Linking Asia's Farmers to the Global Economy

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The world's population is estimated to peak at around nine billion in 2050, with almost half of the increase from 2009 (three billion) occurring in Asia. This will require a doubling of food production on a declining land area and natural resource base and in the context of increasing climate variability. At the same time, however, increasing urbanisation and the globalisation of food production are creating new opportunities for smallholder farmers in Asia to make a transition from subsistence agriculture to more-specialised production systems linked to commercial food production systems. Driving this transition will require increased investment in more-efficient and robust agricultural production technologies and a greater focus on enabling supply chain opportunities for small-scale farmers. In most countries in the region, government extension services have been unable to engage effectively with commercial supply chains. In several cases, the commercial sector is signaling demand for commodities from supply chains based on networks of small-scale producers. Using examples from the region, this paper highlights key issues that enhance smallholder competitiveness in these supply chains.

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Introduction

To meet the demands of a world population predicted to peak at nine billion by 2050, it is predicted that the world will need to increase annual food production by 70–100% over that same period. This is a complex challenge made all the more difficult in most developing countries by declining natural resources in existing agricultural land, limited new areas for agricultural production, increasing variability of weather cycles exposing farmers to widening risks, highly disaggregated production systems with inadequate supporting infrastructure and or services in many areas and a lack of supportive policies and financing. The required gains in food productivity (let alone nutrition) will need to come from sustainable intensification of agriculture ('producing more food from the same land area while reducing the environmental impacts') (Godfray *et al.* 2010). There is no shortage of promising technical options to underpin this intensification (such as more effective integration of cropping and livestock production systems, conservation agriculture, improved water and nutrient management, GM varieties, reduced post-harvest losses) but most of these options require investments of time, capital and knowledge that have been beyond the reach of many of smaller-scale farmers. There has been a consequent widespread trend for farm families to invest their limited cash resources in educating children so they can leave the land, resulting in an aging and decreasing rural population and a stagnation of agricultural productivity. Reliance on remittances from city-based offspring is a widespread phenomenon that underpins the survival of many rural communities. All of these factors mitigate against the emergence of smaller-

scale agriculture as a profitable business enterprise attractive to a new generation of farmers. In some cases, this is creating pressures for consolidation of smaller-scale farms into larger units that are more commercially viable, and while this may be beneficial in some regards long term, in the short to medium term it produces pressures that existing social safety nets cannot handle.

This somewhat bleak scenario for smaller-scale farmers is not necessarily an endgame. There is a growing number of examples where rapid globalisation of agrifood and agro-industry supply chains has driven large and profitable businesses to develop via (or catalyse) a network of smaller-scale producers. Prominent among these examples are (i) rice production in the major lowland areas of Vietnam, China and Thailand for international markets and (ii) vegetable production in small fields supplying the boom in supermarkets. In a paper on cassava supply chains in Vietnam, Nguyen and Cuna (2005) commented:

> Agrifood value chains have become the dominant force in the global food system, and one that presents both potential opportunities and threats for the poor. The question is not whether to participate but how to do so in way that best improves well being. The major threat is that the poor will be bypassed, or even harmed, by the development of these chains. At the same time, their involvement might offer real opportunities for sustainable livelihood improvement.

This paper summarises five cases of agro-industries and agrifood supply chains that rely on large networks of smaller-scale farmers and examines the factors that enhance (or are needed to maintain) the competitiveness of the farmers in those chains.

Case 1: Cocoa in eastern Indonesia

Indonesia is the third-largest producer of cocoa in the world with ~90% of the ~500 000 tonnes of dry cocoa beans produced each year coming from smaller-scale farmers. Around 500 000 farm households, with cocoa plots averaging 0.5–1.5 ha, are dependent on this global cocoa supply chain in which they receive at the farm gate more than 80% of world prices (Panlibuton and Meyer 2004). Cocoa contributes export earnings to Indonesia exceeding US$1.4 billion per year with steadily rising prices, doubling between 2006 and 2009.

