# The Transformation of Rice Value Chains in Bangladesh and India: Implications for Food Security

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## 1. Introduction

Spurred by the food crisis in 2008, Governments and multilateral institutions in Asia called for upgrading the food value chains in the region. At the same time, there was little hard data on how domestic staples value chains are structured and performing. To that end, ADB commissioned the International Food Policy Research Institute to collaborate with research institutions in the region on a detailed study of rice and potato value chains. The study comprised a survey in 2009–2010 (with recall of selected variables over 5 and 10 years). The study was conducted in six zones (two in each economy, one being the area studied for potato and the other, the area studied for rice). About 3,500 farmers, traders, millers, cold storage facilities, and modern and traditional retailers were surveyed. The results for the PRC, India, and Bangladesh are reported in the book "The Quiet Revolution in Staple Food Value Chains in Asia: Enter the Dragon, the Elephant, and the Tiger," forthcoming as a publication (Reardon, Chen, and Minten, 2012) of the Asian Development Bank in November 2012. Rice and potato value chains in each of the three economies studied were transforming, albeit at different speeds. Thus, the book's title uses three emblems: the dragon for the PRC, the elephant for India, and the tiger for Bangladesh. All three are large economies with a powerful impact on the emerging world food economy of the 21st century. The main findings concerning rice value chains in Bangladesh and India are summarized in this paper.

Three questions are addressed in the research: (1) Are staples value chains transforming structurally? (2) Is the conduct of staple value chains' actors' transforming? (3) Is the performance of staples value chains leading to the inclusion of small-scale farmers, small-scale midstream actors, and workers, and leading (all else being equal) to lower food costs for consumers?

In addressing these questions, the focus of the paper and the research is on: (1) while international trade is important, we focus on domestic value chains, as they purvey 98% of the rice and other staples in the region[1]; (2) the "market catchment areas" within 8–10 hours of the capital cities, Delhi, and Dhaka, to understand the rural–urban staple value chains feeding the cities of South Asia (urban areas constitute roughly two-thirds to three-quarters of food demand in the Asian region); (3) private sector action in input supply, farming, processing, storing, trading, and retailing, because the private sector (traditional and modern) is the most important direct actor in staple value chains in the region; (4) the impact of policies and government market

[1] External rice trade was a very minor part of both rice economies studied, which were basically self-sufficient in rice. With some modest yearly fluctuations, about 2% of rice consumption in Bangladesh was imported in the 2000s. India exported on average 4.6% of its rice output during the CYs (crop years) 2001/02–2008/09. India's rice imports had been negligible (less than 1% of total rice consumption in any year since 1990). That very little rice was externally traded by any of the economies studied justifies the focus on the domestic market as the rice value chain's end point.

actions (such as buying output and selling inputs) on value chain transformation; and (5) the implications of the findings for domestic market development policies.

By way of a basis for comparison and identification of the current transformation underway, we note that the traditional rice value chains are perceived in conventional wisdom (that was set in place in important works in the 1960s/1970s such as Lele (1971), as: (1) geographically short (with a heavy component of subsistence and orientation to local rural markets); (2) intermediationally long (with many "hands" or actors between the farmer and consumers); (3) with each segment of the chain highly fragmented and dominated by small-scale actors; and (4) with each segment's conduct characterized by use of traditional technology and commercial practices; and (5) a prevalence of tied-credit-output market relations between farmers and village traders. This conventional image paints a picture of inefficient and static chains, forcing farmers into relations with few options, and consumers into purchasing from costly supply chains.

By contrast, we found changes in the staples value chains that make today's staple value chains very different from the above traditional image. The changes involve an important transformation that is a modern revolution with modern retailing starting in market staples retail markets by modern retail change. It is also, and in South Asia so far mainly, a quiet revolution in traditional value chains for two reasons. First, compared with the rise of modern chains of supermarkets, the avalanche of foreign direct investment (FDI) in processing, and changes in world food trading systems, the changes that are transforming traditional staples chains tend to be in the midstream, among traders, mills, and cold storage facilities. These midstream changes are like the more visible and debated downstream modernization in that they involve consolidation and technological and organizational change in the segments, but they are unlike the modern food revolution in two ways beyond being in the midstream: they are generally not spurred by FDI, and they generally involve investments by small and medium midstream firms. Second, the midstream changes are "quiet" because they are grassroots in nature and are as yet generally unrecognized and their importance is underappreciated, especially in policy circles.

