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The U.S. Government's Global Hunger & Food Security Initiative

Food Security Policy Project Research Highlights
Myanmar

August 2017 *#7*

RURAL ECONOMIC SPILLOVERS FROM FISH FARMING AND AGRICULTURE IN THE AYEYARWADY DELTA

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INTRODUCTION

Aquaculture (fish farming) has been growing rapidly in Myanmar since 1990. Fish farms are concentrated in the Delta regions of Ayeyarwady and Yangon, where they cover an estimated 235,000 acres. Most fish farms in the Delta are in four townships - Maubin, Nyaungdon, Twantay and Kayan.

Aquaculture is a high value activity in comparison with the cultivation of paddy (Myanmar's most important crop in area terms). Average annual returns per acre from farming fish are several times higher than those from rice-based farming systems, but the productivity of fish farms in Myanmar still lags behind other countries in the region, leaving much room for future productivity growth.

Half of Myanmar's fish farms are small (below 10 acres in size), but these account for just 4% of total pond area. Conversely, 6% of farms are very large (sized 100 acres or more), and account for 60% of pond area. Two sets of laws are responsible for this highly concentrated "dualistic" farm structure (Belton et al., 2017a)

First, the predominance of large fish farms in Myanmar is explained by the history of its agricultural land use policy. From 1989 onwards, large scale fish farming was promoted by government as part of a wider policy to encourage industrial scale forms of agriculture. As a result, large areas of untitled "wasteland" were allocated to investors in what are now the main fish farming areas.

Second, the conversion of titled paddy land to any other use (including fish ponds) is heavily restricted. This regulation is intended to protect agricultural land and, thereby, national self-sufficiency in paddy cultivation. Moreover, to convert any type of agricultural land (paddy or non-paddy) to a non-agricultural use (including aquaculture) in a legally compliant manner, households must apply for and obtain a change of land use title. Obtaining this document is a complex, lengthy and costly process, and therefore a major barrier to entry to aquaculture for small farm households.

Beyond generating income for farming households, fish and crop farms are both embedded in value chains. These value chains support livelihoods in the areas where farms are located by creating opportunities for businesses that provide goods such as feeds and other production inputs, services such as transport, and jobs that generate wages for workers.

Workers, farmers, and owners of supporting enterprises in the value chain also spend their incomes on locally produced goods and services, causing money to circulate further through the local rural economy. These indirect "spillovers" can potentially reach and benefit large numbers of people.

Current government policy aims to promote greater diversity in agriculture in order to raise the incomes of farm households and agribusinesses (MOALI, 2017). Small-scale aquaculture has potential to contribute to this goal, but strict land use regulations currently inhibit smallholder fish pond expansion.

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With these factors in mind, we set out to estimate and compare the size of contributions to the rural economy (directly through farm incomes plus indirect spillovers) made by: (1) paddy-based agriculture; (2) small-scale aquaculture; and (3) large-scale aquaculture.

To estimate these contributions we built a Local Economy-wide Impact Evaluation (LEWIE) model of the main fish-farming townships in the Ayeyarwady Delta (See Figure 1). The model was calibrated using data from a representative survey of crop farming, fish farming and non-farm households.

The model shows that, compared to crop farming, aquaculture generates: (1) higher returns per acre of land; and (2) larger spillovers within the local economy. These spillovers particularly benefit landless wage workers. While small-scale fish farms are currently less productive than larger farms, they make more use of local inputs, especially labor from landless households, and generate spillovers on par with large farms. With targeted support, small-scale aquaculture could make important contributions to rural economic growth and poverty reduction.

These results suggest that policies recognizing and promoting the contributions of small fish farms to the rural economy could stimulate more inclusive rural development. But institutional support to smaller fish farms has historically been limited or non-existent.