The Indonesian cocoa industry developed in an ad hoc way through the 1980s when labourers returning from working on cocoa plantations in Malaysia started growing cocoa in their backyards at a time when cocoa prices were relatively high. During the first 20 years, this was a profitable livelihood as cocoa plots were relatively disease and pest free and soil fertility could sustain production with very low labour inputs. In recent years, however, increasing pest and disease pressure, aging tree stock and declining soil fertility are threatening the viability of cocoa production as a small-scale enterprise. Average dry bean yields of 400–800 kg ha^{-1} are as little as half the potential yields if these factors were controlled (Fig. 1). Estimated resulting annual production losses of 240 000 tonnes of dry beans equate to lost value to farmers of US$280 million per year or over roughly US$400 per year per farm family, a significant sum in a country where formal-sector workers receive an average salary of less than US$125 per month. Added to this are losses of as much as US$70 million per year from quality-related discounts. The net effect is that farmers are now achieving <60% of their potential economic returns from growing cocoa, while labour inputs needed to maintain present yields are increasing to levels beyond the capacity of many farm households.

The challenges facing the cocoa industry in eastern Indonesia are not dissimilar from other agro-industry supply chains linked into small-scale farmers: the production base is fragmented among a large number of producers and productivity constraints require investments of capital and access to knowledge and new technologies that

Figure 1. New disease- and pest-resistant varieties are an important driver of revitalisation of the cocoa industry in eastern Indonesia. (Photo: David Guest, University of Sydney)

are difficult for small-scale farmers to implement. Cocoa production is potentially a very profitable and productive enterprise for smaller-scale farmers if production constraints can be overcome. Five relatively simple and robust management practices have been identified that can largely eliminate the main productivity-limiting constraints: declining soil fertility, aging tree stock and increasing disease and pest pressures. Despite large training programs being implemented over the past ten years for up to 100 000 farmers, uptake has been very limited. A key issue limiting uptake is that the transition from low-input systems to managed, higher productivity systems is not simply a matter of demonstrating to farmers the economic benefits of the transition. There are risks in the transition (such as insecure land tenure), borne out of decades of experience among farmers that bad times follow good. A farming strategy based on reducing risk in the longer term is a sound survival strategy for subsistence agriculture, but it makes the process of transition towards a more-commercially oriented production system a much more cautious one.

In 2008, the Indonesian Government embarked on an ambitious US$340 million program to revitalise the cocoa sector in eastern Indonesia. A key driver for this revitalisation has been the development of new disease- and pest-resistant clones, but this in itself is not sufficient to revitalise the industry. It has been recognised (Neilson 2009) that the program will also need to:

- provide ongoing field support to farmers in making the transition to more-productive and sustainable systems
- implement pro-farmer policies
- involve commercial supply-chain participants in the revitalisation process
- implement innovative ways to improve farmers' access to financial service so they can invest in these new production systems.

Case 2: Cassava in Vietnam and Thailand[16]

Cassava is a relatively easy crop for smaller-scale producers to commercialise as they can make a gradual transition from growing cassava for home use to growing it for global markets, without changing the basic production systems. In that process of transition, if global markets are volatile or supply chains relatively new, farmers have other options, including using the cassava to feed their own animals or selling it in local markets. Over a period of 25 years, the cassava industries in Vietnam and Thailand have been transformed from being a backyard food crop grown by farmers as a safety-net should cereal crops fail to a major agro-industrial crop for the starch and animal feed industries (Figs 2, 3). Thailand and Vietnam are now the world's largest exporters of cassava products, earning Thailand about US$1.4 billion annually. In 2007, almost 2.1 million farmers in Vietnam and 0.5 million farmers in Thailand were growing cassava for these supply chains, all of it on relatively small farm areas (0.3 ha in Vietnam and 2.6 ha in Thailand) (Hoang *et al.* 2008a).

Figure 2. Farmers can make a gradual transition from growing cassava for home-use to growing it for global markets. (Photo: Neil Palmer, CIAT)

Figure 3. A doubling of cassava yields in the last 20 years has been due partly to widespread adoption of new varieties. (Photo: Neil Palmer, CIAT)

This remarkable transformation has been underpinned partly by improvements in yield and partly by increases in area. In 2008, cassava fresh root production in Vietnam was about 9.4 million tonnes, up from only 2.0 million tonnes in 2000.