This paper summarizes the main findings and draws implications as to governments' roles in facilitating desirable transformations. The chapter notes the development strategies and policy paths that are likely to help economies to further transform their staples value chains so as to pursue growth, reduce poverty, and enhance food security.

## 2. Survey Methods and Data

This section sets out the survey methods and sample for the entire study on which the book is based (Bangladesh, India, and Bangladesh).

First, "rapid reconnaissance" studies were done for each of the six value chains (two for rice and two for potato in each economy). This consisted of interviews with representative types of actors in each segment of each value chain, plus academics, policy makers, and private sector associations. The literature pertaining to rice and potatoes in each economy was also reviewed.

Moreover, and importantly, the survey data eventually were found to contradict many of the assertions of the key informants, whom the authors found were repeating "conventional wisdom"

and partial perceptions. A striking example is that, although many experts and key informants noted that "tied credit" (trader's credit to farmers in return for a guarantee that the farmer would provide the crop to the trader) was still very common, the surveys showed it was actually very uncommon in the zones studied. Thus, surveys are essential to provide a good base for policy-making information.

Second, based on the broad picture emerging from the rapid reconnaissance, detailed structured questionnaires were formulated. These questionnaires were pretested and then modified about half a dozen times prior to the actual survey. They were then administered in surveys by enumerators who read the questions individually to respondents and noted the responses. No government officials or other people accompanied the interviewers, so no outside influence was introduced into the interviews.

Third, samples were tested in the rural and urban areas of each zone. This gave rise to a sample of about 3,500 farmers, traders, mills, cold storage facilities (CSFs) with potato, and traditional and modern retailers in the three economies on which this book focuses. The details of the sampling methods and samples are presented in the Appendix to this chapter. In general the study used a stratified random sampling method for every segment: the authors typically stratified by geographic area using reasoned sampling (based on the quantitative importance of the zone for supply to the capital cities, and then the choice of villages and markets in the zones based on their quantitative importance in supply). Then the authors generally sampled randomly within a given universe; in some cases, where there was a highly unequal set of actors, they were further stratified by category, such as smaller and larger farmers in the Indian and Bangladesh potato and rice areas; however, in the analysis, the shares of these groups were weighted in the population (as discerned by the study's census of each area) so that the reported figures are unbiased and representative.

The authors call the method used the "stacked survey method," as it entails a full sample survey at every level of the value chain, and so can statistically study differences across actor scales for each segment (each stage represented by sets of actors, such as farmers, processors, and traders) of the value chain. Some of the surveys of specific segments are unique or have rarely been done, such as the surveys of postharvest segments, mills, CSFs, traders, and (especially) of traditional retailers and supermarkets. No comparable survey-based study of staples value chains in Asia is evident in the literature.

In addition, the data were collected mainly in 2009 and the first half of 2010 using questionnaires that asked the interviewees to recall information over the year before the survey; for several key variables, a 5- or 10-year recall was also requested, but in general the survey's questions are for the year before the survey, and thus the viewpoint is mainly a snapshot of short-term change and cross-section comparisons.

The survey questionnaires in general asked the actors four categories of questions:

(1) characteristics of the actor, in particular, the types of assets held (human capital such as education, social and organizational capital such as membership in associations and cooperatives, and physical capital such as holdings of equipment and land and vehicles);

(2) purchase of factor inputs (labor and external nonlabor inputs such as fertilizer and fuel) and intermediate inputs (such as the inventory bought by a trader), in terms of costs, geographic origins, supplier types, value-chain finance, quality attributes, and any contractual relations;

(3) value addition using the inputs plus technology to produce outputs, such as production of rice and potatoes, delivery and marketing of products, cold storage, and so on; and

(4) marketing of the outputs (in terms of prices received, geographic destinations, and buyer types, as well as value-chain finance, quality attributes, contractual relations, and labeling/branding).

