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Author: Goldsmith, Peter

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The Faustian Bargain of Tropical Soybean Production

Peter Goldsmith[1]

Abstract

I use three case studies in this essay to show that policies promoting commercial soy production in the tropics involve a Faustian Bargain. Faustian Bargains, strictly defined, comprise a conflict one faces when a decision-maker trades one's "soul" for greater knowledge. Applied more liberally in the context of soybean development, commercial crop technologies, like soybean, offer the potential for improved labor productivity over traditional staples, and as a result, they can provide a pathway out of poverty traps. However, they also may cause considerable changes to traditional norms, cultivation practices, market relationships, natural resources, and the natural environment, hence, the Faustian Bargain. Relevant to this special issue of *Tropical Conservation Science*, the three case study examples demonstrate how and why commercial crop production requires a shift to intensive input usage. Thus, promoting commercial crops means introducing chemical fertilizers and herbicides into environments where heretofore traditional methods involved little or no inputs other than labor. The Faustian framework involves the tradeoff between potentially greater economic opportunities, but at a cost to traditional norms, practices, and potentially the natural environment.

Keywords

commercial, tropical, soybean, faustian, bargain

I use three case studies in this essay to show that policies promoting commercial soy production in the tropics involve a Faustian Bargain. Faustian Bargains, strictly defined, comprise a conflict one faces when a decision-maker trades one's "soul" for greater knowledge (Dictionary.com, 2017). Applied more liberally in the context of soybean development, commercial crop technologies, like soybean, offer the potential for improved labor productivity over traditional staples, and as a result, they can provide a pathway out of poverty traps (Carter & Barrett, 2006). However, they also may cause considerable changes to traditional norms (Cárdenas et al., 2017), cultivation practices, market relationships, natural resources, and the natural environment, hence, the Faustian Bargain. Relevant to this special issue of *Tropical Conservation Science*, the three case study examples demonstrate how and why commercial crop production requires a shift to intensive input usage. Thus, promoting commercial crops means introducing chemical fertilizers and herbicides into environments where heretofore traditional methods involved little or no inputs other than labor. The Faustian framework involves the tradeoff between potentially greater economic opportunities, but at a cost to traditional norms, practices, and potentially the natural environment.

Rural workers in the tropical developing world produce very few goods and services per unit of labor, resulting in low labor productivity, low wages, and high levels of rural poverty (Goldsmith, Gunjal, & Ndarishikanye, 2004; Gollin, Lagakos, & Waugh, 2013; McCullough, 2017). The low productivity results from the combination of low crop yields in smallholder farming systems and from the low value of the traditional crops that smallholders often produce.

Development policies seeking to raise the yields of low value crops have often failed. The greater supply of low-valued staples only drives down local prices, creates few international market opportunities, and as a result provides little opportunity to exit poverty traps

[1]University of Illinois, Urbana, IL, USA

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Corresponding Author:
Peter Goldsmith, University of Illinois, Urbana, IL 61801, USA.
Email: pgoldsmi@illinois.edu

(Ellis & Freeman, 2004). An alternative development strategy seeks to shift smallholders to higher value or commercial crops (Felat et al., 2016; Schaffnit-Chatterjee, Lanzeni, & Hoffmann, 2014). The logic being that commercial crops often provide greater returns per unit of labor and have greater domestic and international market opportunities.

The Faustian Bargain emerges when policies require a shift away from native staples to higher valued crops. They can disrupt local customs, practices, gender roles, and may change land use and environmental impacts. New crop technologies, like soybean, for example, often involve burdensome new components such as new cultural practices, inputs, and marketing arrangements (See Michelson, 2017, for example.). Alternatively, policies that promote enhanced staple production, such as orange flesh sweet potato, or yield improvement among staples, such as hybrid maize, involve minimal disruption to traditional cultivation practices. Thus, indirectly development workers, and directly farmers, face a challenging dilemma; whether to engage in high-valued commercial crop production when adoption, and then sustaining cultivation, may be difficult. I analyze this Faustian Bargain using three case studies of soybean (*Glycine max* L.), which as a new commercial crop in tropical Africa has the potential to raise rural incomes.