[16] Much information in this case was provided by Dr Rod Lefroy (Centro Internacional de Agricultura Tropical; CIAT)

This was achieved through both a doubling of areas planted (from 240 000 ha in 2000 to 560 000 ha in 2008) and a doubling of average yields (from 8.4 t ha^{-1} in 2000 to 16.9 t ha^{-1} in 2008) (Hoang *et al*. 2008b). These yield increases have resulted partly from broad adoption of new, higher-yielding industrial varieties emerging from 25 years of breeding and selection (now >60% and almost 100% of areas planted in Vietnam and Thailand respectively are using new varieties). The transformation has also been driven by parallel investment in the commercial sector. In 1990, for example, there were no medium- or large-scale starch factories in Vietnam, but by 2008 there were 60 factories with a processing capacity of 3.2–4.8 million tons of fresh roots per year, all grown by smallholders (Hoang *et al.* 2008a).

As with the cocoa industry in Indonesia, the cassava industries in Vietnam and Thailand are facing problems associated with a history of ad hoc development, a production base fragmented among a large number of producers, and emerging serious productivity constraints that require capital, new knowledge and new technologies that are difficult for small-scale farmers to access or implement. In Vietnam, cassava supply chains generally lack coordination and have many layers of participants with low margins and low value-generation along the chains (Nguyen and Cuna 2005). This becomes a key impediment for an industry that has, until now, supplied bulk starch into a raw commodity market. Greater coordination of supply chains will be needed if the smaller-scale farmer production networks are to take advantage of emerging specialised markets which need cassava as a feedstock, in particular bioplastics and ethanol. In particular, policies that promote access to credit are needed for the smaller firms that coordinate these supply chains to survive (Goletti *et al.* 2001). There are also emerging challenges around sustaining productivity. The rapid expansion of cassava into new areas has often meant it is planted on sloping land and soils vulnerable to erosion and fertility decline. New potentially-devastating pests and diseases have just started to emerge in the region (CIAT 2010).

Case 3: Seaweed in eastern Indonesia

Indonesia is the world's largest producer of RAGS ('red alagal galactin seaweeds'), which are a source of hydrocolloids used in a wide range of processed foods. In 2007, Indonesia produced 2.1 million fresh tonnes of RAGS, about double the production of 2000 (McIlgorm and Dworjanyn 2008). World demand for RAGS is forecast to double between 2007 and 2012 (Neish 2007). Almost 90% of RAGS production in Indonesia comes from an estimated 500 000 small-scale producers in coastal communities of eastern Indonesia (Fig. 4). With the widespread and catastrophic decline of fish resources upon which coastal communities depend and with very few other options (especially for remote communities and households that do not own agricultural land), cultivating seaweed to produce a product for global markets is a vital livelihood option.

While the industry has a bright outlook, it has also suffered from recent wild fluctuations in prices and supply that threaten the viability of the producers. Contributing factors include poorly coordinated supply chains and lack of access to market information, declining yields at any location after a few years, and a lack of research support for improving the clones used in cultivation. Furthermore there is no value added at source, either by farmers or regional buyers, despite high potential. Dried whole seaweed is currently shipped from remote coastal communities to Java for processing. As the recovery of

Figure 4. A farmer drying seaweed on the roadside in South Sulawesi (Photo: Peter Horne)

carrageenan (a gum; the dominant product from RAGS in Indonesia) is <30% by volume, 70% of the seaweed is discarded. This not only contributes to very high transport costs per unit weight of seaweed (squeezing profitability for all supply-chain participants) but the 'waste' component has high concentrations of nutrients and plant growth promoters which are needed in the remote communities from which it came to sustain agricultural productivity. Households wishing to start farming seaweed also face substantial initial investment costs to buy necessary infrastructure and these costs are especially hard to meet in remote communities. For the industry to survive and meet predicted rising demand, producers need equitable access to financial services.