## 3. Overview of Changes in the Rice Value Chain in Bangladesh and India

The overall findings are that value chains in rice in Bangladesh and India are transforming rapidly, and that modernized or disintermediated value chains coexist with, while apparently displacing, the traditional value chains.

In general, the rice value chains can be grouped into four types, varying in terms of geographical length (the physical distance from farm to retailer) and by intermediational length (the number of steps from farm to retailer measured in the number of agents intermediating between them).

For the rice value chains in the zones studied (from Noagoan to Dhaka and Shahjahanpur to Delhi), the four types of value chains are as follows:

(1) The most traditional rice value chain, contained in the rural area, is "geographically and intermediationally short" and is the local supply chain of paddy grown by the farmer, dehusked in a local village mill, and consumed by the farm household or sold to the local village market for local consumption.

(2) The rural–urban traditional rice value chain is "geographically long and intermediationally long" and features sale of paddy to local brokers (village traders) who sell it as paddy or have it milled in village mills, which sell it to rural wholesale markets, where wholesalers from the cities buy it. The rice is then sold to semi-wholesalers (who sold to retailers) and/or traditional retailers.

(3) The intermediate (or transitional) rice value chain, which is "geographically long and intermediationally medium," entails the rice farmer selling paddy directly to mills. The mills then sell rice to city wholesale market traders, or sell paddy to rural or city wholesale market traders who have it milled and then sell the rice on the city wholesale market. At the city wholesale market, traditional retailers buy the rice directly.

(4) The modern rice value chain is "geographically long and intermediationally short," with the farmer selling paddy directly to mills that then sell rice to supermarkets and/or urban wholesale markets to sell on to supermarkets and traditional urban retailers.

The surveys showed that in the Bangladesh study value chain (Noagoan to Dhaka), the rural–urban traditional value chain still dominated, but the intermediate (or transitional) value chain was emerging quickly, with direct sales to mills. In India (Shahjahanpur to Delhi), the intermediate (or transitional) value chain strongly dominated, with the continued use of village traders and rural wholesale markets upstream, but direct sale from mills to urban traders downstream. The most traditional value chain no longer had a significant presence—in fact, it had a very minor presence—in both of the study zones.

## 4. Key Findings Regarding the Transformation of each Segment of the Rice Value Chain

### 4.1. The Rice Farm Segment

The study's key findings punch significant holes in the general view of Asia's staple farmers as "traditional," and of input and output markets as underdeveloped and static. Instead, the findings paint a picture of change and development in rice farming and the input and output markets that serve it. The key points are as follows.

(a) Contrary to the extant image of Asian farmers on millions of tiny farms, farm land sizes varied substantially, and there was evidence of land concentration (that is, in the larger farms) particularly in the western-central Uttar Pradesh zone. For example, across Uttar Pradesh, only 25% of the farms were medium- and large-scale, but they had about 66% of the land.

(b) Moreover, land rental markets were developing rapidly in all three economies, but were most advanced in the Indian study zone (west-central Uttar Pradesh). In the latter, the rented land share was 26% in 2009 (versus only 8% in 2004).

(c) Within and across zones, farmers' possession of nonland assets (livestock, farm equipment, and irrigation) was substantially heterogeneous. Larger farms typically had more farm equipment (a substitute for labor), but somewhat less livestock (which is closely related to the livelihoods of the smaller, poor farmers who rely somewhat more on dairy).

(d) Specifically for the subset of farm traction machine assets (tractors, power tillers, and animal traction equipment), Between the two countries, the average holdings of these machines was similar per hectare: the traction machine/land ratio in Bangladesh was about $90/2.4 ha, or $38/ha (taking into account the two seasons) and in India it was $210/5.4, or $39/ha. But over strata the holdings differed a lot: the ratio (upper land stratum divided by lower) of machine holdings was 4.6:1 for Bangladesh and was very high for India (as no farms in the smallest stratum owned machines). However, the differences across farm size strata in terms of traction machine holdings masks an important point: while only a few farmers in the Bangladesh sample, and about half of the samples in India owned tractors, power tillers, or animal traction equipment, nearly all farmers, regardless of size stratum, used farm traction machines. This points to a very well-developed market for farm machine rental in both economies.

e) A surprising finding is that, in Bangladesh but especially in India, tube well owners (larger farmers) sold a lot of water to small farmers who did not own tube wells. Tube well ownership

was especially skewed toward medium and large farmers in India, and thus so is the distribution of subsidies supporting that ownership.

