4.2.1.1. Groundnuts

6. Innovative Value Chain Partnerships (groundnuts) in Darfur,[6]

   Reference: UNDP. (2022). *Enhancing Community Stabilisation Through Innovative Value Chain Partnerships in Darfur*. UNDPARABIC. Web page. https://undparabic.exposure.co/enhancing-community-stabilisation-through-innovative-value-chain-partnerships-in-darfur?fbclid=IwAR3LFYQKLQBxCWoIgmMcBNVt37iZ4MB8ll9orK_02De16RJFOk0PHwfwr6A

   - The web page describes how UNDP capitalized on the power of Private Sector as well as the presence of a lucrative downstream market for groundnuts, to improve the lives and livelihoods of the conflict-affected people through innovate partnerships in Darfur.
   - Results revealed that the intervention has transformed traditional groundnuts farming into a commercial business by modernizing and expanding production scale and improving the efficiency and profitability of the groundnuts sub-sector whilst reducing inter-tribal conflicts.
   - It reveals the high potentials for commercial groundnut (peanut) production in South and East Darfur States.
   - Key is that Producer Associations play a vital role in promoting community collective action and in restoring trust and confidence among communities in post conflict settings
   - It describes how UNDP played a facilitatory role by brokering tripartite agreements among the Groundnut Producer Associations in the 2 States, the Darfood Company and a financial institution (The Nile Bank), enabling the associations to access a credit facility to purchase a set of agricultural machinery and accessories (such as tractors, ploughs, harrows, planters, weeders, applicators, ridgers, harvesters, threshers, bailers etc) to enhance production activities. The sale of groundnut hay constitutes additional source of income for the farmers.
   - UNDP also brokered forward purchasing agreement between Darfood and the Associations, enabling the producers to access guaranteed market including the establishment of adjustable agreed floor prices. *The Darfood Factory Purchase the Groundnuts from the Associations and process it into Plumpy Nuts which is sold to Humanitarian organisations such as WFP, UNHCR and UNICEF for their Nutrition Programmes.*
   - The article additionally describes trainings offered by UNDP in collaboration with Darfood and the Ministry of Production focusing on quality control aspects.
   - However, the article reveals that market participation of vulnerable households in Darfur is low, constraining their ability to increase incomes and to reduce poverty.
   - Key is group farming means greater efficiency in the use of agriculture machinery and expertise as well as cost-efficiency through product aggregation and economy of scale.

   Key words: groundnut, value chain, Darfood company, UNDP, women, South and East Darfur

7. Groundnut value chain analysis [7]

   Reference: Esraa Elkhir Ahmed Douleeb. (2017). *Assessment of the Groundnut Crop Processing Value Chain in North Kordofan State, Sudan* University of Khartoum].

- This study aimed at analyzing the value chain of groundnut edible oil in North Kordofan State. The specific objectives of the study include identifying different actors in the value chain and assess their roles, determine the costs and profit of different activities at each stage in the chain and calculate the marketing margin of the of the different actors in groundnut value chain.
- The data for this study were collected from both primary and secondary sources.
- The results of groundnut value chain analysis revealed that the main actors in the chain were farmers, raw groundnut traders, peeler owner, peeled groundnut traders, processors, oil wholesalers, oil retailers, consumers. Farmers added 17.67% to total value of the marketing margin and the shares of other actors were 11.82%, 5.37%, 12.47%, 20.61%, 1.83%, and 30.23% for traders, owner peeler, peeled trader, processors, oil wholesaler, and oil retailer, respectively.
- The results also showed that the oil retailer and processors have the highest two shares of total gross margin which were 38.18% and 26.20%, respectively.
- Oil retailers are the dominant value chain actors, since their share reached 71% of total gross profit margin.
- The study suggests provision of the modern inputs of production to farmers, improving post-harvest activities through provision of good transport and storage facilities, linking the farmers directly with industries will shorten the chain and increase the producer's share, reducing fees and taxes and protecting the local processors from cheap and low quality imported oil.

Key words: ground nut edible oil, groundnut value chain analysis, oil retailers, North Kordofan state

8. Peanut export ban, Sudan, [8]

Reference: AFP. (2020, Tuesday, August 11). Sudan's 'sudden' peanut export ban baffles traders. *Nation Africa, Online Newspaper*. Available at: https://nation.africa/kenya/business/sudan-s-peanut-export-ban-baffles-traders-1917206

- The article notes that on 11 August 2020, the government of Sudan introduced a ban on the export of raw peanuts explaining that the decision was taken by the government to process the raw peanuts inside the country.
- According to the article, the government says it wants Sudan to process the nuts inside the country to earn more money.
- Furthermore, Sudan is the fifth largest peanuts producer in the world with 14% of world production. The two main customers for Sudan's peanuts were China and Indonesia.

Key words: Peanut, export ban, Sudan

9. Demand-driven seed for groundnut production, [9]

Reference: IAEA. (2020, February 2020). *Sudan looks to nuclear technology to double farmers' income and grow peanut exports*. https://www.iaea.org/sites/default/files/publications/magazines/bulletin/bull61-1/6113133.pdf

- The article starts by noting how Sudanese farmers in areas prone to drought now have a drought-tolerant peanut variety that will improve their livelihoods and increase the country's peanut exports.
- It also shows the adaptability of the new variety revealing that this new variety has shown up to 27% improvement in yields while needing less water and has the potential to double farmers' income. It was developed using nuclear techniques with the support of the IAEA, in cooperation with the Food and Agriculture Organization of the United Nations (FAO)
- In regard to by-products, peanuts, also known as groundnuts, are commonly pressed into oil or used in various local dishes, including salads, soups and stews. Their leaves and stems, as well as cakes pressed from peanuts, are popular for livestock feed. The government is now looking to regain its footing as a top exporter while improving the livelihoods of subsistence farmers.
- According to the article, scientists used irradiation as an initial step in plant breeding to develop this. Researchers were in charge of developing several potential varieties, but it was up to farmers to decide which ones worked best in their fields. The project included farmers across seven villages in North Kordofan State from the early stages of the research process so they could actually select the variety that best fits their needs. The desirable traits farmers were looking for are highlighted in this document.
- Tafra-1 was the clear winner. Meanwhile, the variety's high performance has prompted farmers to start multiplying seeds on their own.
- It further notes that in only three years, we expect to have multiplied enough seeds to supply all 230 000 potential groundnut farmers in North Kordofan State. We will then be able to produce enough for domestic consumption and the external market

Key words: Groundnut, demand-driven, seed, North Kordofan,

10. Peanuts sourcing in Sudan [10]

Reference: Samil Industrial Company. (2019). *Peanuts Sourcing in Sudan: Efforts and Challenges.* . UNICEF. Accessed at: https://www.unicef.org/supply/media/3511/file/_NSF-2019-peanuts-Sudan.pdf.

- Sudan proudly boasts 14% of the world total peanut's production and is one of the top five producers worldwide providing much needed foreign exchange. In fact, groundnut cultivated area represents about 35% of total cash crop area.
- According to the presentation, two varieties of groundnut are grown in Sudan; one is grown in the western part of the county accounting to 60-70% of the total production whilst the other variety grows in Gazeria and East Sudan.
- The presentation reveals that 'western' groundnuts typically grown in Darfur are known to be of better quality possessing higher levels of protein and oil.
- Due to the fact that the current supply of high graded premium groundnuts is quite unreliable and the products' quality is uncertain. Samil Industrial Company, in the past had to source its requirements of groundnuts from different sources to produce the ready-to-use food (RUF).
- Therefore, for both parties, the establishment of a "Certified Sorting Line for the Production of Food Graded Peanuts in El Daein – East Darfur - Sudan" represents a logical extension of their combined business activities in the country as the production will also partly be utilized in the production of RUTF.
- With regards to collaboration with farmers, Cooperation agreements have already been signed with local agricultural cooperatives (Union Farmers) ensuring the producers to obtain an income.
- Trainings and assistance are also provided to producers to increase the quality and to secure market for their product. The project also participates in the development programs of introducing modern tools and methods to the farming activities.
- The presentation notes that the project implemented the mechanical plantation of peanuts as the first experiment in Darfur through two demo farms of 200 feddans. The area will be increased gradually to reach 10,000 feddan with association of the farming societies.

Key words: Groundnuts, peanut, value chain, Darfur Sudan

11. Peanuts in Ethiopia [11]
Reference: Self Help Africa. 2014. Ethiopian Farmers Peanut Butter Dividend. 2014; Available from: https://selfhelpafrica.org/us/ethiopian-farmers-peanut-butter-dividend/.

- An enterprising peanut project is transforming the lives of close to 800 Ethiopian farm families, with producers earning a premium by trading not just their raw nut crop, but also processing and selling peanut butter to supermarkets in the region.
- A combination of improved seed varieties and better farming practices has seen yields grow from an average of 13 quintals (one quintal equals 100kg) of unshelled nut per hectare up to 50 quintals per ha. Half of the farmers involved in the project are women.
- Through their 'parent' Afrankalo Cooperative Union the peanut producers of East Guraghe have received training and marketing skills too, and recently started processing their shelled nuts into peanut butter. Their processed butter trades at a premum, and members recently established a market for the product at local supermarkets and from other buyers.

Key words: Peanut butter, groundnut, value chain, Ethiopia

4.2.1.2. Sesame

12. An Analysis of Sesame Crop Value Chain: A Case Study of Kordofan Region, Sudan [12]

Reference: AHMED, S. A. (2013). *An analysis of sesame crop value chain: a case study of Kordofan region, Sudan* (Doctoral dissertation, School of Agriculture and Enterprise Development, Kenyatta University).

- This study characterized the sesame value chain from producers to processors in terms of material and information flows as well as the inter-relationships between the actors in Kordofan region of Sudan. In addition, constraints and opportunities in the sesame production and processing were determined and marketing costs, value added and profit margin distribution among actors in the chain evaluated.
- The findings revealed that sesame production is constrained by lack of extension services, civil war and conflicts between farmers and livestock keepers over natural resources and scarcity of farming equipment.
- Oil processors are constrained by high cost and insufficiency of inputs and oil imports.
- Sesame producers' opportunities in the region include production of good local varieties and favorable growing conditions.
- Oil processors have the potential to increase oil production and compete with other oils by improving quality and exporting the livestock cake directly to the world market instead of selling it to brokers who then export the product.
- Traditional oil processors appeared to have higher profits (1 ,297.1 SDG/ton) compared to the industry sesame oil and this was attributed to the high cost of oil that was processed traditionally due to increasing demand for organic products and healthy oils.
- The results also showed that tahania processors were the winners of the chain in terms of profits with the highest profit share of 2705.5 SDG in any ton of sesame that, was processed.

Key words: Sesame Crop Value Chain, Kordofan, tahania

13. Overview of the sesame seed sector in Sudan[13]

Reference: GRO Intelligence. (2017). *Sudan's Resilient Sesame Seeds*. Available at: https://gro-intelligence.com/insights/sudansesame-seeds

- Approximately 77 percent of the area devoted to sesame seed farming in Sudan is in three states: North Kordofan, Blue Nile, and Gedarif.
- Pests are a major issue plaguing Sudan's sesame seed production. The lygaeid bug, or sesame seed bug—found prominently in the clay soils of central Sudan—depletes the seed's oil content thus reducing overall quality and quantity. Of the seeds that make it to harvest, losses may occur from poor threshing and storage.
- Losses may also occur when the capsule housing the seeds bursts as a result of non-uniform maturation, a process known as dehiscence. Additionally, the small seeds are susceptible to spoilage caused by air circulation. As a result of these vulnerabilities, the seeds are especially labor intensive during the harvest.
- Oilseeds are transported from crop markets to Port Sudan via road. Taxes and fees, including port levies from 30 to 80 percent of total fees, are collected between the farmgate and the world market.
- On average, 44 percent of sesame seeds produced in Sudan are exported. The main markets for Sudanese sesame seeds are Egypt, the Middle East, and Asia.

- Oilseed exports in the 1970s were monopolized by four companies, which later formed the now-defunct Sudanese Oil Seeds Company. Currently, there are no policies on exports of oilseeds that protect and support the producers or regulate middlemen and exporters.

Key words: Sesame seed, market, post-harvest losses, exports, Sudan

14. Sesame value chain analysis, four states in Sudan [14]

Reference: Mahgoub, E. A. (2023). Improving smallholder access to wholesale and auction markets for sesame at four states, Sudan. Agriculture and Horticulture, Valencia, Spain.

