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Synopsis: Improving agricultural productivity in Papua New Guinea

Strategic and policy considerations

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Overview

In a recent working paper, we examine staple and cash crop production yields in Papua New Guinea (PNG). In doing so, we assess the yield gap (difference between the crop yields farmers commonly obtain and what they might realize with optimal inputs and crop management) for the main staple food crops in PNG. The yield gap for sweet potato is the smallest (1/4 – 1/3 less than attainable yields), while banana shows the largest yield gap at about ¾ less than what might be achieved under intensive cultivation. In addition, we compare PNG agricultural output with areas of similar growing conditions in Indonesia to provide insight into potential investments to further spur agricultural productivity in PNG. Finally, we assess current sector policies in PNG that aim to support agricultural development as an engine for economic growth.

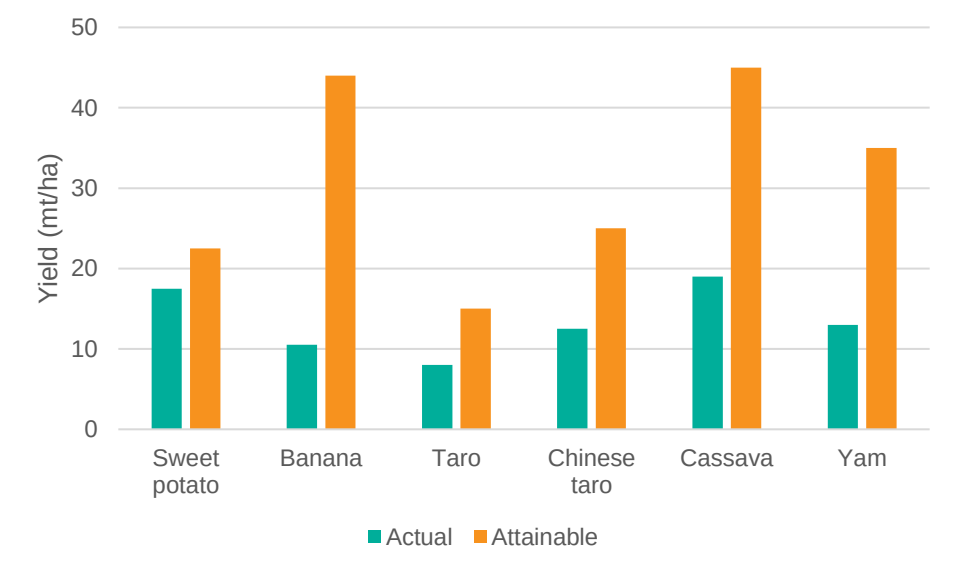
While growing market demand is the principal driver of increasing agricultural productivity in PNG, investing in agricultural research and effective agricultural extension services also make important contributions to ensuring sustainable growth. It is evident that for both banana and coconut in Indonesia and for palm oil in both PNG and Indonesia, agricultural research and development and extension services have resulted in high average productivity levels. The somewhat stagnant cocoa and coffee sectors in both PNG and Indonesia suggest that more effective research and extension efforts on these crops may enable producers to increase their productivity and realize higher incomes. In addition, greater investment in research and development and extension services focused on root and staple crops is warranted.

Staple crop yield levels in Papua New Guinea

We focus on a set of six basic staple food crops to evaluate production potential in PNG. The most recent statistics on agricultural production are summarized in Figure 1, which provides the actual (based on farmer yield estimates) and attainable on farm (given optimal management) yield estimates for each crop. The data on actual versus attainable yields for banana shows the largest yield gap, however yield

gaps are present across different crops. For example, taro, Chinese taro, cassava, and yam are on average between 40 and 60 percent less than current yield potential with improved planting materials and excellent crop management practices (Figure 1). Smallholder farming households in PNG face significant challenges in obtaining up-to-date information on best practices for production, as well as improved inputs and differing seed or stock varieties.

Figure 1: Average actual and attainable yields of major staple food crops in Papua New Guinea



Sources: Bourke et al. (2009); Allen and Bourke (2009); Acland (1971)

Note: Highland and lowland actual yields are averaged in the above figure. Disaggregated yields by elevation or other production conditions are reported in Table 1.