Case 4: Shrimp in Indonesia[17]

Coastal pond aquaculture in Indonesia, which is dominated by shrimp culture, employs around 480 000 farmers in an industry worth close to US$2 billion annually, largely for export. The production systems are dominated by small-scale producers. In South Sulawesi province, for example, with an estimated 60 000 producers, 46% are classified as small scale (<2 ha) and only 23% as large scale (5–10 ha). Two main species of shrimp are produced in these systems: the traditional tiger shrimp (*Penaeus monodon*), and the recently-introduced white shrimp (*Litopenaeus vannamei*). Tiger shrimp live on the pond floor so volumes and yields are relatively low but their management is relatively easy. White shrimp float throughout the pond, are more resistant to disease, have higher survival rates, tolerate higher stocking densities and grow faster but their management is relatively more intensive and requires larger investments in infrastructure and inputs (Yi *et al.* 2009). Despite the large numbers of small-scale farmers using 'extensive' or 'traditional' culture practices, their contribution to total production is only about 5% as they are facing an increasing array of challenges. The emergence of a viral disease affecting *P. monodon* production in the 1990s doubled harvest failure rates among small-scale producers to as high as 50% (Yi *et al.* 2009). Rising input costs and increasing competition and quality demands in the domestic and international markets compounded these problems. While improved management practices have been identified to control disease (including incorporating liming and cleansing, aquaculture rotations and polyculture, disease-free seedstock and isolation techniques), adoption by small-scale farmers has been very low. Adoption by these farmers is hindered by limited access to new knowledge and the costs and risks associated with significant upfront remediation investment. They are also less able to participate in the trend towards increasing production of *L. vannamei* (with its higher productivity and greater disease resistance) because this requires more-sophisticated management and greater inputs. Unlike some other agricultural systems (as with cassava), intensification of production from 'traditional' to semi-intensive systems is not a gradual pathway. Consequently, small-scale farmers will need to make significant and radical investments in both resources and skills to adjust to semi-intensive shrimp aquaculture. The net result 'is forced and chosen disadoption [of shrimp farming], … by small traditional farmers — who find feed costs too much in the face of dwindling yields due to *P. monodon* disease'. Yi *et al.* did conclude however, that 'From a poverty alleviation and small farmer income development viewpoint, the … most promising finding is the emergence of at least some small farmers who are capable of participating in modernizing supply chains. **The study's most worrying finding is that to 'play the modernising game', producers need both market sophistication and scale**. The study concludes that 'small shrimp farmers can participate in modernizing chains, and gain from that participation, by either entering into contract schemes or by starting cooperatives and by making investments in production and traceability capacity'.

Case 5: Cashew in Indonesia[18]

Cashew production occurs in some of the driest, remotest and poorest regions of eastern Indonesia and it is a significant source of livelihood for about 400 000 farmers. The crop is largely exported as nut in shell to India and Vietnam for processing, with total exports in 2005 worth about US$70 million. Cashew is in a sense a 'gathered bounty' for these farmers, providing them with a source of income for very low input. As a result of

[17] Much information in this case is from ACIAR Project FIS/2007/124: Diversification of smallholder coastal aquaculture in Indonesia (http://www.aciar.gov.au).

[18] Information in this case is from ACIAR report FR2008-13: *The Potential for Cashews in Eastern Indonesia*, by Ian Baker and Julian Witjaksono, February 2008 (http://www.aciar.gov.au/publication/FR2008-13).

the minimal management, cashew productivity is typically very low (<500 kg ha^{-1}) with returns to farmers of only US$250 ha^{-1}. The combination of high transport costs, low productivity, lack of local or even national processing and a fragmented production system mean that the margins for all participants in Indonesian cashew supply chains are tight. Without greater investments in productivity, supply chain coordination and local processing, it is hard to see how these farmers can remain competitive in a global market. Despite this challenging outlook, there are longer-term options for improving farmers' returns by 200–300% (through simple orchard management and use of higher-yielding varieties with larger kernels) and for adding value through local processing of nut-in-shell. This will require substantial investments in research on new clones and both government and private-sector support for major industry revitalisation.