- The main objective of this study is to evaluate the effects of the main economic factors on Sesame production, and marketing of North, South, West Kordofan, and Sinnar States.
- The article reveals major Sesame producing regions in Sudan to be West of Sudan, Sinnar, and Gadarif states, which contribute more than 90% of total these three crops output.
- However, the production and marketing of Sesame at the four states are faced with various challenges that need to be addressed. These include low productivity and quality, poor market infrastructure, long and traditional marketing channels among others.
- A long value chain characterizes this crop, which includes producers, village traders, collectors, brokers/wholesalers, oil millers, exporters, retailers and local consumers.
- Smallholders in the Sesame seeds value chain depend on intermediaries, due to the small quantities to be sold and lack of efficient market information system. Price discovery is not based on forces of demand, supply, and do not reflect current international market prices.
- The study suggested that Sesame production, and harvesting cost should be reduced through providing improved varieties; reducing marketing cost through introduction of sieving process in the production areas to reduce physical losses; improving infrastructure to reduce transportation cost of these crops.
- The study key suggestions are:

✓ develop and improving the application of market regulations to attain efficient market structure and performance;
✓ supplying of market credit to farmers and traders to avoid oligopoly practices, and
✓ ensuring of production of quality crops towards improving the access of smallholder farmers to formal markets, auction and wholesale markets.

Keywords: Value chain analysis, Sesame, actors, South, North, West Kordofan, and Sinnar states

15. Guide for the Sesame Value Chain in Sudan [15]

Reference: UNIDO. (2021). *Promoting Good Practices in the Sesame Value Chain for Improved Quality and Enhanced Market Access* [A guide]. https://standardsfacility.org/sites/default/files/Best_practices_guides_sesame_value_chain_actors_Sudan.pdf

- The objective of the guides is to disseminate and promote best practices into each stage of the sesame value chain, to support various value chain actors in Sudan in their efforts to improve quality of their products and compliance with international market requirements which will contribute to increased value addition along the sesame value chain in Sudan.
- The guides cover various topics on Good Agricultural Practice (GAP)– Integrated Pest Management (IPM), post-harvest, transportation, shed/storage facilities, oil extraction, traceability,

market compliance and Business to Business (B2B) linkages, which are relevant to production, processing, storage and transportation and marketing activities along the value chain.

- The guide in addition provides four elements of successful B2B linkages in agriculture giving examples of the Sesame Value chain project case in Sudan, key are:

✓ A profitable opportunity must exist to motivate lead firms to engage with SMEs. In the case of Sudan, the Sesame Value Chain Project, implemented by UNIDO & FAO to focus is on improving farming techniques, quality of sesame seeds, enhancing the yields and establishing a robust traceability system at one of the value chain, while engaging with SMEs (small and large) to help them to become more competitive through value addition and ensuring market compliance in order to better access the export market, by demonstrating tight controls along the export supply chain

✓ There clearly are tangible benefits of working together to achieve the desired outcome. In case of the sesame value chain project, farmers, local traders, exporters working in tandem with the regulatory bodies is the best approach for developing economies. Exporters source their produce from farms that demonstrate good agriculture practices, ensuing quality product, which in turn is processed in accordance with market requirements and compliance to SPS measures.

✓ Sufficient capacity: A minimum level of SME capacity is necessary to meet lead-firm requirements for scale, quality, cost, labor, and environmental standards. Capacity-building activities — such as training, advisory services, and mentoring — can help SMEs contribute to a more assured supply chain. In the case of the Sesame VC project, training starts at the farm level (downstream) and continues along each critical point of the supply chain, resulting in an increase in exports and access to more lucrative markets.

Key words: Sesame value chain, guide, best practices, Sudan

16. Upgrading the Sudanese Sesame seeds value chain, in North Kordofan and Al Qatarif [16]

Reference: UNIDO. (2017). *Upgrading the Sudanese Sesame seeds value chain. STDF Project Grant Application Form* (160177) [Grant]. North Kordofan and Al Qatarif states.

- This project aims to increase export revenues of sesame-seeds in Sudan by improving the quality of sesame-seed, increasing capacity to comply with food safety and phytosanitary requirements, and enhancing market access to value-added markets.
- The project will engage public and private partnership for promoting sesame-seed exports to value added markets. Local government departments take responsibility in extension and training, and related Ministries are responsible for demonstrating compliance with the SPS requirements for trading partners.
- The document highlights the sesame-seed value chain as composing of various actors including sesame-seed farmers, traders at different administrative levels (district, regional and national levels), transporters, small-scale and large-scale processors and exporters. Other institutions that have a bearing on sesame-seed marketing include: The Ministry of Agriculture and Forestry (MOAF), the Ministry of Industry (MOI), Agriculture Research Corporation (ARC), and Sudanese Standards & Metrology Organization (SSMO), and industry stakeholder associations, and International Organizations and NGOs working to improve livelihood of Sudanese farmers.
- The document also highlights Existing Laws and Regulations Related to Sesame-seed Production and Exports in Sudan. The document further shows the Quality requirements for international trade in sesame seed and its products.

- The major challenges for Sudan to export sesame-seed to value added market are to minimize risk of pests, microbiological contamination, mycotoxins-producing fungi and non-compliant pesticide residues in the final product. In particular, aflatoxins, salmonella, and restricted agricultural chemical use such as carbaryl are the major reasons why the sesame-seeds are rejected at the border of import countries. Furthermore, non-SPS quality defects (such as higher levels of rancidity, presence of foreign matter) reduce the acceptability of the product to higher value markets.
- The document in addition highlights on-going and closed projects and programmes that relate to export commodity production and quality improvements of Sesame-seeds in Sudan including:
  - ✓ In December 2015 FAO completed a project in Sudan named "Development of a Quality Seed Production System and Value Addition in Sudan". The project provided the basis for the development of viable, sustainable source of local and improved germ plasma for the oil and vegetable seed sector including sesame-seed through; 1) Strengthening the capacity of plant breeding, seed production, marketing, and seed certification administration; 2) safeguarding and improving the indigenous oil and vegetable crop varieties including sesame-seed; 3)enforcing the legal framework of the Seed law regarding the protection of breeders' rights and regulations to create a favorable environment for the development of the seed sector and reinforcing of the technical capacity of the Seed certification administration/agency.
  - ✓ Seed Development Project in Sudan: aims at increasing crop productivity for about 108,000 smallholders adopting certified seeds in North and South Kordofan. The seed supply system for sesame-seed in Sudan is at the embryonic stage characterized by limited human, technical and financial capacity of the National Seed Administration (NSA) compounded with an ineffective organizational set up causing inadequacy of the existing seed quality control standards. It is believed that the IFAD project could contribute to the identification of quality sesame seed ideal for targeting the international market. Recently released sesame-seed varieties: NCRIBEN-01M and NCRIBEN-02M, and Ex-Sudan (exotic variety), readily meet the premium quality requirements for sesame-seed export (1000 seed weight 3.0 g, 40- 50 per cent oil content and pearly-white seed color).

Key words: Sesame-seed value chain, actors, policies and laws, North Kordofan and Al Qatarif states, Sudan

4.2.2. *Food crops crops*

4.2.2.1. *Cereal Value Chains*

17. Sudan Staple Food Market Fundamentals (millet, sorghum, and wheat) [17]
Reference: FEWS NET. (2015). *Sudan Staple Food Market Fundamentals*. https://fews.net/sites/default/files/documents/reports/Sudan_MarketFundamentals_06152015.pdf

- This report focuses on the Sudan Staple Food Market Fundamentals: sorghum, millet and wheat.
- The document focusses on three cereal crops in Sudan: Millet, sorghum and wheat. Under sorghum, it details the Key actors in Sudan's sorghum markets, Key sorghum trade markets, Domestic trade flows, Regional and international trade flows and the Sorghum price trends
- Under wheat, the report has focused on Wheat consumption trends, Wheat production trends, Wheat import trends, Key actors in Sudan's wheat markets, Key wheat trade markets and wheat price trends, millet marketing, and Millet price trends
- On millet, the publication has largely focused on Key actors in Sudan's millet markets, Key millet trade markets
- The report shows that Sorghum producers vary from small-scale producers in the traditional rainfed production systems to largescale producers in the country's high-productivity irrigated and semi-mechanized rainfed areas. Large-scale producers are also engaged in marketing through storage and trading activities (buying from smaller neighboring producers), particularly in the country's most productive areas.
- Key is that the ABS extends loans for inputs and machinery ahead of the marketing year to be paid back in cash or in kind (delivery to the SRC).
- The report further shows that the largest sorghum trade market (in terms of quantities traded) is Gedaref, in the heart of the surplus producing Gedaref State where the majority of production occurs in the semi-mechanized sector, accounting for just under half of total sorghum production.
- El Obeid, in North Kordofan State, plays a central role in sorghum trade between the surplus and wholesale markets of eastern Sudan and deficit areas of central and western Sudan. El Fasher, the largest market in North Darfur State, receives sorghum supplies from El Obeid and Um Durman, as well as neighboring areas such as Saraf Omra. Other important wholesale sorghum markets include Wad Medani (a key source market for Khartoum), Rabak and Kosti (neighboring towns in White Nile State), Sennar (Sennar State), and Nyala (South Darfur State).
- In regard to wheat, availability is assured through local production (15-25 percent of national wheat supply) and imports (over 75-85 percent of national wheat supply). By some estimates 70,000 to 80,000 50-kg bags of wheat flour are consumed per day by consumers in Khartoum
- The report highlights the main wheat production areas as the irrigated systems in Gazeira, Rahad, and Halfa El Gadeeda States, which account, on average, for approximately 50 percent of national wheat production. Likewise, some limited irrigated wheat production occurs in Northern, River Nile, and White Nile States (SIFSIA 2011). A negligible quantity of rainfed wheat is produced in the Jebel Mara area of West Darfur, and used directly for local consumption.
- Key is that wheat production in Sudan has consistently been supported by government interventions, either through provision of subsidized inputs and credits or through earlier price setting to encourage farmers and local producers to increase their areas of wheat.
- In regard to seasonality, the report shows that March to April is the main wheat harvest period in Sudan, with marketing starting between the end of April and the beginning of May. Imports from international markets, on the other hand, take place throughout the year by contracted companies and the SRC based on local wheat production expectations

- The key markets for locally produced wheat are located in main production areas. These include Dongola in the Northern State, El Damer in River Nile State, Madani in El Gazeira State, Kosti in White Nile State, and Halfa El Gadeda in Kassala State.
- With regards to millet, the report notes that millet is a key staple food for poor households in the western part of Sudan (Darfur States)
- Fewer key actors are involved in the millet marketing system than in sorghum and wheat markets, resulting in relatively short and straightforward marketing channels.
- Furthermore, the ABS and the SRC are involved in national millet financing and marketing in a very limited way and no industrial millet processing exists.
- The largest millet trade market (in terms of quantities traded) is Nyala, in the heart of the surplus-producing South Darfur State
- Unlike the Sudanese sorghum and wheat markets, which involve regional and/or international markets, millet is traded in much smaller quantities and over shorter distances (Dorosh and Subran 2009)

Key words: Millet, sorghum, wheat, value chain, Sudan

18. Cereal markets in Darfur (wheat and sorghum) [18]

Reference: Abay, K. A., Abdelfattah, L., Breisinger, C., & Siddig, K. (2023). Evaluating cereal market (dis) integration in less developed and fragile markets: The case of Sudan. *Food Policy*, *114*, 102399. https://doi.org/doi.org/10.1016/j.foodpol.2022.102399

- This paper evaluates spatial market integration in cereal markets in Sudan, focusing on wheat and sorghum, two major cereal crops.
- Sudan's context provides important insights on the functioning of markets in economies marred by sanctions, conflicts, soaring inflation, and macroeconomic imbalances.
- The paper uses long-ranging monthly cereal price data and a vector of error-correction cointegration model (VECM) to characterize both short-term and long-term spatial price adjustment across cereal markets.
- Results reveal that among the 15 wheat and 18 sorghum markets considered, the authors can only detect significant spatial market integration among 6 wheat and 11 sorghum markets.
- Despite some strong spatial market integration among a few neighboring markets, there is no spatial market integration between several markets, including between major wheat consumption and production hotspots. For example, cereal markets in Darfur are not integrated with cereal markets in the rest of the country, despite exhibiting some level of spatial integration within the Darfur region.
- The authors also observe relatively stronger spatial market integration in sorghum markets than in wheat markets. Sorghum prices require a shorter time to correct deviations from equilibrium than wheat prices.
- The study's findings point to three different sets of interventions.
  - ✓ First, in those states with limited spatial market integration, interventions may focus on developing market infrastructure, including connecting markets with major cereal trading centers. These types of investments can especially benefit markets in the Darfur region.
  - ✓ Secondly, the papers' findings insinuate that boosting productivity through investments in sorghum and wheat production in high potential states can benefit households residing in these states as well as neighboring states when markets are well- integrated.

However, as prices in production hubs are not sufficiently responding to changes in prices in consumption hubs, there is a need to invest in market-orientation and marketing support to wheat and sorghum producers.

✓ Finally, most markets located in cereal consumption hubs and those with relatively improved road and trade infrastructure are sufficiently responsive to changes in prices and shocks in neighboring states. But these markets are likely to be vulnerable to price shocks.