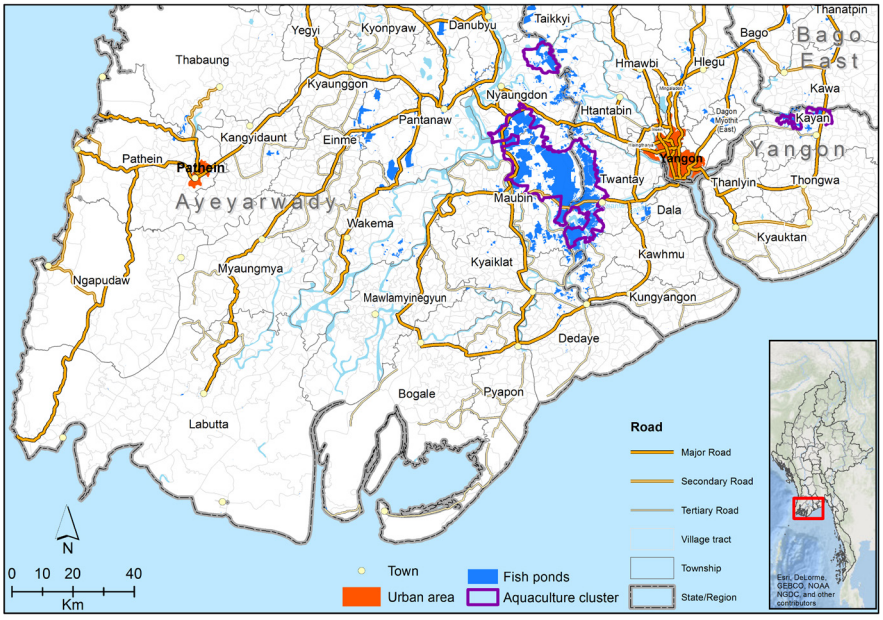
Based on these findings, we recommend a two-pronged strategy to promote rural economic growth and improve livelihoods: (1) allow and encourage the expansion of small fish farms - rather than large fish farms - by permitting smallholders freedom to farm land to which they possess use rights in any way that they choose; and (2) make investments that improve the efficiency of small fish farms to raise their productivity and profitability.

Data collection

All data used in this study originates from a household survey - the Myanmar Aquaculture-Agriculture Survey (MAAS) - implemented in May 2016. Data was collected from 25 village tracts with the highest densities of ponds in the Ayeyarwady, Yangon. Together with neighboring Bago, these regions are home to 90% of the area of freshwater fish ponds in Myanmar. These village tracts were identified from analysis of satellite photographs.

Selected areas encompass the majority of pond area in the Ayeyarwady Delta (Figure 1). A total of 242 fish farming households were surveyed, including 151 growout farms producing food fish for sale and 73 specialized nurseries producing juvenile fish "fingerlings" for sale to growout farms. One hundred and thirteen crop farming households and 347 non-farm (landless) households were also surveyed (full details available in Belton et al., 2017b).

Figure 1. Location of Ponds and Surveyed Village Tracts



Together, these 685 households form a statistically representative sample of the entire population of the surveyed village tracts (about 29,087 households), enabling us to estimate all economic spillovers from aquaculture and crop farming within the local economy in these locations.

Modelling aquaculture & agriculture

Data from MAAS were used to calibrate a Local Economy-wide Impact Evaluation (LEWIE) model of the economy of the 25 village tracts. LEWIE nests models of different types of household within a broader, general-equilibrium model of the cluster economy. Five types of household are distinguished in the model: small fish farms, large fish farms, specialized fish nurseries, crop farms, and non-farm (landless) households. The model depicts all the income-generating activities engaged in by these households and their sales inside and outside of the cluster, as well as the production inputs and consumption goods they purchase. The LEWIE model thus constitutes a complete, albeit simplified, picture of all economic activity in the areas surveyed.

We use the model to evaluate: (1) how aquaculture and agriculture compare in terms of their total impact on the economy; and (2) whether small fish farms and large fish farms impact the economy differently. To do this, we simulated increasing the area of land operated by different types of farm by one acre, and compared all of the (direct and indirect) incomes generated within the economy under each simulation.

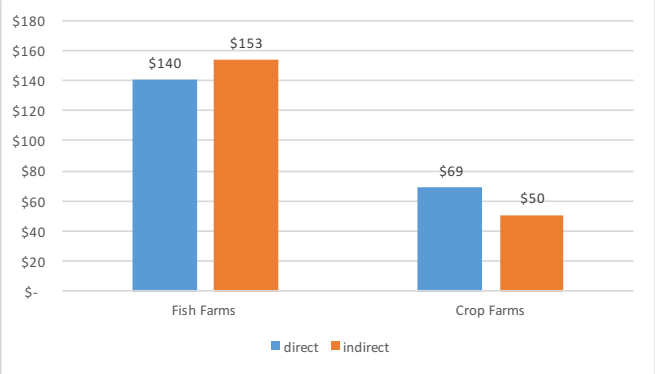
RESULTS

Aquaculture generates higher total returns per acre than agriculture.