Challenges for competing in rapidly changing markets

The cases described above illustrate some of the challenges that smaller-scale producers currently face to be able to compete in a rapidly changing and globalising market environment. Figure 5 illustrates these changes in terms of two key factors that influence these farmers' decisions about the transformations their production systems are facing: **labour demand** and **investment demand**. Figure 1 positions each case on a scale of these two factors with a broad trend from top left to bottom right (as indicated by the arrow) as these production systems **transform** and become more market-engaged and aligned. Production systems towards the left of Figure 1 tend to be disconnected from technical services, business support services, financing mechanisms and markets, whereas those on the right are more connected. This broad trend of transformation of production systems linked to large numbers of smaller-scale farmers involves a transition from ad hoc or opportunistic production systems (as is the case with cashew in Indonesia) to planned and production-oriented systems (as is happening with shrimp production in Indonesia).

The transformations that have taken place in the first four cases involved substantial risks to smaller-scale producers that continue to limit the extent to which they can take advantage of growing opportunities in the global economy. These include risks associated with:

Figure 5. Current labour and investment intensity for five case studies (the arrow indicates the general trend of transformation affecting these industries)

Sustainability

Moving towards a greater alignment with market opportunities encourages a focus on optimising yields and quality, sometimes at the cost of accelerating decline of the natural resource base (as in the case of cassava expanding onto sloping lands in Thailand and Vietnam). Intensification without sustainability is threatening several of the supply chains described above.

Specialisation

Diversification of agriculture is a common strategy for minimising exposure of farm households to economic, climatic and political risks in smaller-scale farming systems. Transformation in these agro-industries has necessitated a degree of specialisation that brings with it exposure to a level of risk that may not be perceived by farmers at the time. So, for example, when coffee prices peaked in the early 1990s, thousands of poorer farmers in the central highlands of Vietnam converted all of their land to coffee, despite the fact that they were on sandy soils and without access to irrigation water. When coffee prices fell in 1999 to 25% of their former levels, these marginal farmers were extremely vulnerable, having removed all of their other crops (Connell *et al.* in press).

Transition from self-sufficiency to a market focus

Making the transition from a focus on self-sufficiency to a focus on production for market is not a simple process driven by farmers'

analysis of economic costs and benefits. In some cases, farmers will take great risks in planting large areas to a new crop on a promise made by buyers that they will return to buy all production. On the other hand, tens of thousands of cocoa farmers in Indonesia have consciously chosen not to adopt new technologies for good reasons, such as low returns to labor and lack of access to credit — despite the fact that these technologies are robust, simple and capable of doubling yields. Cattle raisers throughout South-East Asia routinely receive prices for their animals (per kilogram liveweight) between 150 and 200% of those received by farmers in developed countries, and yet uptake of management practices that can increase growth rates by 50% is generally slow. **Sustained transition to a market orientation is most common when driven by reliable and well-coordinated supply chains**.

Access to key resources

For many (such as most cashew farmers in eastern Indonesia and shrimp farmers in South Sulawesi), the transition to greater market alignment may be beyond reach simply because of lack of easy and cheap access to key resources needed to underpin sustainable intensification of production including technical inputs, knowledge, finance, infrastructure, a supportive business environment and markets.

Despite these challenges, smaller-scale producers are able to compete very effectively in some regional and global supply chains because of specific conditions in those supply chains that favour smaller-scale production, including:

Economies of scale

Some supply chains require labour-intensive inputs and yet are not necessarily suited to commercial or plantation scale (e.g. seaweed in Indonesia). Plantation or nucleus estate systems tend to emerge when there are economies of scale, such as needing minimum feedstock supplies before processing mills can be established (e.g. oil palm and rubber). In the case of cassava in Vietnam, plantation approaches did not emerge partly because of disaggregated land systems but also smaller-scale producers could access starch processing micro-enterprises or sell their dried cassava for animal feed.

Market opportunities targeted at smaller-scale producers

Niche markets are growing that favour specific smaller-scale production systems, such as organic and fair-trade coffee, and organic vegetables. Supermarkets are also presenting a rapidly growing opportunity for farmers in Asia, and while the access requirements for small-scale producers may be prohibitive (such as food safety, quality, processing and packaging), some factors do open market access opportunities. These include:

- larger farmers may have broader marketing options making them a riskier sourcing choice for supermarkets
- smaller-scale farmers may be better able to implement rigorous and labour-intensive management practices required by the market
- smaller-scale farmers may be able to reduce the transaction costs to companies by forming effective cooperatives
- larger companies may prefer to provide inputs directly to smaller-scale producers in managed supply chains to guarantee supply and quality (Reardon *et al.* 2009).