Case I: Central-West Brazil

Case I summarizes the remarkably high labor productivity of tropical Brazilian soy farmers as described in Goldsmith and Montesdeoca (2017). The makeup of soybean production costs involves four basic categories; (a) non-labor inputs (chemicals and fertilizers), (b) labor, (c) fixed costs (land and other capital equipment), and (d) miscellaneous expenses such as fees, licensing, and so forth. The production function of these Brazilian farmers is high input and low labor. In fact, labor comprises only 9% of total costs (Goldsmith & Montesdeoca, 2017). The low labor-high input approach to soybean production results in high yields, 3,009 kg/ha, which is more than one third greater than the world average (Table 1). Total costs of production are 1,015 USD per hectare or 337 USD per metric ton. But soybean prices received by these Brazilian farmers are only 88% of the world price or 449 USD per ton. The high yield and low costs of production compensate for the low prices received by farmers. Returns are 4.04 USD for each dollar of labor input, which has huge implications for elevating rural wages, increasing economic development, and reducing rural out migration. However, the tradeoffs are that chemical inputs are 47% of total production costs and present a potential threat to the natural environment.

Case II: Northern Ghana

Case II examines a region of northern Ghana with similar biophysical and market settings to tropical Brazil, but with very different soy production characteristics. The agro-ecological environments, latitudes, elevations, and soils are similar, tropical oxisols in Brazil vs. tropical alfisols in Ghana. Therefore, seed varieties and agronomic practices are readily transferable. In addition, both local

Table 1. Costs of Production for Smallholder Farmers in Northern Ghana; USAID Soybean Innovation Lab Research Farm; Farmers in the Center-West of Brazil.

	I: High Input[a]	II: Low Input[b]	III:USAID SIL[c]
	Tropical Brazil	Northern Ghana	
Yield (Metric tons per hectare)	3.09	0.75	2.00
Cost components (per hectare)			
Inputs	$481.35	$29.33	$168.06
Agricultural operations	$91.62	$315.42	$382.60
Other costs	$177.54	$35.10	$35.10
Fixed costs	$264.04	$34.86	$104.58
Total costs	$1,014.55	$414.71	$690.34
Average annual price per mt	$448.67	$496.16	$496.16
Cost per mt	$328.69	$551.88	$345.17
Gross revenue per hectare	$1,384.55	$373.66	$992.31
Net profit = Gross rev − Total cost	$370.00	$(41.05)	$301.97
Returns to labor	$4.04	$(0.13)	$0.79

[a]Source: Goldsmith and Montesdeoca (2017).
[b]Source: Dogbe et al. (2013).
[c]Source: Reynolds and Awuni (2017) with author calculations.

Ghanaian and Brazilian soybean markets are well integrated into the larger international market. As a result, for example, Ghanaian poultry producers are indifferent to soybean meal originating from Ghanaian or Brazilian soybean.

Here, we utilize data from colleagues at the Savanna Agricultural Research Institute (SARI) in northern Ghana to show a soy production system that nonetheless is remarkably different to Case #1. Smallholder producers in the region principally utilize labor, which comprises about 75% of the total cost of production (Dogbe et al., 2013) (Figure 1). Soybean yields in the region averaged less than 600 kg/ha, one fifth the yields in Brazil and 25% of the global average of 2,300 kg/ha. A second study of another sample of northern Ghanaian farmers confirms the Dogbe et al. (2013) as to the nature of the production function and corresponding low yield. Tamimie, Goldsmith, and Winter-Nelson (2017) report low yields, between 450 and 950 kg/ha, and weak sustained adoption among female farmers in the Upper West region of Ghana. These farmers as well utilize almost no inputs other than labor to grow soybean.

SARI researchers estimate the total costs of production at about 300 USD per hectare and costs per metric ton of 552 USD, about 68% greater than in Brazil. Prices for soybean in Ghana are 98% of the world price as represented on the Chicago Mercantile Exchange, thus are quite favorable. SARI researchers estimate average revenue between 264 and 302 USD per hectare, thus the average farmer operates at a loss. Low labor productivity and limited sustained adoption are not due to high input costs or low soybean prices, but because of the low revenue resulting from low yields. Environmental impacts though are also low due to a reliance on labor rather than chemical inputs.