The average aquaculture farm generates much higher income than the average agriculture farm, especially when taking into account spillovers (Figure 2). In our simulation, one additional acre of land used in aquaculture generates about $140 of income for the farmer (direct income), compared with $69 for crop farms.[1]

In addition, an acre in either of those activities generates indirect incomes that accrue to other households providing inputs and services for production by way of market linkages. Further spillovers arise through consumption expenditures: households with increased incomes generate demand for goods and services offered by local suppliers who, in turn, generate further rounds of spillovers to other such households.

Figure 2: Direct and indirect income generated in the economy from an acre of land: fish farms vs. crop farms



The total sum of indirect spillovers is also much larger (by three times) for aquaculture than agriculture ($153 vs. $50). Aquaculture generates larger spillovers because it is input-intensive and generates higher revenues than crop farming, resulting in larger production and consumption linkage effects.

Small fish farms create greater local spillovers than large

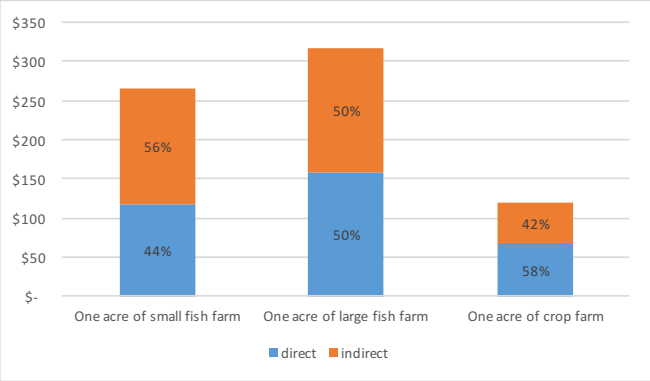
We divide growout farms into those sized 10 acres or less (small farms) and those over 10 acres (large farms). Large fish farms tend to be more productive than small farms: they obtain average yields of about 6.5 tons/acre whereas smaller farms yield on average 4.5 tons/acre. Yields on small farms are about 30% lower because they use their ponds less intensively. As a result, an acre of pond generates a somewhat lower total income in the economy (around $250) when operated by a small fish farm than when operated by a larger fish farm (around $300). Nevertheless, both small and large farms generate much higher total income per acre than crop farms.

[1] These values correspond to the marginal value product of land. Total factor productivity estimates of income are higher.

In addition to operating less intensively than large farms, smallholder fish farmers in the areas surveyed tend to use different technology. While small farms use cheap feed and rely on manual labor, larger farms use expensive industrial inputs and own more capital (boats, pumps, fishnets, etc.). Because small farms tend to use more local inputs, such as labor and locally-purchased feed, they also tend to generate larger spillovers in the local economy, relative to total income.

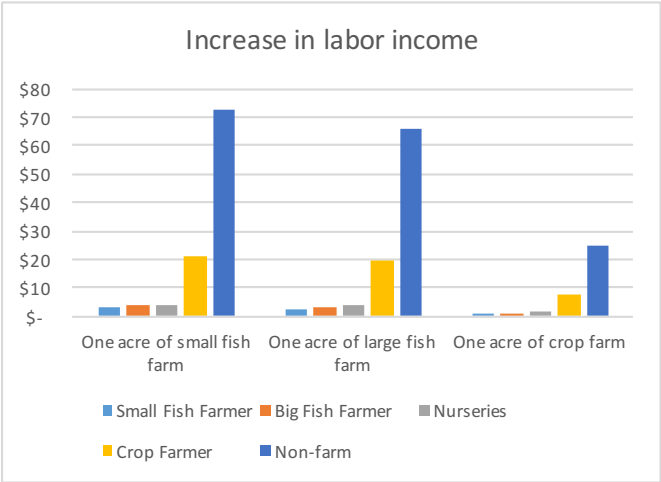
For small fish farms, 56% of the total revenue generated by an acre of pond is in the form of spillovers. Large fish farms generate spillover incomes of 50% (Figure 3).

Figure 3: Direct and indirect per acre incomes for small fish farms, large fish farms, and crop agriculture.



Even though small fish farms generate somewhat lower revenues per acre for the farmer, they generate more labor revenue in the economy than large fish farms. Importantly, most of these indirect benefits are captured by landless households – the poorest and most numerous group living in the areas surveyed (Figure 4).

Figure 4: Labor income in the economy generated by small fish farms, large fish farms, and crop agriculture.