Keywords: Wheat and sorghum, Spatial market integration, Cereal markets, Market efficiency, Sudan fragile markets

4.2.2.2. *Sorghum*

19. Sorghum value chain in Sudan [19]
Reference: Anonymous. (2022). *Sorghum VCA Final Report.* https://www.netherlandsandyou.nl/binaries/netherlandsandyou/documenten/publications/2022/07/17/economic-sector-studies/Sorghum-VCA-FINALdraft-circulation.pdf

- This research looks at the degree to which actors within Sudan's sorghum value chain contribute to, and are impacted by, a distorted market environment. This study examines the sorghum value chain in Sudan with focus on the states of Kassala, Gedarif and Sennar, as part of wider effort to improve economic viability for smallholder farmers and SMEs in eastern Sudan.
- The analysis of value chain distortions reveals distortions related to production, marketing, finance, exports and policy driven mainly by practices of a handful of powerful downstream and upstream actors. These distortions, directly and indirectly, impact the competitiveness of smallholder farmers.
- The study reveals that in addition to Blue Nile, White Nile and South Kordofan states, Kassala, Gedarif and Sennar are sorghum surplus producing states. The dominant systems of sorghum production in the eastern region are the traditional, mechanized and semi-mechanized rain-fed farming systems with a few irrigated schemes such as the New Halfa scheme.
- In regard to exportation, the study notes that most of Sudan's sorghum exports go to the Arabian Gulf region and Turkey (Eltahir 2017). Primary destinations in the Gulf include Saudi Arabia, Qatar, Emirates and Kuwait and most exports to these countries are sourced from Gedarif. Sudanese sorghum exported to these countries is mainly used in animal feed and fodder.
- Key is that the sorghum produced in Sudan has limited international marketing opportunities due to the relatively high cost of production in Sudan and due to the imposition of export controls by the bank of Sudan and MFNE in the form of authorizing exports based on national stocks availability.
- The study also found out that significant share of sorghum production in Sudan is financed through Salam loans underscoring the importance of the pivot price which is currently set at SDG 250/sack. It is important to note that sorghum in Sudan may be sold above or below this price.

- Furthermore, the Government of Sudan (GoS) remains a tremendously influential actor in the sorghum value chain. Through state-institutions like the Agricultural Bank of Sudan (ABS), the Ministry of Finance and National Economy (MFNE) and the Strategic Reserve Corporation (SRC), the GoS finances the largest sorghum farming operations in the country and exerts control over pricing, trade and exports.
- Analysis of revenue margins shows a skewed value distribution with actors in processing and retail accumulating the largest share of the end-market price, while actors involved in production activities receive the lower income shares. Hence, the researcher recommends policy and programme responses to improve economic viability for production actors with focus on smallholder producers, highlighting the potential role for private sector responses
- The article presents suggestions and considerations for value chain development. Key suggestions for programme development include:
  - ✓ Enhance productivity per feddan through contract farming
  - ✓ Strengthen smallholders' storage capacity through development of hermetic storage supply chain
  - ✓ Develop farmers' associations to stimulate local market-systems

Key words: Sorghum, value chain, markets, exports, Kassala, Gedarif and Sennar states

20. Forecasting the sorghum production in Sudan [20]

Reference: Frah, E. A. M. (2016). Sudan production of Sorghum; forecasting 2016-2030 using autoregressive integrated moving average ARIMA model. *American Journal of Mathematics and Statistics*, *6*(4), 175-181. https://doi.org/10.5923/j.ajms.20160604.06

- The article shows that sorghum is the largest crop in Sudan, where Sudan is one of the most important countries producing sorghum in the world. Additionally, Sudan is the fifth country after China, India, USA and Nigeria in sorghum production worldwide.
- Sorghum is the most important crop and livestock feed. The study aims at forecasting the sorghum production in Sudan.
- The forecasting findings have shown that between 1960 and 2015, Sudanese sorghum production at an annual increasing.
- The study notes that the growth in production is attributed to changes in harvested area land.
- The paper suggests that for more increase productivity growth, farmers should be provided with new technology, access to modern inputs, and sufficient logistical support.

Key words: Sorghum, production forecasting, Sudan

21. The reduced of sorghum production in 2019/2020 in Sudan, [21]

Reference: OCHA. (2020). *The national production of sorghum and millet in 2019/20 is less than last year – Sudan Ministry of Agriculture*

- According to the Ministry of Agriculture and Natural Resources (MoANR) food supply assessment for Sudan (CFSAM), the national total production of sorghum and millet in 2019/20 is estimated at 5.1 million tonnes, 36 per cent below the previous year's record output and 18 per cent less than the past five-year average.
- The CFSAM assessment was carried out by MoANR—with assistance from the United Nations Food and Agriculture Organization (FAO) and other partners—between 24 November and 14 December 2019 to determine crop production and food supply situation throughout all 18 states in the country.
- The decline in production can be attributed to farmers shifting crop production to more remunerative cash crops, such as sesame and groundnuts, compounded by lower yields resulting from unfavourable weather conditions and pest infestation.
- Constraints on the availability of, and accessibility to, agricultural inputs were reported as a result of high and increasing inflation, which also led to soaring costs of production.
- Rat infestations were reported at significant levels in Kassala, Blue Nile, West Kordofan, South Kordofan, White Nile and Darfur states.

Key words: Sorghum, millet, production, Sudan

22. Opportunities to improve the sorghum value chain, Sudan [22]

Reference: WhitePeak. (2021). Sudan's Roadmap to becoming World's Sorghum Basket. *WhitePeak*. Available at: https://whitepeakconsulting.org/blogs/f/sudans-roadmap-to-becoming-worlds-sorghum-basket?blogcategory=Agriculture+

- The blog highlights the opportunities in the Sudan's Sorghum value chain and provides a roadmap that will aid in Sudan's transformation from fifth-largest to largest Sorghum producer in the world.
- The blog reveals that Sudan's Sorghum value chain continues to struggle with highly volatile production, area under cultivation, and yield. The article highlights key opportunities in Sudan's sorghum value chain including:

✓ Input supply- Sudanese farmers must be made aware of the improved varieties of seeds, chemical fertilizers, and Integrated Pest Management (IPM) practices to revitalize the productivity of land for Sorghum production

✓ Production and post production- Smallholder farmers in Sudan use traditional means of production which are labour-intensive and suffer post-production losses such as weed infestation and pest attacks. In such a scenario, farmers' capacities in harvesting and post-harvesting technologies can be strengthened by providing systematic training and regular technical assistance to farmers.

✓ Processing- There is an emerging market for Sorghum based products in Sudan. To tap into this market, Sudan must focus on making uniform grade Sorghum accessible to Sorghum processors by strengthening the post-harvesting practices followed by farmers

✓ Marketing and distribution- To improve the marketing & distribution system, Sudanese government can direct investments in marketing, storage, and feeder road infrastructure in high potential agriculture areas. It can also focus on revitalizing the market information

system to strengthen the bargaining power of Sorghum farmers and help in reducing price instability in the market

Key words: Sorghum value chain, roadmap, opportunities, Sudan

4.2.2.3. *Wheat*

23. Wheat farming in the south (White Nile State)– a first for the area, [23]

Reference: UNDP. (2020). *Wheat, bread and resilience in Sudan during Covid-19*. United Nations, Sudan. https://sudan.un.org/en/43867-wheat-bread-and-resilience-sudan-during-covid-19

- UNDP has successfully trialed wheat farming in the south – a first for the area in White Nile state.
- The article describes how UNDP and the Ministry of Production & Economic Resources provided advanced agricultural training and high-quality seed to maximize production, collaborated to ensure fuel supply for machinery, and created locally-led 'community management committees' who own and manage farms and harvesting.
- To tackle local food shortages and unemployment, a workforce of almost 1,400 laborers and farmers were recruited to open new land for wheat cultivation, and an additional 2,700 households provided equipment and training to develop small, single-family farms while commercial operations expand. Key facts include:
  - The first commercial-scale harvest created 1,400 jobs and produced 202.5 tons (over 4,050 sacks) of wheat. Enough for 4,860,000 loaves of bread each with a retail price of SDG 2, it generated almost 10 million Sudanese pounds in revenue. Anticipating a productive season, UNDP had committed to market the wheat for sale - but private sector and government clients immediately purchased the entire harvest.
  - To open 46 square kilometers of new farmland for cultivation with irrigation, UNDP dug or rehabilitated 86 kilometers of canals across White Nile State
  - These newly irrigated fields also expanded farming, production and output for other crops in the area, creating 24,000 seasonal jobs in total and increasing local cotton production by 50%
  - Increasing usable land and food production, creating jobs and value chains, these are all critical to economic recovery. But if it isn't sustainable long-term, we have failed. With local ownership, local experts, and the right partnerships, we're confident the farmers can make a substantial contribution to local bread shortages and their community's livelihoods.
- While this is only a small step in tackling Sudan's wheat shortage, it goes a long way to demonstrating the homegrown opportunities that exist in Sudan's fertile countryside, and the benefits for employment, peacebuilding and national self-sufficiency that long-term development can provide.

Key words: Wheat, value chain, production, White Nile State, Sudan

24. Wheat, bottlenecks and challenges, [24]

Reference: Fatma Abdelaziz, A. W., Kibrom A. Abay, and Khalid Siddig. (2022). *An assessment of Sudan's wheat value chains: Exploring key bottlenecks and challenges*. International Food Policy Research Institute. https://doi.org/10.13140/RG.2.2.20759.85929

- This report evaluates and identifies key bottlenecks that likely cause wheat and bread supply disruptions while also shedding light on untapped opportunities and possible policy options to improve the functioning of Sudan's wheat sector.
- IFPRI has been working on Wheat in Sudan for the last 10 years:
- Very recent book on the value chain of wheat [25]

- Subsidized imports good for urban poor, but suppress prices [26]
- The article discusses the governments' interventions that Sudan's domestic and imported wheat sectors have been subject to over the last decades. Most interventions have focused on and aimed to (i) stimulate domestic production, (ii) ensure a reliable flow of wheat imports to compensate for low domestic wheat production, and (iii) monitor wheat flour and bread distribution processes to limit leakage and wastage.
- Sudan has two distinct wheat value chains, for imported and for domestic wheat.
- The imported wheat value chain involves three major actors: milling companies, wheat flour agents, and bakeries.
- The domestic wheat value chain involves four main actors: wheat producers, wheat grain wholesalers, wheat grain retailers, and consumers.
- The authors document wheat value chain actors' policy preferences, which vary depending on whether actors are engaged in domestic or imported value chain.
- Lack of irrigation water (39 percent) followed by lack of finance (37 percent) were the two highest binding constraints that farmers suggested as limiting their capacity to increase wheat production by domestic value chain members, followed by lack of access to inputs of production such as fertilizers and seeds (5 percent) and lack of land (5 percent). However, access to finance is still considered a top persistent bottleneck facing flour agents
- El-Gezira Project Administration finances farmers by supplying them with needed inputs of production: fertilizers, seeds, and soil enhancers.

Key words: Wheat value chain, actors, policy, Sudan

25. Very recent book by IFPRI on the value chain of wheat [25]

Reference: Resnick, Danielle. 2021. Political economy of wheat value chains in post-revolution Sudan. Sudan SSP Working Paper 1. Washington, DC: International Food Policy Research Institute (IFPRI). https://doi.org/10.2499/p15738coll2.134701

- This paper describes how Wheat flour and bread have played a central role in Sudan's political economy throughout the country's post-independence history
- Questions raised in this publication include: How has Sudan's recent political transition and economic circumstances impacted distortions within the wheat value chain? What are the policy preferences of relevant stakeholders for improving the affordability of wheat products and the productivity of domestic wheat farmers?
- This paper addresses these questions by drawing on key informant interviews in Sudan and utilizing a political settlements approach, which captures the underlying distribution of power among elites and citizens.
- The paper elucidates the preferences of different stakeholders to address policy distortions and discusses bottlenecks that need to be overcome for those options to be feasible.
- In doing so, the analysis reveals that, while the policy of subsidizing bread remains contentious, there are broader coalitions for interventions related to regulatory and monitoring reforms, improvements in domestic wheat procurement, enhanced agricultural investments, and targeted cash transfers to cushion subsidy reductions.

Key words: Wheat, Sudan, trade, bread, value chain, wheat flour

26. Subsidized imports good for urban poor, but suppress prices [26]

Reference: Dorosh, P.A., Distributional consequences of wheat policy in Sudan: A simulation model analysis. Strategy Support Program - Working Paper 02. Vol. 2. 2021, Washington DC: International Food Policy Research Institute (IFPRI).

