Research Article

# Guerrilla investors: Firm-level innovation and productivity in South Sudan's private pharmaceutical sector

Garang M. Dut

**Author Affiliation:**
Adjunct Lecturer, University of New South Wales, Sydney, Australia
Fellow, Australian National University, Canberra, Australia

Correspondence:
g.dut@unsw.edu.au

**Submitted:** April 2025
**Accepted:** May 2025
**Published:** November 2025

## ABSTRACT

**Introduction:** Innovation enables firms to thrive under constraints or transform their sectors. This has been little studied in South Sudan's pharmaceutical sector, where it could promote sustainable access to medicines.

**Methods:** The World Bank's Enterprise Survey 2014 was applied to private pharmaceutical firms between July and September 2021. There were 21 respondents (58% of the registered firms, n = 36). Firm characteristics, major constraints, and firm-level innovation were considered, and productivity was mapped. Percentage comparisons were drawn for firms in South Sudan and sub-Saharan Africa.

**Results:** Nineteen firms were included in the analysis. The average pharmaceutical firm was 14 years old and had 10 employees. Only 16.7% of pharmaceutical firms offered training to their employees, while political and financial conditions constrained all. Additionally, only 11.1% invested in research and development, and the skilled workforce comprised 53.3% of the workforce. However, pharmaceutical firms innovated to address these constraints: 73.7% had introduced new products or services, 63.2% had partaken in process improvements, and 61.1% recognized products or services as new for their market. 89.5% of pharmaceutical firms increased revenue per worker by US$600-1200, with labour cost accounting for 5% of sales among 88.9% of firms and up to 10% of sales among 5.6% of firms. 40% of pharmaceutical firms reported growth of less than 2%.

**Conclusions:** Innovation is a key factor in the survival of firms in South Sudan's private pharmaceutical sector. Better sector governance and financial support would enable and help improve the availability of medicines.

**Key words:** innovation, pharmaceuticals, industrial policy, essential medicines; fragility, South Sudan.

**Citation:** Dut. Guerrilla investors: Firm-level innovation and productivity in South Sudan's private pharmaceutical sector. South Sudan Medical Journal, 2025;18(4):184-189  DOI: https://dx.doi.org/10.4314/ssmj.v18i4.6

## Introduction

Innovation is essential for firm survival in low-income countries (LICs).[1] The Oslo Manual defines innovation as "the implementation of a new or significantly

improved product (goods or services) or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations."[2] Accepted indicators for innovation include research and development (R&D) investments, patents owned or requested, and scientific publications.[3] These metrics are limited in their ability to understand innovation in impoverished settings, where firms innovate under constraints.[4,5] In many settings, small firms and new entrants deploy 'guerrilla tactics'[6] to withstand competition in established markets or uncertainty in evolving markets.

Although Africa represents 1% of global R&D investments and 1% of total patents,[7] 'frugal innovation' – observed among firms that thrive in impoverished settings – is less reliant on R&D and involves customised application of existing technology, low-cost solutions, and design thinking.[4] This presents transformative potential for South Sudan, where the private sector is nascent and public capacity is limited.[8,9]

Unleashing potential among private pharmaceutical firms is essential for the availability of medicines, which is 50.4% in Juba.[10] But the extent of innovation among private pharmaceutical firms remains poorly studied in South Sudan. Locally-situated innovation could indigenize donated technology, where consumables and maintenance costs are often prohibitive.[11]

This article is the first to report innovation among private pharmaceutical firms in South Sudan. It characterizes firms and highlights constraints, comparing averages for the private sector in South Sudan and sub-Saharan Africa. It then examines productivity among the pharmaceutical firms before profiling firm-level innovation.

## Method

### Study Sample

This study surveyed private, for-profit pharmaceutical firms in South Sudan. A random sample was surveyed through the Pharmaceutical Society of South Sudan. There were 21 respondents, which comprised 58% of all registered private pharmaceutical firms (n = 36) (Personal

**Table 1. Characteristics and constraints among firms in South Sudan and sub-Saharan Africa**

| | Pharmaceutical firms in South Sudan† | Other types of firms in South Sudan‡ | Firms in sub-Saharan Africa‡ |
|---|---|---|---|
| **Basic characteristics** | | | |
| Age (years), *m* | 13.6 | 4.2 | 15.1 |
| Size (number of workers), *m* | 10.3 | 12.3 | 32.1 |
| Purchased fixed assets (% of firms) | 57.9 | 38.1 | 38.1 |
| Skilled workers (% of all production workers) | 53.3 | 69.8 | 77.4 |
| Firms with formal training (% of firms) | 16.7 | 17.1 | 27.5 |
| Foreign ownership (% of firms) | 38.9 | 42.7 | 16 |
| **Challenges reported as "major obstacle" (% of firms)** | | | |
| Political instability | 100 | 30.4 | 10.6 |
| Access to finance | 100 | 50 | 38.2 |
| Corruption | 100 | 40.1 | 39.1 |
| Connecting telephone | 100 | N/A | 26.8 |
| Electricity | 79 | 58.6 | 40.6 |
| Transport | 84.2 | 46.2 | 24.2 |
| Access to land | 68.4 | 7.2 | 4.2 |
| Inadequately-educated workforce | 52.6 | 19.5 | 16.3 |