(f) The farmers were engaged in substantial amounts of rural nonfarm employment, somewhat in Bangladesh but especially in the India study zone. Local off-farm employment was far more common than migration for employment. That rural nonfarm employment was a major source of cash may help to explain why credit and output markets were no longer "tied" in these areas.

(g) The study found very broad participation in seed, fertilizer, and pesticide and herbicide markets among the farmers in all the zones. In nearly all cases, the smallest farmers were participating as fully as, and sometimes more than, the larger farmers. It appears that the rapid rise in use of herbicide is correlated with pressure on labor costs from the developing off-farm labor markets.

The state played a minor role in these markets in terms of direct sale of inputs. In the input markets, governments were involved only in a few areas (for rice seed, 25% of farmer purchases in Bangladesh but less than 5% for Indian farmers; for fertilizer, very little for Bangladesh farmers but 28% in India. Importantly, the great majority of the subsidized fertilizer sales went to medium/large farmers – not marginal/small farmers.

(h) The study found an increased quality of output over the past decade in the study zones, especially in Bangladesh, with variety change and quality upgrading, with a rapid shift to medium from coarse grade rice in Bangladesh. However, the price premium for this higher quality represented a minor price differential for Bangladesh rice farmers – while the differential was much greater in the midstream and downstream segments – implying that the millers, wholesalers, and retailers captured the quality differential in the growing market for higher quality rice, while the farmers did not.

(i) Rather than mainly subsistence or even semi-subsistence farmers, the great majority of the farmers are small commercial farmers. Farmers' marketed surplus rates were found to be high (above 80-90%) overall; even the marginal and small farmers in these zones were really small-scale commercial farmers—with staples as cash crops. Only the marginal farmers in Bangladesh had a substantial home consumption rate (43%), and thus could be termed semi-subsistence, but still sold more than half their rice.

(j) The structure of local rice markets has changed a lot since the traditional situation painted in Lele (1971) where village traders were dominant and seen even as in monopsonistic competition. Rice value chains in most of the study zones appeared to be shifting from traditional to an intermediate stage, with a decline in the role of the traditional rural middleman or village trader and the rise of direct sales from farmers to mills and wholesale markets. This means an incipient disintermediation of the value chain. The study found first, that the role of the village trader had become minor, with only 7% of farms and sales in Bangladesh and 38% of farms and 18% of sales in India. The marked difference between shares of farms and sales in India is because smaller farmers tended to use village traders much more than did the larger farmers. (Due to their small lots, the small-scale farmers sold to local traders who collected the produce, rather than having to deliver to the larger traders.) Second, by contrast, in South Asia, the wholesaler's role

(mainly at the wholesale market but also, in a minor way, at the mill) was far greater, buying directly from the farmer: in both Bangladesh and India, farmers sold about 63% of their paddy to wholesalers. Third, incipiently in Bangladesh, but not yet in India, farmers were bypassing middlemen and selling directly to mills. Of all paddy sold, 30% was sold directly to mills in Bangladesh, and 5% in India. The latter limited result is probably due to the continuation of the APMC Act in force in Uttar Pradesh, limiting market transformation.

(k) Whereas the traditional literature on grain markets in South Asia emphasizes (rightly, in a historical context) the linkage between credit and output markets, in which traders "tie" output transactions to their advancing credit to farmers, the study found this is currently rare. Nonfarm income, mobile phones, multiple trading sites, better roads, and other forms of credit had undermined this tie over time. This implies that the traditional image of farmers tied to rapacious village traders cum moneylenders is now outmoded.