- The paper argues that despite reforms in early 2021, including a devaluation of the currency and a liberalization of imports, there remain significant distortions in Sudan's wheat value chain, especially related to subsidized sales prices of flatbread indicating that this flatbread subsidy, a key component of wheat policy, is not well-targeted.
- The paper presents the results of several simulations of a partial equilibrium model of Sudan's wheat economy that are designed to analyze the impacts of recent shocks and various policy options.
- The model simulations show that increased wheat imports, such as those financed by food aid, add to supplies for processing into wheat flour, flatbread, and other wheat products, resulting in lower prices for consumers and increased consumption, but also disincentives for production.
- The paper further indicates that a 300,000 Tons increase in wheat imports, as occurred in early 2021, resulted in an 8 percent increase in wheat consumption and a 35 percent decline in the market price of non-flatbread wheat products. Production falls by 12 percent. Since flatbread prices are unchanged, wheat consumption of the urban poor, for whom flatbread is the major wheat product consumed, increases by only 4 percent.
- The paper further reveals that raising flatbread prices by 30 percent to reduce the size of the fiscal subsidy reduces total consumption of flatbread by 17 percent and sharply reduces wheat consumption and real incomes of the urban poor. All households suffer a loss of 41 to 45 percent in the value of flatbread subsidies received. The urban poor experience the largest decline in total consumption of wheat (14 percent) and in total income (11 percent). (The average total income loss for all households is only 3 percent.)
- The paper therefore argues that reducing the flatbread subsidy without a compensating income transfer would significantly reduce the welfare of the urban poor.
- The papers results suggest that a combination of key wheat policies involving high levels of imports – including injection of food aid wheat into the economy in late 2020 – and subsidized flatbread will significantly benefit urban poor households. Nonetheless, it indicates that there are important data gaps on several aspects of the wheat sector, including no recent nationally representative household expenditure survey data. In addition, greater transparency, including publication of quantities and prices of government purchases, sales of wheat and wheat flour, and quantities and prices of subsidized flatbread across the country has the potential to significantly increase the efficiency of the entire wheat sector.
- As shown in this paper, Sudan's wheat policies in recent years, such as increased wheat imports, price subsidies in the wheat value chain, and low prices of flatbread, have in general favored consumers, to the detriment of producers. These interventions in the wheat value chain, especially those related to subsidies on flatbread, have especially large effects on the welfare of urban households, making these policies particularly politically sensitive.

Key words: Wheat, policies, trade, subsidies, urban poor, Sudan

27. Improving the wheat value chain in Sudan with innovation platforms [27]

Reference: Opaluwah, A. (2019). *A quarterly publication of Technologies for African Agricultural Transformation (TAAT)* (TAAT news Issue. https://doi.org/10.21955/gatesopenres.1116820.1

- Within the framework of the TAAT program, the wheat compact established close collaboration with all concerned partners along the wheat value chain in Sudan to scale up proven wheat technologies with the objective of achieving a widespread and transformative impact.
- Key is to tackle the wheat crisis, Sudan's National Agricultural Research System, in collaboration with international Centre for Agricultural Research in Dry Areas (ICARDA) and International Maize and Wheat Improvement Centre (CIMMYT) developed and released a number of high yielding heat tolerant wheat varieties ((Imam, Goumria, Zakia, Elnielain and Bohaine….) with production potential of 5-8 t/ha.
- Innovation Platform sites are selected by the TAAT wheat team for scaling up and widely promoting the impact of proven wheat technologies to farmers and stakeholders along the value chain.
- During the 2018-19 season, a number of activities were implemented as the compact established 6 Innovation Platform (IP) sites, including the production and delivery of high quality seeds, scaling up and adoption of proven wheat technologies and capacity strengthening of different stakeholders along the wheat value chain.

Key words: Innovation platforms, wheat value chain, heat tolerant wheat varieties El-Gezira region, Sudan

4.2.2.4. Millet

28. Pearl millet value chain, Sudan, [28]

Reference: Abbas Elsir M Elamin, Fadelmola M Elnour, & Abdelhameed M Magboul. (2013). Enabling policy for pearl millet value chain and marketing. *Agricultural Research Corporation*, *3*(2), 1-42.

- The study conducted situation analysis to identify constraints that limit peal millet production and identify the major actors on pearl millet value chain and review policies, laws and seed regulations system that encourages or discourages marketing of pearl millet.
- Results showed that the amount of millet produced is locally consumed with no observed import however some quantities were exported during the period 2006-2009.
- Further, the document outlines urbanization and change in consumer income as main reasons responsible for the slight shift from millet to sorghum and wheat.
- Constraints that limit millet production and value addition and have implications on food security include low productivity, high post-harvest handling losses, limited processing and utilization, limited marketing, unfavorable policy, limited capacity building and institutional development; and limited knowledge and information exchange.
- Key is that millet is noted to comparatively having shorter marketing channels.
- The study suggested promotion of seed associations and creation of encouraging environment for the private sector in seed multiplication and distribution of improved seeds is needed to enhance the adoption process, develop market institution capable of making markets work better by improving market coordination and ensure availability of price information.

Key words: Pearl millet, value chain, actors, production, exports, North Kordofan

4.2.2.5. Potatoes

29. Potatoes in the River Nile[29]

Reference: Ahmed, E. A. (2021). Potatoes Value Chain Analysis and Development in River Nile State of Sudan. *Scientific Journal of Agricultural Sciences*, *3*(1), 158-176.

- total of 44 producers, 19 wholesalers, 35 retailers, 2 cold storages managers and 34 consumers were interviewed.
- The field survey in area of the study undertook four major districts along the State specializing in production of potatoes.
- The value chain analysis showed that, at the level of marketing, there are inadequate cold storages for preserving potatoes, poor extension services at different levels of the crop chain.

Key words: Potatoes, value chain, River Nile State, Sudan

30. Potential of potatoes in Sudan, CIP [30]

Reference: Simpson, H., Mikkola, J., & Parker, M. (2021). *Unleashing Potato's Potential in Sudan. A Scoping Mission Report* (9290606053).

- This scoping report maps partners relevant to potato development and provides an agro-ecological and socio-economic assessment of potential areas for developing potato sector considering differing profiles of value chains: rural, food security focused, urban, commercially driven.
- The scoping exercise shows great potential to uplift the potato sector to transform the various value chains, and ultimately contribute to development goals to improve livelihoods of Sudanese. Results reveal that:
  - Limited access to costly seed is the principal bottle to potato sector development, with the majority of certified seed being imported and sold at 1.37 to 1.87 USD/kg, whereas commercial seed in East African countries ranges from 0.5 to 0.6 USD/kg. As a result, market prices for potato for consumption are high, having been observed as much as 2.20 USD/kg in rural markets, prohibitive for rural households to afford as a food security crop.
  - High production costs affecting supply prevent potato from reaching its potential to provide income and economic development from household to regional levels, and contribute to food security at the national level.
  - Urbanization, change of dietary habits and removal of wheat import subsidizes continue to drive demand of potato in Sudan.
  - Sudan's potato value chain is characterized by lack of cold storage space which is up to standard. AfDB funds a potato value chain development project which is implemented by the Ministry of Agriculture and Forestry (MoAF) and the ARC and focuses on developing cold storage and seed production capacity
  - The scoping report will advise pathways to support potato to reach its potential through creating opportunities for diverse partners, including national and regional institutions, private sector, national NGOs, farmer organizations and microfinance institutions.

Key words: Potato, value chain, production costs, Sudan

4.2.2.6. *Soybean*

31. Soybean production, processing and consumption in Sudan [31]

Reference: OCHA. (2015). *Soybean, Soybean-based food products to help deal with Sudanese nutrition needs* https://reliefweb.int/report/sudan/soybean-based-food-products-help-deal-sudanese-nutrition-needs

- During an event organized in Sudan's capital, Khartoum, the United Nations Industrial Development Organization (UNIDO) commissioned soybean processing equipment to the Industrial Research and Consultancy Centre of Sudan and distributed different types of soybean-based products to people living in flood-stricken areas.
- The action was part of a project being implemented by UNIDO together with the Industry Ministry of Sudan.
- The project is helping introduce soybean-based food products and processing equipment into the country to help foster the national capacities along the entire value chain and help meet the nutrition needs of those living in flood-stricken areas, and of orphans and infants

- Currently, soybeans grown by farmers in the State of Gezira are being processed in a pilot soybean processing plant at the Industrial Research and Consultancy Centre in northern Khartoum.
- There article suggests a need for strong policy and investment for soybean in Sudan and soybean production, processing and utilization need to be considered in the national agricultural policy framework.

Key words: Soybean value chain, processing, UNIDO, Gezira state, Sudan

32. Soybean research in Sudan, [32]

Reference: Ibrahim, S. E. (2018, December). Soybean research in Sudan: current status, achievements, challenges and future prospects. In A Symposium to Mark the 100th Anniversary of the Gezira Research Station:"Agricultural Research in Sudan: Current Status, Achievements, Challenges and Future Prospects (pp. 25-26), At: Wad Medani, Sudan.

- The documents outline Soybean (Glycine max (L.) Merr.) as a new oilseed crop in Sudan. The start of commercial exploitation of soybean in Sudan is nearly four decades old. In this period, the crop has shown unparallel growth in area and production.
- Soybean is considered as irrigated and rainfed crop in Sudan. Four non-GM soybean varieties introduced from IITA were released for commercial production in Sudan under the names 'Sudan 1', 'Sudan 2', 'Soya 3', and 'Soya 4'.
- Sudan1 and Sudan 2, released in 2012, are late-maturing varieties (120 days), and Soya 3 and Soya 4, released in 2017, are early-maturing varieties (100 to 105 days). Soybean cultivation area and production has increased dramatically in Sudan, from about 800 ha in 2013 to 3,000 ha in 2017, and from 1,200 t in 2013 to 5,000 t in 2017, respectively.
- The expansion of soybean production in Sudan can be attributed to the growing demand as a high-protein ingredient in livestock feed, release of improved varieties, ease of production, low production costs, and high market demand. Soybean yield has been stagnant in Sudan for five years at about 1.5 t ha−1, lower than the world average, representing one of the most challenging issues in the soybean industry in Sudan.
- The low soybean yield in Sudan can be attributed to the poor crop management, and to the limited application of fertilizers and rhizobial inoculants in soils with no history of soybean production.
- Further improvements in the yield of soybean grain and quality of soybean oil are possible by use of new research methodologies and by exploitation of recent advances in biotechnologies.
- The author feels that scaling up of soybean production and utilization in Sudan can be further promoted through strengthening the entire soybean value chain and networking research scientists, policy makers, extension services, non-governmental organizations, and public and private breeders.

Key words: Soybean, varieties, value chain, Sudan

33. Soybean production – new varieties, [33]

Reference: Seifeldin E. Ibrahim, Amin E. Ahmed, & Seif F. Mohamed. (2012). *A proposal for the release of new soybean varieties for irrigated and rainfed farming in Sudan Agricultural Research Corporation (ARC), Wad*

Medani Oilseed Crops Research Center. Submitted to The National Variety Release Committee 14 May 2012. Agricultural Research Corporation (ARC), Wad Medani Oilseed Crops Research Center

- The presentation introduces the history of soybean in Sudan. Key is that since 2007 to present there has been great interest to introduce soybean as a commercial crop
- The presentation in addition lists Soybean utilizations and products including: human foods, livestock feeds, pharmaceutical products, Industrial products
- The paper highlights the factors for introducing Soybean in Sudan. Key is market factors whereby it indicates Demand for edible oil and high-protein feed (ii)Appropriate processing facilities (iii) A guaranteed market and price
- Soybean on-farm trial different sites and conclusions made depending on the yield, oil content, protein content in meal, suitability for irrigated areas in addition to its preference by private sectors and availability
- The presentation suggests that since there is no released soybean variety in Sudan, it is suggested that, the National Variety Release Committee (NVRC) to recommends the release of the five soybean varieties which are highlighted in the presentation

Key words: Soybean, market factors, Sudan

4.2.2.7. *Mixed Value Chain reports*

34. The Value Chain of Groundnut, Tomatoes, Hides and Skins, South and East Darfur and South Korofan States – Sudan [34]
Reference: Adam, I. A. (2021). *The Value Chain of Groundnut, Tomatoes, Hides and Skins in South and East Darfur and South Korofan States – Sudan*
    - The value chain study was conducted in the year 2016 for CARE International Foundation Switzerland-Sudan covering East and South Darfur and South Kordofan States targeting three commodities namely groundnut, skins and hides and tomatoes
    - Primary data was collected from government officials, NGOs, wholesalers, farmers, brokers, retailers and manufacturers and CARE staff and Secondary data from relevant sources of the study, secondary data and observations also used.
    - The study shows that unreliable seeds purchased from local traders and the segregation of the indigenous varieties deemed as principal reason for both low production and quality of groundnut and tomatoes. Moreover, haphazard use of insecticides, pesticides, weedicides and fertilizers application without scientific advice claimed to reduce the quality and spoiled the product
    - The report further indicate that raw hides and skins have very low price and in most cases monopolized by a sole wholesale trader which regarded as a product with non-economic value. The industry related to skins and hides is very poor, and the production is very small compared to the number of slaughtered livestock. The findings also included analysis to the skin market and its price trends. However, the study also gives suggestion on how improve the skin value chain
    - As far as groundnut production and harvesting are concerned, small farmers are using traditional implements for agricultural practices and harvesting. Local rural shelling machines have been introduced, although they create value addition, however, they are making big losses by mixing

pods with kernels and bringing kernel with the peanut shells afterwards results in a dark low oil quality and poor storage properties and consequently low selling price.