Strengthening agricultural markets across the country is equally as important as increased research, development and outreach of improved crop varieties and management. There are 2 important functions that agricultural markets must meet to enhance productivity: 1) effectively supply farmers with improved agricultural inputs at prices that allow them to make a reasonable net profit on the use of those inputs, and 2) sufficient market demand that incentivizes farmers to grow specific crops at higher levels of productivity. **Without strong markets, most smallholder farmers in PNG are as productive as is financially viable given the constraints under which they farm.** The PNG government and development partners have tools to change the structure of incentives currently available to smallholder decision-making. This can be done by increasing access to improved farm technologies, facilitating market interaction through improved marketing and transportation infrastructure, and enhancing communication technologies across market actors.

Comparing staple and cash crop yields in PNG and Indonesia

Some of the constraints listed above can be further investigated by comparing agricultural performance in similar biophysical conditions, but under different market and development contexts. Smallholder agricultural systems are a significant part of farming systems in PNG and Indonesia. However, Indonesian smallholder farmers make crop productivity decisions based on incentives driven by the market-based income they may earn from selling their produce, rather than the subsistence consumption needs of

their household. In addition, smallholder farmers in Indonesia have better access to modern farm inputs, primarily through the market, as well as greater information on improved farming practices. Table 1 compares the average productivity levels reported in Indonesia and PNG for the food and cash crops for which data is available (no recent national or sub-national productivity estimates for taro, Chinese taro, and yam in Indonesia are available). To provide more comparable estimates, we report on productivity levels in the eastern provinces of Indonesia that agro-ecologically are most comparable to PNG – the islands of Kalimantan and Sulawesi, the Maluku Islands, and the provinces of Indonesia (Papua and West Papua) on New Guinea itself.

Table 1: Productivity levels of selected food and cash crops in Indonesia and Papua New Guinea, most recent estimates, mt/ha

Crop	Papua New Guinea	Indonesia	Eastern Indonesia	Papua (Indonesia New Guinea – mainly lowland production)	Kalimantan and Maluku (lowland production)	Sulawesi (some highland production)
Sweet potato		17.1	13.2	13.1	13.9	13.0
Lowlands	13					
Highlands	15					
Cassava		24.0	21.8	12.1	22.5	22.1
Lowlands	22					
Highlands	16					
Banana		55.4	42.1	38.2	36.5	50.1
Lowlands	12					
Highlands	9					
Cocoa		0.36	0.37	0.24	0.28	0.39
Smallholders	0.2-0.4					
Plantations	0.4-0.6					
Coffee, Arabica		0.55	0.38	*limited production*	*no production*	0.42
Smallholders	0.75-1.25					
Plantations	1.00-2.40					
Copra (coconut)						
Smallholders	0.40-0.70	1.1	*na*	*na*	*na*	*na*
Plantations	0.70-1.00	2.8	*na*	*na*	*na*	*na*
Oil palm						
Smallholders	6.0-14.5	15.3 [44.6]	*na*	*na*	*na*	*na*
Plantations	19.0-21.5	19.5 [48.8]	*na*	*na*	*na*	*na*

Source: PNG yields – Bourke et al. (2009); Indonesia banana, cassava, cocoa, and coffee – KPRI (2021); Indonesia oil palm – GYGA (2021); Indonesia copra – Alouw & Wulandari (2020).

Note: Numbers in brackets represent reported potential yield estimates; na = "not available".

Data suggest that sweet potato and cassava have similar productivity levels in Indonesia and PNG, particularly when comparing PNG with the eastern provinces of Indonesia (Table 1). Given the technical challenges for long-term storage and limited commercialization of both sweet potato and cassava, low levels of investments characterize these crops in both countries. Developing deeper marketing systems that offer farmers good incentives to raise their levels of productivity in tandem with developing higher yielding crop varieties are needed to increase overall productivity.[1]

[1] The arguments for why yields of sweet potato and cassava in Indonesia are low related to restricted market potential may also apply to taro, Chinese taro, and yam. Moreover, it is difficult to obtain information on their production or productivity levels in either PNG or Indonesia in part due to the crops being viewed as purely for subsistence, with any commercial potential being primarily restricted to local markets and not for wider domestic markets or for international trade. Agricultural researchers similarly give them much less attention than more commercial crops, further exacerbating data gaps on the productivity of these crops.