Source: †Author's own. ‡World Bank (2015).[12]

Note: *m:* mean.

communication). This excludes private, not-for-profit pharmaceutical firms, such as humanitarian or faith-based organisations.

### Survey

This study used the World Bank's Enterprise Survey (WBES) 2014[12] via an online survey tool (Qualtrics), between July and September 2021. This comprised 54 questions previously used for studying private firms in South Sudan, allowing for comparison with the private sector in South Sudan and sub-Saharan Africa. It required informed consent and explored ten categories, including workforce, innovation, finance, firm performance, infrastructure, other constraints, other firm characteristics, ownership status, legal and export status, and sectors in which the firm operates. This article presents data on workforce, finance, firm performance, infrastructure, and other constraints concerning innovation.

### Outcome

Firms were characterized by factors that impact innovation, and constraints considered with the percentage of firms identifying each as 'major obstacle.' These factors included age, size (number of employees), fixed assets purchased, skillset among employees, formal training offered, and foreign ownership. Major constraints studied included political instability, access to finance, corruption, connecting telephone, electricity, transport, access to land, and an inadequately educated workforce. Percentage comparators were drawn for the private sector in South Sudan and sub-Saharan Africa, based on findings from the WBES 2014.[12]

**Table 2. Productivity among private pharmaceutical firms in South Sudan**

| Firm performance metric | Performance | % of firms |
|---|---|---|
| Value-add per worker (US$) | 600-1200 | 89.5 |
| | 1200-2400 | 5.3 |
| | 2400-3000 | 5.3 |
| Cost of labour per unit of sales (%) | 0.5 | 5.6 |
| | 5 | 88.9 |
| | 10 | 5.6 |
| Real annual sales growth (%) | 5-10 | 53.8 |
| | 11-15 | 23.1 |
| | 16-20 | 23.1 |
| Annual employment growth (%) | ≤ 2 | 40 |
| | 5-10 | 30 |
| | 10-20 | 30 |

### Analysis

Three out of 19 respondents included in the analysis omitted one question each: a question on employee training, one on R&D investment, and a question on a product or service that was new to the firm's main market. Descriptive statistics were used for characterisation.

Firm-level innovation was measured as new products or services by the firm, process improvement, R&D, and a product or service new to the firm's market. Firm-level performance was quantified with labour productivity, assessed by value-added per worker, average annual salary or wage, and cost of labour per unit of sale. Financial capital expenditure was assessed by real annual sales growth and annual employment growth.

## Results

The average pharmaceutical firm was 14 years old and had 10 employees. This made it older than the average firm in South Sudan and younger than the average for sub-Saharan Africa, but with fewer employees than a firm in South Sudan or sub-Saharan Africa. 57.9% of the pharmaceutical firms purchased fixed assets in the preceding year, compared with 38.1% of all firms in South Sudan and 38.1% for firms in sub-Saharan Africa. The skilled workforce comprised 53.3% of the pharmaceutical firms' workforce, compared with 69.8% for all firms in South Sudan and 77.4% for firms in sub-Saharan Africa. Fewer pharmaceutical firms (16.7%) offered formal training to employees in the preceding year, compared with 17.1% for all firms in South Sudan and 27.5% of firms in sub-Saharan Africa. Foreign ownership was reported by 38.9% of pharmaceutical firms, compared with 42.7% of all firms in South Sudan and 16% of firms in sub-Saharan Africa (Table 1).

These reflected a restrictive business environment, whereby 100% of the pharmaceutical firms reported political instability, access to finance, corruption, and connecting to the telephone as major obstacles. 79% of pharmaceutical firms reported electricity as a major obstacle, compared with 58.6% for all firms in South Sudan and 40.6% in sub-Saharan Africa. Transport was a major obstacle for 84.2% of pharmaceutical firms, 46.2%