The production system described by the SARI team reflects little change from the cultivation practices used for traditional native staple crops, low levels of non-labor inputs, and high levels of manual labor. The Faustian Bargain is *not* at play under these conditions as there is no tradeoff. Farmers are not being disrupted from their traditional norms of production. Unfortunately, managing a commercial crop, like soybean, as if were a native staple leads to poor productivity, low profitability, weak adoption of the technology, and little opportunity to exit poverty traps (Tamimie et al., 2017).

Case III: Nyankpala, Ghana

The third case involves the application of appropriate technologies within the Ghanaian context. Data from USAID's Soybean Innovation Lab research farm in Nyankpala located in Northern Ghana show yields of 2,000 kg/ha and profitability of 301 USD per hectare.

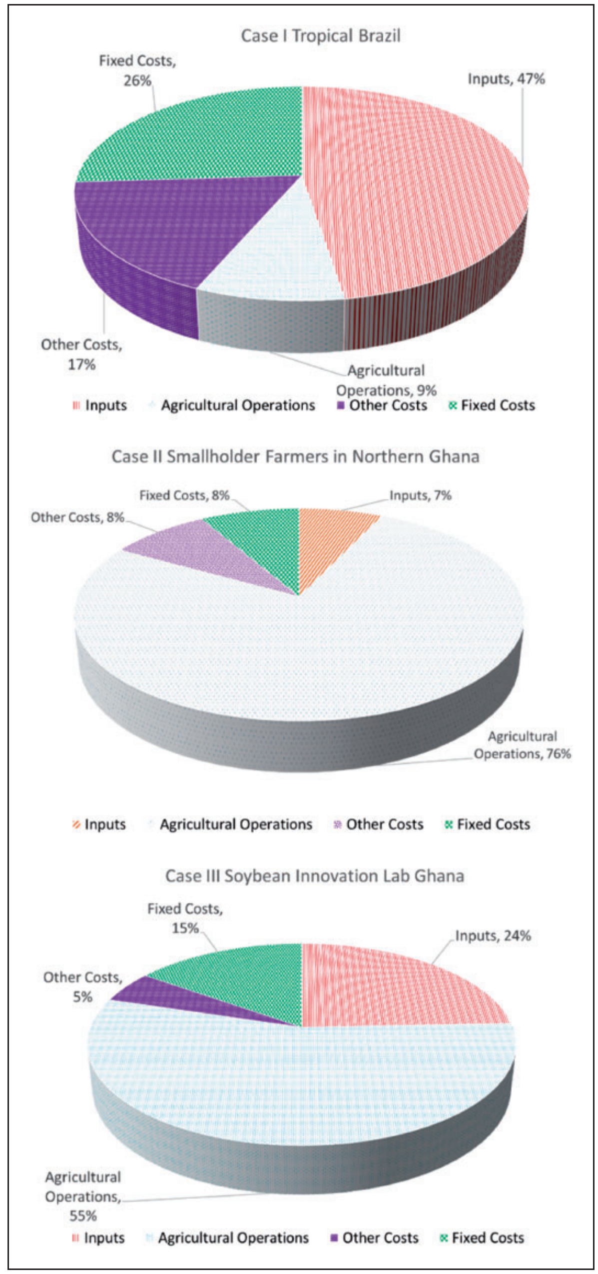

Figure 1. Breakdown of the cost of production for tropical soybean: three case studies.

Labor costs, though still high, fall to 55% of total costs, while chemical and fertilizer inputs rise to 24%. Labor productivity, not as high as in the Brazil case, rises to $0.79 per dollar of invested labor. This Case III reflects a middle path of appropriate and available technology application, profitable and economically sustainable soybean production, and favorable levels of labor productivity. The production function though shifts from traditional to commercial and as a result presents a Faustian Bargain involving the introduction and application of chemical inputs. These higher levels of chemical fertilizer and pesticide usage require the bundling of pesticide application training, effective erosion control, and vigilance with respect to water resources to assure proper stewardship of the natural environment. It also requires appropriate access to fertilizer and pesticide markets and credit.