### 4.2. Key Findings regarding the Midstream Segments (Mills and Domestic Traders)

a) There have been significant structural and organizational changes in the mill segment. Rice milling was becoming more concentrated in the medium and large mills (with a rapid decline in small village mills, especially in India. The mill technology has also been changing (toward semi-automatic and automatic mills) in both countries. The improvements in the midstream segments of the rice value chain were largely private sector initiatives. Private milling and trading firms had made large investments in capacity expansion, new technology, logistics, and services to farmers. Yet the findings and the reasons behind them suggest that the government had played an important enabling role, as for example when the Indian government "de-reserved" the mill sector in 1998. Other measures directly facilitated change, such as the major improvements in roads and other infrastructure in the last 10–15 years.

b) The survey showed evidence (as noted above) of disintermediation upstream, with the traditional role of the village trader being reduced, wholesale markets sourcing paddy directly from farmers, and increased direct sourcing by the mills from farmers. Moreover, disintermediation was also evident downstream, with mills selling directly to wholesale markets in the big cities.

c) The conduct of the rice value chain was changing quickly, especially in Bangladesh, where mills and wholesalers representing mills, have begun selling branded, labeled bags to retailers. This was introducing traceability in the rice value chain.

d) Moreover, as noted in the farm section, whereas in South Asia the traders used to provide advances to farmers in the form of "tied credit," this practice had nearly disappeared in both countries. The change appears to be due to farmers' improved options for selecting buyers, taking credit, and accessing other forms of cash.

e) Government played only a small direct role as supplier to or buyer from mills in Bangladesh, but in India, it remained a major player, as a client (via the levy system) of mills, required in Uttar Pradesh to provide 60% of their rice output to the government; we found they sell 59%.

f) Mill and especially trader profits were found to be fairly high, although in line with some prior research findings. The high profit rates can reflect the risky nature of the trading enterprise, and possibly some local market power. An outlier was the case of rice trading in Delhi, with especially high profits. The high profits in general may have been related to the high investment required to be in rice milling and trading. In particular instances, the profits may have been related to policies such as the market licensing and entry restrictions in India.

### 4.3. Key Findings regarding the Downstream (Rice Retail) Segment

a) Traditional rice retail, as revealed by the detailed survey in South Asia, was somewhat different from the images and assumptions normally associated with it. Traditional rice retail was evolving in ways that pointed toward greater quality differentiation, packaging, and brand development. Our study showed that this has initiated in Bangladesh but barely so in India; not reported here is that this has proceeded quickly and earlier in the PRC. Given these incipient changes, it is probable that (mill and/or modern retail chain) branding and the resulting traceability will be significant factors in the development of rice markets in urban Asia, and will probably also encourage continued consolidation in the mill and trader sector. Further, traditional retailers provided very little value-chain finance (by letting customers buy on credit), and they tended to do little home delivery in Dhaka and Delhi.

b) Modern retailing has started to penetrate rice markets in Dhaka (with less than 1% of the market) and Delhi (with about 7% of the urban rice market). The latter seems small, but is surprising given that about 80% of supermarket growth in Delhi had occurred in just the three years before the survey in 2009. While supermarkets still charged more for rice in Dhaka, already in Delhi, controlling for the type of rice, supermarkets charged less than did traditional retailers. Moreover, supermarkets sold a greater variety of rice to appeal to quality differentiation needs and desires of consumers with increasing incomes (although this is more developed in the China case).

c) The government had little direct role in rice retailing in Bangladesh, but did (modestly) in urban India, where it had about 15% of urban rice retail (about twice that of modern private retail). The government did not appear to have a comparative advantage in retailing rice. A large share of Indian public system shops was not open during store hours, corroborating the findings in the literature of inefficiency and low access by consumers to the subsidized retail.

d) To date, foreign direct investment in retail has not played a significant role in Bangladesh and India. This may start to change quickly with the liberalization by the central government of India, in September 2012, of FDI in multi-brand retail.