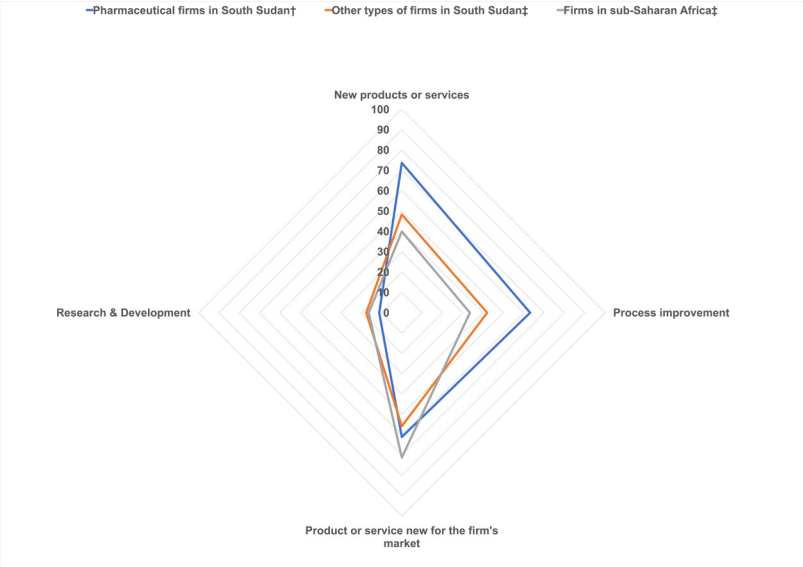


Figure 1. Private pharmaceutical firms innovate under constraints in South Sudan. (Source: †Author's own. ‡World Bank (2015).[12])

of all firms in South Sudan, and 24.2% in sub-Saharan Africa. Access to land was a major obstacle for 68.4% of pharmaceutical firms, 7.2% of all firms in South Sudan, and 4.2% of firms in sub-Saharan Africa. An inadequately educated workforce was a major obstacle for 52.6% of pharmaceutical firms, compared with 19.5% in South Sudan and 16.3% in other countries (Table 1).

These constraints impact performance among private pharmaceutical firms. 89.5% of the pharmaceutical firms added US$600-1200 to revenue per worker, with labour costs accounting for 5% of sales for 88.9% of pharmaceutical firms and up to 10% of sales for 5.6% of pharmaceutical firms. Real sales growth was low among pharmaceutical firms: 53.8% reported 5-10%, 23.1% reported 11-15%, and 23.1% reported 16-20%. Consequently, 40% of pharmaceutical firms reported annual employment growth of less than 2% (Table 2).

These restrictive conditions force firms to innovate. Although only 11.1% of private pharmaceutical firms (blue in Figure 1) invested in R&D in the preceding financial year, compared with 17.5% of other types of firms in South Sudan (orange) and 16.3% of firms in sub-Saharan Africa (grey), 73.7% of the pharmaceutical firms (blue) had introduced new products or services in the preceding year, compared with 48.3% of other types of firms in South Sudan (orange) and 39.9% of firms in sub-Saharan Africa (grey). Similarly, 63.2% of the pharmaceutical firms (blue) partook in process improvement, compared with 42% of other types of firms in South Sudan (orange) and 33.5% of firms in sub-Saharan Africa (grey). 61.1% of pharmaceutical firms (blue) recognized products or services as new to their market, compared with 55.8% of other types of firms in South Sudan (orange) and 71.2% of firms in sub-Saharan Africa (grey) (Figure 1).

## Discussion

This study showed that private pharmaceutical firms in South Sudan innovate against constraints. Unfavourable investment conditions have rendered private pharmaceutical firms generally small-sized (<19 employees), less productive, and diminished competencies.[9] These conditions demand 'frugal innovation,' an approach that springs from societal and operational constraints to avail accessible and adaptable solutions.[4,5] They also confirm the lack of cluster scale constraints, sector-based sources of financial capital, bargaining power, and a firm's access to larger markets.[3,7]

While R&D investments, good governance, suitable infrastructure, and talent pool are critical to innovation [13] this study suggests pharmaceutical firms in South Sudan likely partake in 'frugal innovation'[4,5,14] as a means to survival in a hostile investment climate. This approach has been likened to 'guerrilla warfare,' characterised by hit-and-run methods that evade direct competition in a duopoly, as small firms strive for survival under uneven and unfavourable conditions, rather than a classical market entry.[6] In this instance, innovation among private

pharmaceutical firms could also become a viable vehicle for strengthening health systems.[15] Supportive political and business conditions would increase the number of large-sized firms in the pharmaceutical sector, thereby increasing sector-wide potential for harnessing financial power and networks[3] for firm-level productivity.

However, public institutions' reforms have often proven sluggish in fragile and conflict-affected states such as South Sudan.[16] So, context-specific innovation is also instrumental for sustainability when an institutional void exists.[5,14] These insights should inform approaches to the pharmaceutical sector and health systems strengthening in South Sudan and similar settings.

## Conclusion

Innovation is a means of survival for firms in South Sudan's private pharmaceutical sector and helps the sector thrive despite constraints. Better governance and financial support would encourage sector sustainability and improve the availability of medicines.