Market segregation

With growing urbanisation and the emergence of a larger middle class in many Asian countries, there are opportunities for market segregation providing access for smaller-scale producers to specific markets. For example, rising incomes and increasing awareness of the health benefits of milk in Indonesia are expected to increase demand between 2009 and 2013 by 17.1% for fresh milk and 22.5% for milk powder. Consumption growth of fresh milk in non-urban areas is limited by poor infrastructure and access to refrigeration. These constraints mean that fresh milk is still unavailable in large parts of the country. Other forms of milk, such as powdered and sweetened condensed milk, are however popular in Indonesia especially outside the main population centres as they are easier to transport and are less perishable (BMI 2009). In response to these demand patterns, Indonesian milk production is characterised by segregated supply chains: tightly managed supply chains feeding fresh milk from processors' own farms into the high-end urban fresh milk market, and outgrower supply chains

procuring milk from ~100 000 small-scale dairy farmers for the more-processed products going to the larger mass market (DA 2005).

Land disaggregation

Many supply chains that are linked in to large numbers of smaller-scale producers may exist largely because of heavily-disaggregated land ownership in the key production areas (e.g. cocoa in Indonesia and cassava in Vietnam). In many cases, however, this is not a recipe for success but simply the pathway along which particular supply chains have developed. The problems associated with heavily disaggregated supply chains have been illustrated in the cases above.

Conclusions

The case studies presented in this paper reinforce the view of von Braun and Diaz-Bonilla (2008) that:

> Technological progress, improvements in infrastructure, and the creation of markets are facilitating the commercialization of traditional agriculture, but globalization—and trade liberalization in particular—produces both winners and losers among smallholders. The winners have been smallholders who have either vertically integrated with agribusinesses or have devised institutional mechanisms (such as associations) for collective action. Also, smallholders who have access to better physical infrastructure and credit and who have benefited from capacity-building activities implemented by the public sector, private industry, or international cooperation have managed to integrate successfully. The losers have been farmers who are poorly endowed in terms of natural resources, assets, and infrastructure; who lack access to markets for outputs, inputs, and land, as well as financial services such as credit and insurance; and who have limited alternatives for off-farm employment.

For some agrifood industries (such as shrimp in Indonesia), the best option for the 'losers' may well be to diversify into other production systems. In other cases, however, there is a positive and promising role for governments, donors and R&D agencies to improve the competitiveness, sustainability and viability of farmers in global agro-industry and agrifood supply chains through:

- improving access to the technical inputs, technical and market information, innovative and equitable financing mechanisms (such as warehouse receipting), infrastructure and markets that are needed to bring about sustainable intensification of production
- implementing policies that provide a supportive financial and business environment
- research to overcome constraints to the levels of productivity that could be easily achieved using existing technologies, management systems and varieties
- supporting farmer alliances and organisations for group marketing of products and purchasing of inputs and development of stronger managerial skills
- supporting agricultural intensification that sustains the natural resource base of the farming system
- market incentives that make an easier transition for smaller-scale producers to move towards more-profitable agricultural enterprises
- encouraging improved environmental and social standards
- working within alliances of public-sector organisations, the commercial sector, research agencies, NGOs and farmers' groups to coordinate efforts to create coordinated, profitable and sustainable supply chains.

These suggestions may seem ambitious and yet, in the first four cases presented above, elements of all these points are being implemented by different supply chain participants and R&D agencies. The major challenge is coordinating these efforts between disparate stakeholders who may not normally work together. An example where this challenge is being addressed is the Cocoa Sustainability Partnership (CSP) in Indonesia (http://www.cspindonesia.org) (Neilson 2009). CSP joins together Hasanuddin University, the Indonesian Cocoa Industry Association, several major international buyers and processors, the Indonesian Cocoa and Coffee Research Institute, the Indonesian Cocoa Industry Association, provincial research and extension agencies, several NGOs and international R&D agencies to guide the development of a sustainable and competitive national cocoa industry. It is an approach with wider potential application throughout the Asian region.

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