- The report describes of a big producing and processing oil company (Dafood) found in East Darfur (Al Deein) established in 2017. Key is that after shelling, four main value added commodities are produced. Pure kernels (Nagawa) exported to China, Jordon and other Arabian Countries, oil, seed cake and roasted groundnut processed afterwards to be used as children food supplements. A third line is under process for fodder making from cakes and groundnut by products.
- The report also describes the two big advanced ternaries in Nayala with a daily processing capacity amount to ten and three thousands of hides (sheep and goats) however revealing that they are not operating because of logistical and operational constrains. Moreover, the private sector in East Darfur (Al Daeein) has initiated and idea of constructing advanced tannery and a big area of land allocated by the government.
- Ground slaughter areas, slabs and tennaries produce large quantities of hazardous waste which pollute the environment.
- The study in addition elaborates on the four commodities; exploring their actual production and productivity, and then understanding the market, and studying the potential opportunities that can come out from the actual possibilities around the commodities value chain and their derived products as such it gives relevant and affordable guided recommendations for Care's intervention to map-out how the value chains could change to benefit the target groups
  - Key suggestions provided by the report include:
  - ✓ For the Groundnut value chain problems revolved around creating more economic benefits through more investment on people knowledge and Skills, connecting everybody with everybody in the chain, and facilitating access to better technologies
  - ✓ To improve the skin value chain, recommendation is focused on increasing the awareness of pastoralists and improving the butchers' skills to increase the skin productions and quality, attracting new leather production companies to shake the monopoly of the skin wholesalers and to give more opportunities for employment. It is also recommended to bring more actors as leather processors and organize them into associations to help them to explore new opportunities
  - ✓ Recommendations in tomato chain is focused to create new economic benefit from the value chain through more investment on farmers' capacity, facilitating of credit opportunities through VSL and other financial linkages, and attracting of new suppliers of small scale processing machines in order to create more local demand on the derived products

Key words: groundnut by-products, tomatoes, hides and skins, value chain, Darfur, South Kordofan

35. Groundnut and sesame value chains, West Kordofan and East Darfur [35]

Reference: Hudson, N. (2022). *Integrated enterprise and market systems assessment on the refugee and host community livelihoods in Sudan: groundnut and sesame value chains in West Kordofan and East Darfur*.

- The report details the findings of market assessments conducted on the groundnut and sesame value chains in East Darfur and West Kordofan. FDPs (forcibly displaced persons (including refugees and IDPs)) and HCs (host communities) were the central focus.
- This study applied the Inclusive Market Systems (AIMS) approach.

- The report provides a concrete analytical understanding of local market systems and the dynamics surrounding entrepreneurship, micro and small-scale enterprises (MSSE), cooperatives, access to finance and financial literacy in the targeted regions. The report further describes the production process, actors and market paths for groundnut and sesame value chain. Key findings are:
  - ✓ Linkages between market actors are often weak in the two target states, with a severe lack of access to market information.
  - ✓ The current and widespread production process in both value chains is labour intensive and centred around traditional practices associated with low productivity and low-quality outputs.
  - ✓ It is worth mentioning that most of the farming and value-adding activities involved in groundnut production are performed by women
  - ✓ There is no structured system for exchanging market information. Producers and merchants obtain information about prices based on their own contacts from surrounding markets. Mobile phone services (though poor) help buyers and sellers to get information about prices in nearby markets.
  - ✓ A near complete absence of formal financing services at the community level prevents (small-scale) farmers from accessing the resources to improve and expand their operations and commercial activity;
  - ✓ There is large potential of establishing and supporting cooperatives and collective production models. Formalizing and facilitating relationships between cooperatives and traders and processors is deemed to help increase the availability and flow of market information.
  - ✓ The report suggests that push-pull approach could offer an opportunity to tackle the constraints of both supply and demand sides, developing the market systems to expand and diversify the market opportunities available, and enhancing the target groups' ability to engage with the market and seize these new and improved opportunities.

Key words: Groundnut and sesame value chains, market information, AIMS methodology, women, West Kordofan and East Darfur

36. Sesame, groundnut, and sorghum [36]

Reference: IFAD. (2017). *Republic of the Sudan: Integrated Agricultural and Marketing Development Project (IAMDP)* ("Near East North Africa and Europe Division Programme Management Department", Trans.) [Final project design report]. The International Fund for Agricultural Development. https://webapps.ifad.org/members/eb/122/docs/EB-2017-122-R-24-Project-Design-Report.pdf

- IFAD conducted a value chain study on the three most important crops for the traditional rainfed small-scale farming in Sudan: sesame, groundnut, and sorghum (March 2017). IAMDP project will be implemented in the four states of Sinnar, North Kordofan, South Kordofan, and West Kordofan. Key component of the IAMDP project is: Market linkage and value addition. Three main activities will be supported: (i) physical market access (wadi crossings); (ii) storage facilities development; and (iii) market linkages and value addition (village processing).
- The findings reveal that Sorghum is a major source of household food security, but for households with surpluses it is also an important cash crop.
- In addition, Millet is an important food security crop in North and West Kordofan, but as per SDP experience, farmers to date do not wish to adopt improved technologies. They see Millet as a hardy crop that will always provide enough grain for food security and they prefer to invest their scarce resources on cash crop or Sorghum.

- In relation to the technical Knowledge, the smallholder farmers have little technical knowledge about improved or proper land preparation, seeds, inputs, planting, weeding, harvesting, and storage. They lack the business skills to make sound decisions about inputs, services, finance, and marketing, directly or through their associations
- Key is the adoption of Gender Action Learning System (GALS). The GALS aims at increasing awareness of gender roles in the households and communities by improving their capacity to negotiate their needs and interests and find innovative, gender-equitable solutions in livelihoods planning and value chain development.
- The value chain opportunities has been detailed in relation to Shelling (groundnuts), grading; aflatoxin-free (groundnuts); oil production (sesame and groundnuts); Flour production (Sorghum); International certification (Crops and gum Arabic)
- The study reveals three key enabling environment factors required for successful smallholder value chain integration which include: finance, strong farmer associations, and business skills
- Key is that larger commercial oil refineries have indicated a possible interest in the purchase of unrefined oil from village processors, if minimum quantities can be aggregated and if the price is competitive. The seedcake by-product produced is a valuable livestock feed for local animal fattening operations, and surpluses also would find a ready market from large-scale livestock operations, which could make arrangements for bulk collection. Larger exporters and processors have expressed interest in purchasing shelled groundnuts at the village level (the normal practice is to buy in-shell groundnuts because of concerns over damage caused by low quality shellers and poor storage practices).
- The study also identified that there is ongoing interest from seed companies to purchase certified seed from smallholder groups in the SDP project areas, which is close to being on a sustainable basis. IAMDP will support additional FPAs that wish to produce certified seed under contract to private seed companies, and for local sale, and to expand the scope of to Sinnar and West Kordofan (where at least one seed company is interested in sourcing certified groundnut seed).
- The three main conclusions provided in these studies: (i) the high comparative advantage of rainfed areas in Sinnar, North, South and West Kordofan in the production of the three field crops and gum Arabic agroforestry; (ii) the existence of a well-established national and international markets with increasing demand for the crops; and (iii) the importance of these crops for the livelihoods and resilience of the smallholder rainfed farmers, rural women and youth in the project area. Sesame, groundnuts and gum Arabic are the main sources of income as cash crops.
- Building on achievements and lessons learned from implementation of SUSTAIN, SDP and WSRMP, the rationale for IAMDP is based on four main lessons learned, key are:

✓ adoption of improved agricultural practices is linked to exposure though demonstrations led by extension teams, but much more needs to be done on building the supply chain down to the small-scale farmers and on the private sector provision of extension services wherever possible to complement the public sector;

✓ initial adoption with limited scaling-up is mainly by large farmers (who have the financial means and ready access to required services) or by smaller farmers who access to financial and technical services;

✓ focus was more on productivity enhancement and production increase with less emphasis on post-harvest processing and marketing; and

✓ rural finance is a key to enable farmers to invest in agricultural production.

Key words: sesame, groundnut, and sorghum value chain, gender, opportunities, IFAD, North, South and West Kordofan

37. Groundnuts, Sesame, Potato, and Gum Arabic, North Kordofan, West Kordofan, and Khartoum [37]

Reference: AfDB. (2018). *Sudan Agricultural Value Chain Development Project (AVCDP)*. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Boards-Documents/Approval-_Sudan-Agricultural_Value_Chain_Development_Project__AVCDP_.pdf

- The overall goal of the Agricultural Value Chain Development Project (AVCDP) is to contribute to the attainment of Sudan's National Agriculture Investment Plan (SNAIP) goals in achieving a comprehensive national socio-economic development driven by a dynamic agricultural sector.
- Focus is on edible oil seeds (Groundnuts, and Sesame), Potato and Gum Arabic value chains.
- The project will be implemented in three states, namely, North Kordofan, West Kordofan, and Khartoum and will focus on four commodity value chains: Groundnuts, Sesame, Potato, and Gum Arabic.
- The Formulation of this project drew lessons learnt from ongoing agriculture projects and other similar Bank operations on the continent.
- Key lesson is that Interventions intended for increased crop production and productivity should be complemented with enhanced postharvest storage, processing and market access.

Key words: Groundnuts, Sesame, Potato, and Gum Arabic, value chain, North Kordofan, West Kordofan, and Khartoum

38. Sorghum, groundnut and the hides and skins, South Sudan experience, [38]
Reference: UNIDO. (2022). *Enhanced Local Value Addition and Strengthened Value Chains. Independent Evaluation Unit Office of Evaluation and Internal Oversight Independent. Terminal Evaluation. Republic of South Sudan.* (UNIDO project ID: 140320). UNIDO.
    - The evaluation aims to support the assessment of results and lesson learning from Enhanced Local Value Addition and Strengthening Value Chains Project in South Sudan, with relevant recommendations for key stakeholders.
    - The initial project document foresees 4 main results covering i) knowledge on value addition commodities, ii) access to technology, iii) capacities of operators and iv) establishment of 4 agro processing centers. Key findings of the evaluation include:
    - The project established functional service provision in Kangi and Ayien, supporting some 7,600 households in food processing; The project addressed relevant needs of local households, farmers, and livestock owners, particularly through its support to the processing of sorghum, groundnut and the hides and skins value chains, the setup of APCs, and the improvement of 2 slaughterhouses. Grain storage facilities were provided to 934 beneficiaries. Slaughtering facilities in Wau and Ayien were improved, with benefits related to the hygiene of butchered meat
    - APCs neither managed to establish sustainable agribusinesses nor to expand private sector businesses, enhance value chains or deliver significant benefits to farmers. Constraining the effectiveness of the APC approach have been i) the structural weaknesses of local private sector, ii) the lack of attention to private sector needs, iii) the adoption of a Public Private Partnership approach when conditions were not in place. Contextual challenges are further discussed in the main report.
    - The project's logic and theory of change were simplistic, based on naïve assumptions and an inadequate result chain.
    - Project design considered local entrepreneurs as "competitors" and the project did not manage to strengthen value chains through entrepreneurship development. PPP at local level did not work due to the absence of capacities and conditions to set a viable partnership.

- Only a small fraction of the population had a marketable surplus of staple' production. The large majority of beneficiaries were subsistence farmers, struggling to provide food for their households. Only to a minor extent did the project respond to the priorities of local business and value chain operators, unable to meet demands for a more favourable enabling environment for micro enterprises development and an inclusive access to micro finance.
- Design was never fully readjusted to take into account the changed context, insecurity and conflict. Reasons underlying the absence of a full overhaul of the design include the very limited viable options to promote business development, the rigidity of administrative mechanisms, the volatile and fluid context and, at a later stage, the development of COVID 19 pandemic.

➢ By the end of the project, early changes include: a more committed behaviour of APC's private sector operators; the hides and skins value chain appears to be genuinely private sector driven, with some likelihood of sustainability. The project results further manifested sustainability gaps by the end of the intervention which are documented in the report. Key lessons learnt are:
➢ It is risky to build projects on unfounded assumptions and unquestioned paradigms.
➢ Small projects in difficult contexts need agile and flexible implementation mechanisms
➢ Importance, in a fragile development context as South Sudan, of sound conflict sensitivity analysis and political economy analysis to support interventions.