**Ethics approval and consent to participate:** Ethics approval for this study was granted by the Australian National University (Protocol: 2021/272). Additional approval was obtained from South Sudan's Ministry of Health (Protocol: 32/07/2021 – MOH/RERB/AF/33/2021). Participation was voluntary and anonymous, and no personally-identifying information was collected. Except for the informed consent, respondents could skip questions and submit a partially completed survey. This offered flexibility while preserving anonymity.

**Competing interests:** None.

**Funding:** None.

**Acknowledgements:** The author acknowledges Buchay Othom Rago and Rita Tulba, who facilitated correspondence with the Pharmaceutical Society of South Sudan, and thanks members of the society. The author is also grateful to Sir Paul Collier, Professor of Economics and Public Policy at the University of Oxford, for his feedback on an earlier draft.

References

1. Gebreeyesus M. Innovation and microenterprises growth in Ethiopia. WIDER Research Paper, No. 2009/51, ISBN 978-92-9230-230-6. 2009, Helsinki: The United Nations University World Institute for Development Economics Research (UNU-WIDER). DOI: https://hdl.handle.net/10419/45080
2. OECD, Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Ed. 2005, Paris: European Commission, pp.46. DOI: https://www.oecd.org/en/publications/oslo-manual_9789264013100-en.html
3. Fu X, Zanello G. Innovation under the radar as a response to constraints: the nature of innovation in Africa. In: Fu X (Ed). Innovation under the Radar: The nature and sources of innovation in Africa. 2020 Nov, New York: Cambridge University Press, pp.65-104. DOI: https://doi.org/10.1017/9781316869482.005
4. Hindochi CN, Antonacci G, Barlow J, Harris M. Defining frugal innovation: a critical review. BMJ Innov. 2021 Oct 5;7:647-656. DOI: https://doi.org/10.1136/bmjinnov-2021-000830
5. Levänen J, Hossain M, Wierenga M. Frugal innovation in the midst of societal and operational pressures. Journal of Cleaner Production. 2022 May 1;347:131308. DOI: https://doi.org/10.1016/j.jclepro.2022.131308
6. Fershtman C. Survival of small firms: guerrilla warfare. Journal of Economics & Management Strategy. 1996;5(1):131-147. Doi: https://doi.org/10.1111/j.1430-9134.1996.00131.x
7. Fu X. Innovation and Growth of African Firms: survival and growth. In: Fu X (Ed). Innovation under the Radar: The Nature and Sources of Innovation in Africa. 2020, New York, NY: Cambridge University Press, pp.125-151. DOI: https://doi.org/10.1017/9781316869482.007
8. Collier, P., Gregory, N., & Ragoussis, A. (2020). Pioneering Firms in Fragile and Conflict-Affected States: Why and How Development Financial Institutions Should Support Them. Journal of Accounting and Finance, 20(3). Doi: https://doi.org/10.33423/jaf.v20i3.3016
9. Dut GM. Private pharmaceutical sector in South Sudan: underdeveloped but essential. South Sudan Medical Journal. 2025: 18(2):78-83 DOI: https://doi.org/10.4314/ssmj.v18i2.5
10. Deng J, Mayai AT, Kayitare E, Ntakirutimana T, Swallehe O, Bizimana T. Assessment of prices, availability and affordability of essential medicines

in Juba County, South Sudan. J Pharm Policy Pract. 2023 Dec 30;16(1):172. Doi: https://doi.org/10.1186/s40545-023-00675-5

11. Malkin RA. Design of health care technologies for the developing world. Annu Rev Biomed Eng. 2007;9:567-87. DOI: https://doi.org/10.1146/annurev.bioeng.9.060906.151913

12. World Bank. Enterprise survey (ES) 2014, Ref. SSD_2014_ES_v01_M. 2015 Oct 7, Washington DC: World Bank. https://www.enterprisesurveys.org/en/data

13. Congressional Budget Office. Research and Development in the Pharmaceutical Industry [Internet]. Updated 2021 April, Washington DC: the US Government. [Cited 19 May 2025] https://www.cbo.gov/publication/57126

14. Bhatti Y, Basu RR, Barron D, Ventresca MJ. Frugal innovation: models, means, methods. 2022, Cambridge, UK: Cambridge University Press, pp.12-14. Doi: https://doi.org/10.1017/9781316986783.004

15. McPake B, Hanson K. Managing the public-private mix to achieve universal health coverage. Lancet. 2016;388:622-30. Doi: https://doi.org/10.1016/S0140-6736(16)00344-5

16. Andrews M, Pritchett L, Woolcock M. Building state capability: evidence, analysis, action. 2019, Oxford: Oxford University Press, pp.29-52. DOI: https://doi.org/10.1093/acprof:oso/9780198747482.003.0003