## 5. Key Findings regarding overview of margins and costs along the segments of the rice VC

An overview of the distribution of costs and rewards in the rice value chains in Bangladesh and India, and the composition of the costs, gave rise to several salient points.

a) Rice farmers in Bangladesh and India captured roughly two-thirds of the final (urban retail) price in the rice value chain. That share varied by quality of rice. Farmers in Bangladesh captured least the differential between fine and common rice (and had a higher share in the value

chain for common rice than for fine rice). The differential for the farmers in the India zone was very slight and the gains were shared fairly equally across the value chain segments in India.

b) The largest single component of rice value chain costs was farm-level external inputs (other than labor), at roughly a third in both countries. Therefore improving the efficiency with which inputs are delivered and used could have a significant effect on the rice value chain.

Hired labor was about a third of value chain costs in Bangladesh and India. Developments in the nonfarm labor market could put upward pressure on rice prices over time unless both countries continue to mechanize their farms.

c) The share of the off-farm components in total margins of the value chain was roughly 35% in both India and Bangladesh.

d) While market fees have figured mightily in food security debates, in particular in India, their impact in the rice value chains was slight (less than 1% effect on final price).

e) Energy costs were important in the rice value chain, at the farm level in mechanization, and intensively so in the mill and trading segments of the two economies. Thus, energy shocks can translate into higher rice prices.

f) Transport costs as a share of rice prices were modest in Bangladesh and India mainly because the chains were relatively short. However, transport costs per ton per kilometer in the South Asian countries were twice as high as in the PRC.

## 6. Conclusions and Implications for Food Security

The survey has shown that rice value chains are transforming in Bangladesh and India. The main elements of the transformation are as follows:

a) Rice value chains in both countries have begun to "geographically lengthen" and "intermediationally shorten." This has involved an orientation from subsistence to commercial agriculture in these zones near large cities, from selling to local final consumers toward selling to the big cities, and from selling to village traders to selling to wholesale market traders and mills.

b) Farmers capture about 60% of the final urban retail price of rice; this can be compared to about 23% in the US in 1998 and 37% in 1980 (Elitzak 1999), but it can also be compared to a much higher share of capture in traditional situations where farmers are selling into local markets in their same villages.

c) The corollary is that about 40% of the value chain is formed by the post-harvest segments of the rice value chain – in milling, in trading, and in retailing. This implies that these segments are nearly as important as the farm sector in forming the rice price for consumers. Yet the productivity and development of these off-farm segments does not receive even a fraction of the attention in the public debate that the farm sector does. This imbalance should be addressed with

much more attention to encouraging and facilitating development in the midstream and downstream segments.

d) While much policy debate centers on direct government operations in food value chains, such operations were in general quite small in the rice value chain, except for Indian government purchases from mills. The implication is that the great majority of the activity in rice value chains is based on private sector (traditional or modern) actions. Thus, a great deal of emphasis should be placed on enabling the private sector's involvement and providing it with the incentives to assist in attaining national food security objectives.

e) The indirect roles of governments have been important in enabling and at times providing incentives for the transformation: 1) by investing in rural areas through research and development and distribution of seed; and investments in irrigation canal systems, road and railway systems, rural wholesale markets, power grids, and mobile phone communication grids—these were major investments in the 1990s and 2000s, and all were essential to the transformation in the midstream the study observed; and (2) investment in extension, which was important overall, but the data suggest a limited impact and availability of extension services in some areas, particularly in the Uttar Pradesh study zone in India.

f) Government subsidies had important effects, but evidence of accessibility to and the impact of the services was mixed. Subsidies for rice seed and fertilizer sales in all the study countries, for private tube wells in Bangladesh and India, for mill upgrading in all the zones, appear to have encouraged use of and investments in all these productive items, and all the items played important roles in transforming the value chains. However, the survey results show that sometimes the subsidies were not going to the target beneficiaries. For example, tube well, fertilizer, credit, and seed subsidies in India went mostly to medium and large farmers, with little going to marginal farmers. A key policy implication is that if large subsidies are distributed, great care should be taken to assure they are properly targeted and delivered.

g) The study points to the importance of farm input supply chains upstream from farmers and of midstream and downstream postharvest activities such as logistics and wholesale, milling, and retailing. Little empirical research work has been done on these areas, but is needed for the policy debate and the systematic evaluation of policy impacts. There needs to be a concerted public policy debate on how to enable and encourage input supply chains to become modernized and midstream and downstream businesses to invest in upgrading equipment and expanding.