Banana productivity levels are substantially higher in Indonesia than in PNG. Domestic demand in Indonesia largely drives this distinction. With over half of the Indonesian population living in urban areas (over 150 million urban dwellers), there is a large domestic market for banana and very little is exported. The low productivity levels for banana in PNG reflect the low (domestic and export) commercial potential for the crop. Efforts to raise banana production and productivity levels in PNG would likely require close attention to developing export markets for PNG's bananas.

Indonesia is the third largest producer of cocoa globally but productivity levels are sub-optimal. Both Indonesia and PNG have similar constraints where poor crop management, old trees that need replacing, limited access to credit for cocoa farmers, and volatile prices for both cocoa beans and inputs result in significant gaps in cocoa yields (Fahmid et al. 2018). Similar constraints limit coffee production in both countries—a crop that is 90 percent produced by smallholders. Though Indonesia is the fourth largest coffee producer globally, coffee bean yields are comparable to those of coffee producers in PNG.

While PNG is among the top ten global producers of coconut, FAO coconut production estimates for PNG for 2019 are less than 10 percent those of Indonesia (FAO 2021). Again, Indonesian domestic demand for coconut drives considerable specialized processing of the crop into a range of food products. Because of this greater commercial potential, coconut producers in Indonesia, most of whom are smallholders, demand more productive varieties of coconut and information that will allow them to produce the crop most profitably. The higher productivity for copra in Indonesia reflects, at least in part, greater investment in agricultural research and extension service providers to meet the demands of smallholder farmers.

The domestic market for coconut products in PNG is much smaller and unlikely to provide the returns on public and private investments to improve productivity as compared to Indonesia. However, given that coconut is predominantly a smallholder crop (similar to coffee and cocoa) in PNG, targeted investments to raise coconut productivity levels would have a much greater direct welfare and poverty reduction impact than investments in crops that are less commonly produced by smallholders (e.g., oil palm).

Policies and strategies to increase agricultural productivity

As outlined in the Papua New Guinea Vision 2050, improved agricultural productivity as a development objective is anchored to the country's development plan as well as in both the 20-year and 5-year development plans. The National Agriculture Development Plan 2007-2016 (NADP), although now dated, remains the overarching statement of the priorities and strategies of the government of PNG for the development of the agricultural sector to achieve Vision 2050 (DAL 2007). In addition, a variety of other policy documents (described in more detail in the working paper) outline specific milestones and objectives for greater agricultural productivity, and improved food and nutrition security in PNG.

However, the majority of the policy documents focus on enhancing commercialized and cash crop agriculture. Only the NARI June 2021 draft of the Strategy and Results Framework for 2021 to 2030 clearly recognizes the need for substantially improved productivity across all agricultural sub-sectors – not cash crops alone – if PNG is to reach its ambitions for agricultural development and rural and national economic growth.

Based on the assessment of agricultural productivity in this study, investment in research and development and extension services for traditional staples have generally been neglected in PNG and Indonesia. This neglect hinders poverty reduction goals outlined in PNG government development strategy

documents. Increased productivity of these staples with parallel development of markets and staple crop value chain diversification should help to stabilize production and prices. The benefits of reliable production levels and, ideally, lower (and stable) prices for staples will result in improved consumption levels for poor households.

However, raising productivity levels is not solely an agricultural sector development challenge. Farm households make their cropping decisions based on their assessment of their household's livelihood needs and the expected return they will receive from each crop they produce. For many crops, smallholders' willingness to invest is linked to the profits they will realize at different levels of intensity. Farm households will raise their productivity levels if they are reasonably certain that they will realize higher benefits relative to the costs that they will incur to do so.

Assuming that opportunities to spur market demand are successfully implemented, extension services will be important to realizing greater staple and cash crop yields. Thus far, ***how*** agricultural extension services will be provided is an important gap in policy documents and investment efforts seeking to increase agriculture productivity levels in PNG. In addition, other public investments will be needed such as market support infrastructure, including improved market facilities, facilitated transportation, enhanced storage, and better-connected and utilized ICT services.

Finally, the challenges that farmers face in their crop production today are not necessarily the same challenges that they will face in the future. Consequently, agricultural research and advisory services across PNG must be alert and proactive to emerging production challenges. Climate change will introduce new production challenges, whether through changes in rainfall and temperature patterns or through increased incidence of pests and diseases (Crimp & Howden 2018). Continuous research and effective communication to farmers of improved techniques and technologies will be necessary to enable both smallholder and larger commercial farmers to sustainably and profitably manage diverse agriculture production risks.

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