Thus, while small fish farms are currently less productive than large, they generate greater relative spillovers in the rural economy. This suggests that supporting smallholder fish farm development – increasing numbers of smallholders and improving their efficiency - could stimulate more rapid and more inclusive rural economic growth.

Our work suggests two complementary pathways to achieve this result.

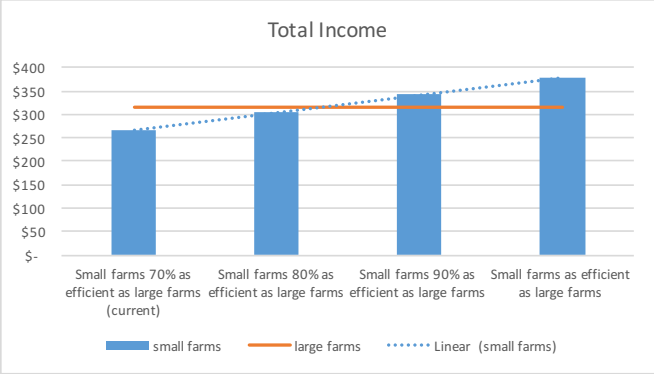
Unlocking smallholder potential and stimulating rural economic growth

Smallholder fish farms face constraints that prevent them from utilizing their ponds as efficiently as larger farms. Chief among those is lack of access to credit. As a result, the smallholder marginal value product of land is only 70% of larger fish farms. This leads us to ask how smallholder aquaculture might perform from an economy-wide perspective if smallholders were to increase the efficiency of their land use to levels comparable to larger farms.

Figure 5 shows the results of LEWIE model simulations, in which the smallholder fish farmer uses an acre of pond with increased efficiency, and reaches the same levels as large pond owners. These simula-

tions do not entail changing smallholder production technology, but rather assuming they are able to apply their current technology more intensively.[2]

Figure 5: Total income per acre of small fish farms at varying efficiencies of land use, compared to large fish farms



Simulation results suggests that if constraints are relaxed, smallholder fish farms are able to reach and surpass large farm levels of income per acre. Higher total incomes come from (1) higher yields per acre, as small-scale farmers tend to use their ponds more intensively if they have the resources to do so; and (2) higher spillover incomes in the economy, because small scale farmers make more purchases locally.

This finding suggests the need for a two-pronged strategy for rural growth based on the aquaculture sector: (1) promoting the expansion of small-scale aquaculture, and (2) removing constraints to efficiency, to enable existing small-scale fish farmers to maximize direct (and, more importantly from point of equity/poverty, indirect) income effects.

CONCLUSIONS

This study reveals that aquaculture is more profitable for fish farmers than crop farming, and generates large income spillovers for the local economy, thus presenting important opportunities for rural growth.

Furthermore, small-scale fish farms, while currently somewhat less productive than large farms overall, generate larger indirect spillover effects per acre of land. Viewed through an economywide lens, small-scale aquaculture has substantial potential to support smallholder livelihoods whilst creating large income spillovers that principally benefit landless households and raise rural incomes.

These findings imply that any aquaculture development strategy should focus on fish farms under 10 acre in size, rather than the large-scale farm development prioritized in the past. First, small-scale farmers should be empowered to use their ponds with maximum efficiency by, for instance, facilitating access to sources of credit and information. Second, regulations should be revised to allow smallholders the freedom of choose to construct ponds on any agricultural land to which they have use rights.

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[2] Simulations are performed by exogenously increasing pond holding of farmers by the rental value of one acre of land for large holders (MMK 200,000), or by an increasing fraction of that amount for small holders (from 70% to 100%).

FSP and this brief are made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents are the responsibility of the study authors, who are affiliated with Michigan State University, the Center for Economic and Social Development, and the International Food Policy Research Institute, and do not necessarily reflect the views of USAID or the United States Government. The brief was also supported with financial assistance from the Livelihoods and Food Security Trust Fund (LIFT), supported by Australia, Denmark, the European Union, France, Ireland, Italy, Luxembourg, the Netherlands, New Zealand, Sweden, Switzerland, the United Kingdom, the United States of America, and the Mitsubishi Corporation. We thank these donors for their kind contributions to improving the livelihoods and food security of rural people in Myanmar. We also thank Patricia Johannes for her editing and formatting assistance. The views expressed herein should in no way be taken to reflect the official opinion of any of the LIFT donors.

Published by the Department of Agricultural, Food, and Resource Economics, Michigan State University, Justin S. Morrill Hall of Agriculture, 446 West Circle Dr., Room 202, East Lansing, Michigan 48824