Conclusion

Commercial crops like soybean can significantly raise rural labor productivity among tropical farmers when yields are sufficiently elevated. But high yields require input utilization and proper crop management. The development strategy question though arises as to the level of social and economic disruption that is required, and is acceptable, to achieve sustainable levels of productivity and profitability. Economically sustainable soybean production, like other commercial crops, requires new practices, relationships with input and commodity markets, and the adoption of basic technologies and practices such as high-quality improved seed, the use of inoculum and fertilizer, higher plant populations, crop rotation, and environmental stewardship. Additionally, the reliance on markets, inputs, and new technical knowledge may disrupt social systems, thereby potentially marginalizing women within male-dominated commercial channels. Similarly, commercial crop production requires investment in land improvement, such as correcting poor soil fertility and pH, but doing so might conflict with very restrictive land tenure norms. As questioned by Tamimie et al. (2017), is soybean production too long a "jump," for small holders, and also how should we attend to the natural environment? Is the Faustian Bargain too great?

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References

Cárdenas, J.-C., Janssen, M. A., Ale, M., Bastakoti, R., Bernal, A., Chalermphol, J., . . . Wang, Y. (2017). Fragility of the provision of local public goods to private and collective risks. *Proceedings of the National Academy of Sciences*, *114*, 921–925.

Carter, M. R., & Barrett, C. B. (2006). The economics of poverty traps and persistent poverty: An asset-based approach. *The Journal of Development Studies*, *42*(2): 178–199.

Dictionary.com. (2017). Retrieved from http://www.dictionary.com/browse/faustian-bargain.

Dogbe, W., Etwire, P. M., Martey, E., Etwire, J. C., Baba, I. I., & Siise, A. (2013). Economics of soybean production: Evidence from Saboba and Chereponi districts of the Northern region of Ghana. *Journal of Agricultural Science*, *5*(12): 38.

Ellis, F., & Freeman, H. A. (2004). Rural livelihoods and poverty reduction strategies in four African countries. *Journal of development studies*, *40*(4): 1–30.

Frelat, R., Lopez-Ridaura, S., Giller, K. E., Herrero, M., Douxchamps, S., Djurfeldt, A. A., . . . Rigolot, C. (2016). Drivers of household food availability in sub-Saharan Africa based on big data from small farms. *Proceedings of the National Academy of Sciences*, *113*(2), 458–463.

Goldsmith, P. D., Gunjal, K., & Ndarishikanye, B. (2004). Rural-Urban migration and agricultural productivity: The case of Senegal. *Agricultural Economics*, *31*(1): 33–45.

Goldsmith, P. D., & Montesdeoca, K. (2017). The productivity of tropical grain production. *The International Journal of Agricultural Management*. Manuscript submitted for publication.

Gollin, D., Lagakos, D., & Waugh, M. E. (2013). The agricultural productivity gap. *The Quarterly Journal of Economics*, *129*(2): 939–993.

McCullough, E. B. (2017). Labor productivity and employment gaps in Sub-Saharan Africa. *Food Policy*, *67*, 133–152.

Michelson, H. (2017). Variable Soils, Variable Fertilizer Quality, and Variable Prospects. *Tropical Conservation Science*.

Reynolds, D., & Awuni, G. (2017). *Annual SMART Farm Report 2016, cost addendum*. USAID Soybean Innovation Lab.

Schaffnit-Chatterjee, C., Lanzeni, M. L., Deutsche Bank AG, & Hoffmann, R. (2014). Agricultural value chains in Sub-Saharan Africa. *From a development challenge to a business opportunity. Deutsche Bank Research, Frankfurt*. Retrieved from http://dbresearch.de/PROD/DBR_INTERNET_DEPROD/PROD0000000000333152/Agricultural+value+chains+in+Sub-Saharan+Africa3A+From+a+development+challenge+to+a+business+opportunity.PDF.

Tamimie, C. A., Goldsmith, P. D., & Winter-Nelson, A. (2017). *Determinants of soybean adoption and performance in Northern Ghana* (Working paper, p. 30). Champaign, IL: Department of Agriculture and Consumer Economics, University of Illinois.