Good practice highlighted in the document include:

➢ Developing "project sponsored service provision centres", as an approach to help communities to bridge the transition between emergency, recovery and development.
➢ Supporting grain storage and post-harvest losses

Key recommendations provided by the document include:

➢ Private sector approach needs to be informed by entrepreneurship capacities (or lack thereof) and be driven by a full involvement and ownership of private sector. The business (enabling) environment needs to be studied and supported; entrepreneurship should be at the hearth of business development.
➢ APC and PPP approach: In case an APC approach is pursued in future programming, the following measures should be adopted: sustainability should be based on entrepreneurship; conditions to set up PPP need to be very carefully assessed. When such conditions do not exist (as in the case of APC and slaughterhouses) such partnerships should not be pursued; business plans need to be based on due diligence and aligned to private sector best practices
➢ Management mechanisms: New mechanisms should be developed by UNIDO to strengthen its management effectiveness in challenging local context. Options may include subcontracting to NGOs present on the ground.
➢ Business support should be part of a strategy to leverage women and youth empowerment.

Key words: Sorghum, groundnut and the hides and skins value chains, APC Approach, Greater Bahr elGhazal Region, South Sudan

39. Sesame, livestock, dairy, horticulture, Gum Arabic, World Bank Study, recent, [39]
Reference: World Bank. (2020). *Sudan Agriculture Value Chain Analysis*
https://documents.worldbank.org/en/publication/documents-reports/documentdetail/731741593616746051/sudan-agriculture-value-chain-analysis

- The purpose of this study is to provide a road map to develop and promote agriculture and livestock sectors as an important part of the government's priority of addressing the economic crises and establishing the bases of sustainable development.
- Chapter 5 (Assessment of prioritized value chains) lays out a convincing case that opportunities for growth are available in the five key value chains covered by this report (Sesame, livestock, dairy, horticulture, Gum Arabic).

- Results reveal that hurdles to growth are present as well, which leave the value chains characterized by low crop and animal productivity and supply chains plagued by poor information flows, high transaction costs, and inadequate investments in storage and transport that reduce the quality, safety, and value of commodities as they move from farm to domestic consumers and export markets.
- Constraints at the macro and sector levels make resolving subsector constraints along the five value chains more difficult; however, the prospect of lifted sanctions, a reduction in conflict, and WTO membership will create new opportunities for the five subsectors as well.
- Largely, problems along the value chains stem from an underinvestment in public services, missing private investments, and the inherent difficulties of including dispersed smallholder producers in efficient supply chains.
- Building adequate capacity in agricultural research and the tools needed to manage plant and animal health services will take time, although there may be opportunities to enlist the private sector, too.
- Digital technologies can certainly help improve the dissemination of information about market conditions and production technologies.
- Potentially, market incentives to establish and meet private quality and food safety standards can supplement the country's current limited ability to enforce SPS standards.
- Fully incorporating smallholder producers will remain a challenge. Working with existing producer associations and supporting the formation of new ones can help.
- Innovative digital technologies, which link farmers to input providers and buyers, show promise as ways to overcome well-known hurdles to productivity and better-integrated and more efficient supply chains. The report notes that government and donors should consider finding ways to support similar innovation efforts in Sudan.

Key words: Sesame, livestock, dairy, horticulture, Gum Arabic value chain, roadmap, Khartoum, Sudan

4.2.2.8. Vegetables and Horticulture

40. Tomato markets, Sudan[40]

Reference: Eltahir, N. F., Mohamed, H. H. A., & Suliman, S. E. (2023). Market Integration Analysis of Tomato Markets in Sudan. *The International Journal of Science & Technoledge, 11*(1).

- *Tomato in Sudan is characterized by seasonality and perishability, which causes instability in market supplies and prices in Khartoum State and other markets of Sudan.*
- *This study aimed to estimate market integration in Khartoum State, Sudan. The study depended mainly on secondary data obtained from relevant sources.*
- *The results of the time series analysis indicated that the prices of tomatoes were stable and variable throughout the year, reflecting a seasonal pattern.*
- *The results of the co-integration analysis indicated the strong integration among the different tomato markets in Sudan, with Khartoum and Port Sudan having 85% and Khartoum and Zalingei markets having a 67% level of co-integration.*

- *The study concluded that despite the poorly organized marketing system, the tomato market channel is well-integrated as prices tend to move up and down together in all markets of Sudan.*

Key words: Tomatoes, Khartoum state, market integration, markets

41. Value chain analysis for tomatoes in Khartoum State [41]

Reference: Hanadi, E., Mohammed, I., & Salih, E. (2018). Value Chain Analysis for Tomato Production and Marketing in Khartoum State, Sudan *Current Investigations in Agriculture and Current Research 5*(4), 651-657 https://doi.org/DOI: 10.32474/CIACR. 2018.05. 000219. 651

- The study considered a value chain analysis of tomato production and its related activities conducted in Khartoum state to perform financial analysis for the whole chain to assess the value added and profit margin distribution among the different actors. The main objective was to look at the costs, returns and profit distributed along the chain by each actor.
- The primary data for the study was collected through structured questionnaires for 365 respondents which included farmers (100), Intermediate (25), wholesalers (60), retailers (90) and consumers (90). The secondary data were collected from the Federal Ministry of Agriculture and Forests and Ministry of Agriculture and Animal Wealth, Khartoum State. Results shows that:

✓ The degree of value addition was 53% at primary processor in stage of farmer, 21.7% added in stage of middlemen, wholesalers added 10.2% and retailers added 15.1%. The highest percentage of total profit was get by retailer (52.1), while the farmer got the lowest one (8.8), however, the middleman and wholesaler extremely got equal percentages of total profits (19.2) and (19.9), respectively.

✓ Middlemen play a significant role in facilitating tomato sales and in distributing tomatoes to different traders, they also play a significant part in creating an efficient pricing system in the market through signaling critical information to other market participants

✓ The study suggested that the decision makers should take up initiatives for strengthening of the tomato value chain by establishing processing units in the production belts as well as improving credit services can enhance income generated from tomato marketing through increasing production and reducing dependence on middlemen.

Key words: Marketing, production, share profit, tomato value chain, value added, Khartoum

42. Production and marketing of vegetable crops, marketing, [42]

Reference: Babiker, M. H. O., & Frahna, H. M. (2017). Production and marketing of vegetables crops in Khartoum State, Sudan. *Int J Agric Innov Res*, *6*(2), 320-324.

- Khartoum State ranks top among other states in Sudan regarding to production and consumption of vegetables that relates to the higher increase in population growth, income level and nutritional awareness.
- This paper's aim is to develop a detailed description of socio economic characteristics, farming system, production and marketing of vegetables' crop in Khartoum State. It also aims to assess the problems and obstacles which face the vegetables farmers.

- Findings reveal that farmers use both local and improved seeds varieties to grow vegetable crops. The use of seeds depends on the type of the crop; for example, imported improved seeds are a must to use when growing crops like potatoes due to the unavailability of technology to produce them locally while local or imported seeds can be used to grow the onion crop. Key is that the quality of imported seed potato have declined, because the commercial companies and individual importers focus on high profits and ignore the quality of seed potato and consequences on potato production and famers loses.
- The study further revealed that poor infrastructure for storage, transportation and marketing of vegetables contributed to losses to the farmers. Smallholder farmers generally focused on production activities and showed relatively little interest in post-harvest and marketing activities
- The increased production cost of some crops leads to increasing vegetables prices when they are offered in the market so that the price could be rewarding compared to production cost. Nevertheless, this affects the demand on these crops negatively.
- Further, results show that vegetables' farmers not having appropriate places for displaying and selling the crops in big and central markets, especially with the considerable number of merchants who display their vegetables in seasons which might lead to decreasing vegetables prices because of the increasing supply. The high taxes and commissions of the market. This makes vegetables prices increase which, in return, leads to prices instability.

Keywords – Production, Marketing, Vegetable, seed, Khartoum, Sudan.

43. Impact of policies on fruit and vegetable sectors In Sudan, 2003 -2009, [43]

Reference: Elsayed E.E.M. Alnagarabi, & Sazal Ahmed. (2015). Impact analysis of the government policies on fruit and vegetable sector in Sudan in 2003 and 2009. *Arab Universities Journal of Agricultural Sciences*, *23*(1), 167-177. https://doi.org/10.21608/ajs.2015.14568

- The main objective of this paper was to analyze the impact of government policies on fruit and vegetable sector in 2003 and 2009 in terms of profitability, protection, efficiency, competitiveness and comparative advantages in Sudan.
- The study depended on secondary data and information collected from relevant sources and references.
- The analysis indicated that the adopted policies had a negative impact on the production of vegetables and fruit crops in seasons 2003 and 2009 and the horticultural production and producers had subjected to taxes.
- The study results show that fruit and vegetable sector was taxed for outputs and subsidized for inputs, the net effect of outputs taxation and inputs subsidies resulted in a net taxation on value added at varying degrees.
- Consequently, the paper feels that still there is a room for much improvement through an intensification of the production if the discouraged adopted polices (output taxes), that hinder the producers to utilise their resources fully is revised and reevaluated.
- The study suggested further vertical and horizontal expansion of fruits and vegetables, strengthening production infrastructures, and government should enact efficient policies that correct the distorting tradable - outputs policy.

Keywords: Government; Policies; fruits and vegetables, Sudan

4.2.3. Livestock and mixed

4.2.3.1. Livestock and livestock products

44. The dairy sector, Sudan, [44]

Reference: The Friesian. (2016). *Dairy quick scan Sudan*.

- The goal of this quick scan was to have insight in the specific constraints and requirement for the development of the Sudanese dairy sector as well as to make an overview of possible business opportunities for Dutch companies that will contribute to the development of the Sudanese dairy sector and for bi-lateral B2B activities.
- The quick scan includes: (i) A general overview of important stakeholders in the dairy sector (i.e. the large and smaller dairy companies, cooperatives and dairy farmers). (ii) Insight in the main constraints, challenges and needs of the dairy sector and dairy farmers. (iii) Overview of Dutch expertise and equipment that could meet the demand and that could contribute to the development of the dairy sector. (iv) Identification of possible Sudanese and Dutch partner(s) for further (B2B) cooperation (including public and financing organisation). (v) Overviews of actions to be taken in order to develop the dairy sector and to further generate B2B activities.
- Key findings on dairy marketing and processing include:
    - 98% of the produced milk is sold loose; The processing sector processes only 2% of the fresh milk, mostly procured from their own modern dairy farms; CAPO Dairy is the most prominent dairy processor; Supermarkets offer a wide variety of fresh and long shelf life dairy products; A substantial part of dairy products is imported or partial made of imported dairy products; Prices of dairy products are high compared with the EU prices, even prices of loose milk are comparable with high quality long shelf life fresh milk in The Netherlands
    - Along the value chain the cooling chain is completely missing, so if farmers want to sell milk to far away cities, they have to expand the shelf life by turning it into cheese.
    - In Sudan there are big companies, local and foreign owned, private and government owned or mixed, who are interested in dairy development. Currently they import milk or purchase milk from their own farms. These companies have international contacts and are relatively easy to approach for business. The efforts on the Arabic Peninsula to safe water and therefore to reduce forage production will give a boost to the dairy sector in Sudan
    - In Kassala and Gadaref region many large scale (20 head and more) commercial oriented dairy farms are present all eager to improve their performance in terms of milk volume, herd size and financial viability.

Key words: Milk value chain, Sudan, Dutch companies, market, processing

45. Livestock trade disruptions, Sudan,[45]

Reference: Alex Humphrey, Carmen Jaquez, Simon Levine, & Chloe Stull-Lane, H. S., Steve Wiggins,. (2021). *Impacts of Disruptions to Livestock Marketing in Sudan* [Technical Report].

- This report documents what was discovered for Sudan, a country that in recent years has been sending 4–5 million live sheep across the Red Sea to Jeddah. This trade has been disrupted in the past, most notably by bans on exports when Rift Valley Fever has broken out in Sudan's herds, including a long ban of almost one year in 2007– 2008. Key findings are:
    - Exports of live sheep from Sudan, very largely to Saudi Arabia, is a growing business, worth more than US$400 million in recent years.

- The trade is made possible by an effective and relatively efficient marketing chain that links herders across Sudan to the Red Sea ports.
- Marketing chains have been improved since 2000, incrementally over time.
- The chain is often heavily disrupted, especially when animal disease breaks out. The 2007 outbreak of Rift Valley Fever in Sudan led to almost a one year ban on exports to Saudi Arabia.
- For traders and herders there was little protection from that ban: traders took heavy losses, many went out of business. Herders saw demand collapse and prices plummet for their sheep.
- The chain is, however, resilient. Once bans are lifted not only has the trade recovered, but it has grown quite rapidly.
- Policy implications include strengthening veterinary efforts to prevent and control animal disease; and considering some form of insurance or mutual fund to assist herders and traders when disruptions occur.

Key words: Sheep, trade, marketing and exporting, Sudan

46. Sudan Livestock Feasibility Study, [46]

Reference: USAID. (2022). *Sudan Livestock Feasibility Study - Desk Research Findings & Initial Recommendations*. https://pdf.usaid.gov/pdf_docs/PA00ZDT7.pdf

- The main objective of the Private Sector Landscape Assessment (PSLA) was to gain an increased understanding of the private sector landscape in Sudan, as well as private sector perspectives on challenges and opportunities relevant to USAID/BHA's objectives in Sudan.
- Most of the conglomerates the PSLA team interviewed and surveyed base their core growth strategy on agriculture. For example, they are expanding farming capacities, diversifying their crops, scaling up domestic supply and distribution, developing value-added capabilities (e.g., light manufacturing of agricultural products), and looking to export to new markets
- This document reveals how contract farming model has helped to better connect the conglomerates with small-scale farmers and enhanced resilience and sustainable livelihoods. Furthermore, this has also enhanced the geographic reach of conglomerates to areas where more vulnerable populations reside and where humanitarian assistance is ongoing.
- Although most of these projects are currently based in Khartoum, companies are exploring different supply models such as contract farming in Khartoum, Kordofan, Darfur, and the Jazeera states.
- Sourcing cattle from western Sudan offers a greater opportunity as they can travel far distances, whereas poultry is more sensitive to distance so sourcing must be close to slaughterhouse.
- The representative from SAY Group mentioned that the company was looking into expanding their products from seeds and groundnuts to livestock, and that the company would employ the same contract farming model as it does for its existing product line. Despite the conglomerates' value chain thinking, the hyde and leather sectors are not considered in the portfolio yet.
- The PSLA highlighted several areas where USAID/BHA could plug into the private sector for shared-value partnerships that advance the business goals of companies while also supporting USAID/BHA prioritized development objectives.
- Key opportunities include: (i) Expand the market push towards the cattle and poultry value chains by encouraging conglomerates to apply the contract farming model to livestock and source directly from rural and vulnerable producers and pastoralists (e.g., in Kordofan and Darfur) with potential replication in other areas like Gadarif and Sinnar States, (ii) Explore the

hyde and leather value chains, which offer significant employment opportunities for both refugees and host communities. (iii) Ideally consider support through ecosystem-focused partnerships that also address market strengthening, finance, training, etc

- At the end, the report provides key recommendations and next steps. Key are:
  - ✓ While goat is important for household livelihoods in many communities in the targeted regions, the main focus of the private sector seems to be on cattle and sheep for national consumption, value addition, and for export
  - ✓ Improve linkages with large scale businesses and strengthen traders/aggregators
  - ✓ Leverage the RISING II project experience for multi-stakeholder initiatives. As we learned through our desk research and interviews with the public sector, there have been few engagements between the public sector and NGOs with the private sector

Key words: contract farming model, Private Sector Landscape Assessment, value chain, opportunities

47. Livestock value chain, [47]

Reference: Paul Guthiga, Joseph Karugia, Stella Massawe, Maurice Ogada, Lydiah Mugweru, Silas Ongudi, Michele Mbo'o-Tchouawou, & Leonard Mulei. (2017). *Mapping livestock value chains in the IGAD region*. CTA.

- The study was expected to provide CTA with recommendations on the types of value chains to be supported and information on particular nodes that CTA could be involved in.
- The study used a desk research approach and key informant interviews (KIIs) with selected livestock value-chain experts in the region. The desk research involved an extensive review of information and existing literature on livestock value-chain initiatives in the IGAD region
- The selected value chains include: the dairy value chains in Ethiopia, Kenya and Sudan; beef value chains in Ethiopia, Kenya, Sudan and Uganda; small ruminant value chains in Ethiopia, Kenya and Somalia; poultry value chains in Ethiopia, Kenya, Sudan and Uganda; and apiculture in Ethiopia, Kenya and Uganda. Data for Sudan actually is for the former unified Sudan
- Sudan is ranked sixth in the world with 41.9 million heads of cattle producing 5.4 million litres annually. Cattle growth rate is estimated at 5.6% per annum. Local demand for milk is met largely through imports estimated at 43,000 t of powder and fresh milk valued at US$212 million. Total production of beef and beef products in 2013 was 358,000 t. The main export markets for Sudan's meat are Jordan and Egypt. Export abattoirs in Somalia, Sudan and Ethiopia are small and mainly process goat and sheep carcasses. Annex Table 3e describes Livestock initiatives in Sudan
- The study also found that majority of interventions do not explicitly address gender imbalances and inequities in livestock value chains. Thus, significant efforts are still required to promote gender responsiveness of livestock value-chain initiatives. projections suggest that the sector has the potential to provide increased employment opportunities for the youthful population
- The study makes the following suggestions:
  - ✓ It is notable that there is very little coordination between different initiatives. This is a serious gap that often leads to duplication of efforts and loss of opportunity to create synergistic relationships
  - ✓ There is need to improve coordination among development partners to ensure less duplication of efforts and more synergies among them. This can be done by creating awareness among key stakeholders.

- ✓ A lot of efforts are still required to promote gender responsiveness of livestock value-chain initiatives. Very clear metrics of gender responsiveness should be incorporated into livestock value-chain projects.
- ✓ A lot of interventions in pastoral areas have an emergency perspective; they are implemented during emergency or post-emergency. While this is important, it is important to have long-term approaches that increase the resilience of communities in a sustainable way
- ✓ In order for the livestock value chains to fully develop, there is need to address the overarching policy and regulatory constraints that hinder their growth. Although there are many efforts being undertaken, further policy interventions are needed to address the issue of production and productivity, particularly in the pastoral and agropastoral systems

Key words: livestock value chains, exports, IGAD region, Sudan,

48. Livestock value chain potential, Sudan [48]

Reference: Mamo, Y. S. (2019). *Livestock Trade in COMESA: Assessment of Livestock Market and Mapping of Enterprises in Exporting and Importing Countries to Establish Basic Data on Import and Export of Live Animal (Beef Cattle and Small Ruminants) and Meat.* . COMESA.

- This publication provides information on the potential of livestock marketing in selected member states of COMESA. It provides information on the volume of trade, major challenges, opportunities and policy options for improvement
- The document shows that Sudan is the second largest livestock rich country in Africa, with about 31 million cattle, 41 million sheep, 32 million goats and 4.9 million camels. Thus, the country has high potential for trade in live animal, meat and meat products.
- Additionally, the animal industry has strong government support and enjoys fairly strong trade orientation dating back to colonial and pre-colonial times.
- Rising demand in animal products locally and internationally and increasing awareness and demand for grass-fed animals and animal products combine to create a high and increasing demand for Sudanese livestock.
- In regard to exports, the report shows that the country exports live animals (cattle, sheep, goats and camels) to some COMESA member countries such as Egypt and Libya, has in formal cross-border trade with others such as Ethiopia and Eritrea.
- Sudan's main livestock (live animals) market is the Middle East, with Saudi Arabia leading in numbers sheep, goats, cattle and camels respectively. Other ME countries importing animals from Sudan are UAE, Qatar, Jordan, Bahrain, Lebanon and Oman
- The report further indicates that Sudan has established a national trade point which provides all round (export and local) market information to the business community, specially the SMEs using e-commerce tools and platforms, as well as advisory services to the government on the export market. Information provided includes prices, demand, requirements of the various markets
- The country has both formal and informal live animal trading systems in place. While a significant proportion of cross-border trade with neighboring countries is informal, all the export trade is formal and runs through a well-designed quarantine system.

- Further, the document outlines measures put by the government of Sudan to control informal cross-border trade including increasing the number of border points with its neighbors and developing bilateral agreements to control cross-border animal movements.
- The country is also experiencing increased private sector investment in modern abattoirs and feedlots that will enhance its ability to reach markets with new value-added products in the short term.
- The live animal, meat and meat products trade faces a number of significant challenges in Sudan. They include poor access to market information due to absence of a systematic information system, and information asymmetry among stakeholders, poor marketing and communication infrastructure, lack of a credible identification and traceability system, and lack of linkages with markets with another COMESA member states

Key words: Livestock value chain, markets, opportunities, Challenges, Sudan

49. Community-based breeding of indigenous breeds in Ethiopia [49]

Reference ICARDA. (2020). *Resilient Crop-Livestock Systems*. https://annual-report-2020.icarda.org/livestock-in-details/

- ICARDA's Community-Based Breeding Programs (CBBP) supported by the CGIAR Research Program on Livestock (CRP Livestock), International Livestock Research Institute (ILRI), the World Bank, and the International Fund for Agricultural Development (IFAD), continued in 2020 to increase the productivity and profitability of indigenous breeds across Ethiopia. CBBP were established through community flocks to enlarge the genepool and identify prime rams and ewes for selective breeding.
- In 2020, the program expanded to 3 major regions of Ethiopia (Amhara, Oromia, and South) with a total of more than 60 legal breeders' cooperatives now leading day-to-day operations. An upscaling operation, undertaken with financial support from the United States Department of Agriculture (USDA) in Konso, Ethiopia, involved more than 2,000 households, the purchasing and dissemination of 479 goat bucks from existing Community-Based Breeding Programs (CBBPs), and mass synchronization and artificial insemination to disseminate improved genetics.
- Farmers were also linked with one of the biggest export slaughterhouses in Ethiopia (Allana), and the purchase of 100 goats was facilitated, which were slaughtered and exported to Dubai. Results on meat quality and consumer evaluations were very positive. The program is now being replicated in Burkina Faso, Iran, Liberia, Malawi, South Africa, **Sudan**, Tanzania, and Uganda.

Key words: Livestock value chain, Community-Based Breeding Programs (CBBP), Ethiopia, replicated, Sudan

4.2.3.2. Mixed Livestock-crops value chains

50. Mixed value chains (including cheese, sorghum, …) [50]

Reference: Irma Specht, & Abdelrahman El-Mahdi. (2021). *Evaluation Report Final Evaluation of Community Security and Stabilization Programme (C2sP) 2015-2020* [Evaluation Report](For United Nations Development Programme.

- The evaluation was conducted from December 2020 to March 2021. The geographical coverage of primary data collection included Blue Nile, West Kordofan, North Kordofan, White Nile and Sennar States, with some additional data from Khartoum
- The evaluation revealed that fisheries value chain in White Nile, grains milling and cheese making projects implemented in Blue Nile State targeted mainly women to enable them to participate fully in the local economy and peace-building efforts. C2SP interventions participated in agricultural extension for a number of women. This is from obtaining very good production, and selling the produce in the local market, which has a great impact in improving their living conditions
- There is some evidence from the evaluation that program activities resulted in empowering women, including through fostering a value chain. A case of an animal farm targeting the women headed households and men in vulnerable positions is described with the women managing to accumulate capital from such business and utilize part of this capital in launching new agriculture projects.
- The agriculture managed to secure two sorghum sacks per household of the farm's members for selling. The animal farm managed to bring those women together to implement their business plan. Training was also provided to 60 trainees (10 men and 50 women) beneficiary of animal fattening which was provided by General Directorate of Animal Resource.
- The challenge however was that in some locations the tractors, which were procured by C2SP, were not the popular brand that was common in the market (Massey Ferguson, TAFE or New Holland) and consequently these would be difficult to repair or find parts for.
- In terms of involvement of the Sudanese private sector, C2SP created some highly innovative and promising partnerships. However, the team only found evidence of this in few locations, and mostly the private sector partners directly with the Community Management Committees (CMCs)
- In terms of maximizing efficiency, the evaluation suggests focus on economic reintegration and local economic development on selected value chains with high economic and peacebuilding potential and create catalytic effects through this.
- The key strength, as confirmed by many key informants, is the community-based approach of C2SP, which is responsive to the local context and in sync with the government's priorities and development objectives, more specifically the focus on boosting agricultural productivity.
- In terms of markets, the rapid changes of market trends are also named as a challenge
- Key lessons highlighted from the evaluation include:
  - Invest in real economic opportunity mapping and choose, with CMCs, local government and the local private sector, two value chains per location with highest potential, and link all livelihood and infrastructure investments to these
  - Expand geographical scope and ensure neighboring communities are targeted to facilitate exchange, cross community value chain development and joint lobby and advocacy
  - Co-investments by the private sector, the government and other agencies will increase the scale and impact of interventions.
  - Additional government partnerships, e.g. ministry of commerce, chambers of commerce and other economic bodies would be helpful in this, especially at State level.
  - Additionally, linking projects to local government structures will further assure greater impact and chances of sustainability than standalone projects.
  - Involve the private sector more systematically from the beginning

- C2SP IPs were found to need training on gender and social inclusion, especially when operating in communities where more conservative gender and age norms are strongly embedded and fuelled by cultural and religious contexts. More innovation is required and C2SP would benefit from a specific gender and social inclusion strategy – with a strong anthropological tone.
- The evaluation found that the (maximum) one-year timeline is inadequate. Some ventures, and value chain development takes longer to lead to sustainable results, and requires significant support for a longer period of time.

Key words: Cheese making, grinding mills, value chain development, 6 states in Sudan

51. Sudan's Country Strategic Opportunities Programme (COSOP) [51]

Reference: IFAD. (2020). *Republic of Sudan COSOP completion review 2013-2020*. https://webapps.ifad.org/members/eb/132/docs/EB-2021-132-R-21-Republic-of-Sudan-COSOP-completion-review-2013-2020.pdf?attach=1

- The present COSOP completion review was prepared by the mission under special restrictive circumstances imposed by Covid-19 pandemic. The mission was not able to undertake field travel and in-country consultations of the international mission members. The mission team worked remotely with local consultants based in Khartoum and organized virtual meetings to coordinate with the local government bodies and other stakeholders.
- The review revealed that within the rainfed sub-sector eco-system, there are at least three high-potential agricultural value chains: gum Arabic, sesame seeds, and livestock (meat), in addition to organic HMAP, such as Hibiscus and Baobab.
- The review further notes that these value chain provide an excellent opportunity to empower poor smallholder farmers and labor in peripheral areas of Sudan by engaging in a Public-Private Partnership with the local actors and international importers to increase the value added to poor producers, including women and youth. The review goes further to describe the feasibility of key value chains as follows:
  - **Sesame seeds**. Sudan produces high-quality sesame seeds and has a relative advantage in global markets because of its access to large and fast growing import markets like China and Japan. Many smallholder farmers grow sesame seeds as a cash crop and could benefit from interventions that bolster demand and prompt productivity gains. Additionally, opportunities are present in job creation from processing and value addition.
  - **Livestock (meat).** The livestock value chain is a key contributor to foreign exchange earnings of the country. The value chain provides opportunities for the livelihood to more than 50 percent of the Sudanese population, many of whom are part of pastoralist communities that could benefit by addressing challenges in this sector.
- The review additionally suggests that a pre-requisite for successful value addition is access of the value chain actors to finance. Despite the efforts and progress made, the level of financial intermediation is still low and non-bank financial markets and institutions are small and underdeveloped. Most of the Sudan's population continues to be under-banked, as most banking and financial institutions are concentrated around the Khartoum area.
- Annex 4 outlines comments from the government during the Sudan's Country Strategic Opportunities Programme COSOP Consultative Workshop for COSOP Design (2021-2027), 8th December 2020 Khartoum.

Key words: Sesame, Livestock (meat), value chain, Sudan

4.2.4. Socioeconomic aspects, gender and social inclusion in value

52. Women in value chain, South Kordofan [52]

Reference: CARE International Switzerland (CIS). (2020). *Step Up to Empower Women and End Violence project study on income generating activities and agricultural value chains in Abujibiha and Rashad localities in South Kordofan.*

- The study was conducted in Abujibiha and Rashad localities in South Kordofan
- The crops selected for value chain especially sorghum, sesame and groundnut were found to be strategic in relation to food security as well as sources of income, as the estimated percentage sold reached 56%, 90% and 64% for the crops respectively in Abujibiha and 46%, 80% and 68% for Rashad locality.
- The study found no remarkable regulation that influence the value chain linkages, and this because the selected crops and activities are mainly within small production framework, where most of the value chain linkages are within the targeted localities.
- Sorghum, groundnut and sesame cultivation found to be rewarding and contributing remarkably to women income. This is because women dominate cultivation of these crops at Bildat farms (small farms close to villages).

Key words: sorghum, sesame and groundnut Value chain, women, cash crops, South Kordofan

53. Socio-Economic Assessment, business case, [53]

Reference: International Labour Organization. (2021). *Socio-Economic Assessment: East Darfur and West Kordofan States, Sudan*. https://ilo.org/wcmsp5/groups/public/---dgreports/---ddg_p/documents/publication/wcms_819056.pdf

- In Sudan, PROSPECTS aims to establish and strengthen sustainable solutions and support systems that enhance protection and basic services in areas where forcibly displaced persons (FDPs) and host communities (HCs) are living.
- In East Darfur, the PROSPECTS partnership targets Assalaya and Al Nimir Camp. In West Kordofan, the PROSPECTS partnership targets Kharasana/Keilak and Al Meiram
- Results reveal that like East Darfur, West Kordofan has limited economic and livelihood opportunities, low social indicators, poor access to government services, and there is fierce resource-competition between farmers, nomadic-pastoralists and FDP populations
- Key finding is that businesses in the target locations operate at a highly localized scale, often at the very end of the value chain, without engaging in value-adding business activities. Together with efforts to make larger market networks accessible for community members, PROSPECTS could introduce a number of value-adding activities, including storage, packaging and food processing (such as oilmaking).

- Key market opportunities in the target locations centre around adding value adding activities to existing agricultural production and investing in particularly profitable value chains, infrastructure development, and transportation services.
- The document highlights key challenges in the area that could affect business development. The study further notes that it is improbable that businesses have access to larger market networks that they could tap into for business development
- The study further provides opportunities that could be tapped. Key is that while awareness of cooperatives is low, multiple cooperatives relevant to PROSPECTS programming exist near each of the target locations. This offers opportunities for collaboration and building on existing frameworks for programming.
- While data appears to point towards the need for grinding mills and oil presses, activities that focus on added-value and accessing larger market networks will also likely need trucks, storage facilities, equipment needed for packaging, and so on.

Key words: Business, challenges, opportunities, value adding, East Darfur, West Kordofan,

54. Extension service program, insights, [54]

Reference: Abt Associates Inc. (2013). *Extension Services and Training Needs Assessment* [Report]. https://pdf.usaid.gov/pdf_docs/PA00JMWZ.pdf

- The Food, Agribusiness and Rural Markets (FARM) Project is designed to increase agricultural productivity, increase trade, and improve the capacity of producers and private sector and public sector actors.
- The project has developed an extension service program that employs 39 extension workers. At this stage, these workers have received basic agronomy training, but they need to enhance their skill level from promotion of production techniques to encompass a wider range of skills.
- The study recommends the following key improvements to the project's extension component:
  - Introduce participatory planning, including simple value chain analysis for selection of crop(s) and preparation of basic enterprise plans.
  - Initiate work to strengthen farmers' organizations as soon as they join the project.
  - Motivate farmers to provide extension services.
  - Systematically make use of well-established farmer-based organizations (FBOs) to introduce FARM concepts to new groups.
  - Involve farmers in supervision, follow-up, and monitoring and evaluation (M&E) activities, through participatory monitoring and evaluation (PM&E).
  - Include critical cross-cutting issues in training of staff and in general extension work.
  - Intensify involvement of the Ministry of Agriculture, Forestry, Tourism, Animal Resources, Fisheries, Cooperatives and Rural Development (MAFTARFCRD) in field supervision and M&E.
  - Build MAFTARFCRD capacity to play its role in stakeholder coordination and collaboration.
  - Translate selected extension materials into local languages.

Key words: Extension workers, value chains, farmer's organizations, South Sudan

4.2.5. Post-harvest losses management

55. JICA introduces an electric drying machine, [55]

Reference: AAI News. (2017). *To Sudan, East Africa! Appropriate Agriculture International.* https://www.koushu.co.jp/en/wp-content/uploads/News99-1-E.pdf

- The technical cooperation project of JICA in Kassala, Sudan, has supported capacity building of extension workers through a number of pilot activities for four years since 2011. The pilot activities ranged from horticulture to mechanized agriculture, and from irrigation agriculture to traditional rain-fed agriculture. The project has also supported livelihood improvement of women in farming villages. The project has come to an end, having yielded a good level of positive impact, achieving set targets.
- JICA had a discussion with Sudanese counterparts on what the needs are in the next stage of support based on the achievements and milestones of the technical cooperation project.
- Support for value addition of horticultural crops and promotion of export were found to be important for improving farmers' livelihood. In the horticultural zones of Kassala, there used to be a major onion drying business and dry onions were important export items
- Old plant was constructed with financial support from the former Soviet Union (Russia). Dry onions were exported to European countries such as the Netherlands, Belgium and Germany. However, the large size of the facility meant there were a lot of management and maintenance problems with high costs for operation.
- Given this, JICA decided to examine the feasibility of establishing several small-scale drying and processing bases, and to revive the plant in a much simpler way.
- To establish a stable production system for exporting dry onions, and to minimize the running cost, JICA examined the possibility of introducing electric drying machines on a pilot basis. JICA concluded that they would first verify the suitability of electronic drying machines by trying them locally.
- With Taikisangyo Co., Ltd, the electric drying machine introduction project commenced.

Key words: Onions, value chain, electric drying machine, JICA, Sudan

56. Post-harvest losses reduction, [56]

Reference: Baidya, P. (2022). *Sudan: Affordable solutions reduce food losses and increase income*. WFP, Africa. Retrieved Jun 23 from https://medium.com/world-food-programme-insight/sudan-affordable-solutions-reduce-food-losses-and-increase-income-3c1c0ab72a2d

- Poor harvests are significantly affecting people's access to food in Darfur.
- WFP is training smallholder farmers in best harvesting practices combined with the use of affordable and effective hermetic (airtight) storage solutions.
- The farmers are provided with tarpaulins for harvesting and drying of crops and silos and hermetic bags for storage. This means farmers can safely store his harvests of sorghum and groundnuts for longer and sell when prices are higher.
- According to a WFP study conducted in February 2022, the introduction of effective harvesting and storage solutions by participating farmers saw a reduction in post-harvest losses from as much as 40 percent down to just 2 percent.
- This has resulted in increased food security at the household level, more income for farmers and greater availability of food for the surrounding communities.

- WFP is actively engaging with the private sector to manufacture and distribute hermetic bags at affordable prices to every smallholder farmer in Sudan in a bid to improve food security and incomes by reducing post-harvest losses.

Key words: cereal production, Post-harvest losses, hermetic bags, WFP, Darfur, Sudan

57. Reducing post-harvest losses in fruits and vegetables,[57]

Reference: Elbashir, H. A., & Imam, M. A. (2010). Status report on fruits and vegetables production and processing industry in Sudan. AARDO Workshop on Technology on Reducing Post-harvest Losses and Maintaining Quality of Fruits and Vegetables, Taiwan, Republic of China.

- This study conducted by the Ministry of Agriculture, Sudan relied on secondary data. Generally, the study shows that Sudan has a great potential to produce good quality fruits and vegetables. This is because of its large areas of fertile soil, abundant amount of water from rivers, rains and underground water, suitable wide range of climate which allow variability of crops.
- Studies showed high losses (30→40%) of fruits and vegetables during harvesting, transport and handling. These losses add to the cost of production and have negative impact on marketing and hence national economy.
- There are no marketing institutions dealing with fruits and vegetables. Farmers and producers deal as individuals directly with local traders and exporters. The trade lacks exhibition sheds, loading and unloading platforms, cold stores and trucks loading equipment.
- The main local markets are in Khartoum, Khartoum North, Omdurman, Wad Madani and Port Sudan (Abdalazeez, 2005). There are many factors dealing with fruits and vegetables processing in Sudan but most of these factories are out of functioning because the grown variety is unsuitable for processing characteristic, financial storage and lack of technical experiences.
- The study suggests adoption of proper post-harvest techniques, investment in the infrastructure and post-harvest technology establishment, revision of Sudan's horticultural policies with the objective of increased production and better qualities of produce. It further recommends that Agricultural scheme be adopted and financed, taxation policies should be revised to make the sector competitive in international markets.

Key words: Fruits and vegetables, post-harvest losses, marketing, Sudan

58. Contamination of traditionally processed peanuts butter with aflatoxins, Sudan [58]

Reference: Elshafie, S. Z., ElMubarak, A., El-Nagerabi, S. A., & Elshafie, A. E. (2011). Aflatoxin B 1 contamination of traditionally processed peanuts butter for human consumption in Sudan. *Mycopathologia*, *171*, 435-439.

- A survey was carried out to detect the presence of aflatoxin B_1 in 60 duplicated samples (120 samples) of peanuts butter purchased from the local markets and other traditionally prepared and distributed by the street sellers in Khartoum state, Sudan.
- The study reveals that Aflatoxin B_1 was detected at variable levels in 100% of the screened samples.
- Traditionally prepared samples showed the highest incidence of aflatoxin B_1 which is above the internationally regulated tolerance levels (5–20 ppb). The means and the ranges of the aflatoxin B_1 recovered were as follows: 63.9 ppb (29–128 ppb), 54.5 ppb (21–131 ppb) and 101 ppb (17–

170 ppb) for samples collected from Khartoum, Khartoum North and Omdurman areas, respectively.

- Samples from retail stores presented relatively low aflatoxin B_1 incidences 14.5 ppb (1–57 ppb), but only 30% of the samples revealed aflatoxin level below 10 ppb.
- Laboratory segregated and carefully prepared butter from good grade nuts showed the lowest levels of this toxin (3.3 ppb; 2–6 ppb).
- The results showed that peanuts butter prepared by the street sellers and distributed by the retail stores are evidently hazardous to human health. The use of excellent grade peanuts and care during processing and storage are priority is key.

Key words: Aflatoxin B_1, processed, Peanuts Butter, Khartoum, Khartoum North and Omdurman

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