

# The hidden middle: the quiet revolution in the midstream of agrifood value chains in developing countries

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**Abstract** The food security debate has focused largely on the farm sector and on trade. Relatively neglected or ‘hidden’ from mainstream debate are the middle segments (processing, logistics, wholesale) of agrifood value chains in developing countries—and yet this ‘midstream’ forms 30–40 per cent of the value added and costs in food value chains. The productivity of the midstream is as important as farm yields for food security in poor countries. The article shows that over the past several decades the middle segments have transformed quickly and surprisingly—with a huge volume expansion, a proliferation of small and medium enterprises (SMEs), but also concentrating and multinationalizing (in some places and products), with technology change characterized by capital-led intensification, and with the incipient emergence of branding and labelling and packaging, of new organizational arrangements in procurement and marketing interfaces with farmers and retailers, and of private standards and contracts. Economic policies of market and foreign direct investment (FDI) liberalization, commercial and business climate regulations, hard and soft infrastructure investment, and food safety laws, have paved the path to the expansion and shaped the transformation of the important midstream segment of food value chains.

**Key words:** value chains, developing countries, Asia, wholesale, wholesale markets, food processing, structural change, food industry transformation

**JEL classification:** O12, O13, O16, O19, Q12, Q13, Q18

## I. Introduction

Academic debates on changing food markets in developing countries have tended to focus on three main themes over the past several decades. The first theme is the growth of exports and imports with trade liberalization and globalization (e.g. [Anderson \*et al.\*, 1997](#)), and sourcing by US and European supermarkets from developing countries ([Dolan and Humphrey, 2000](#)). The second theme is the transformation of upstream in the food system, in farming intensification, commercialization, and diversification ([Pingali and Rosegrant, 1995](#)) and the growth of input markets, for water ([Rosegrant](#)

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*et al.*, 1995), land (Deininger and Feder, 2001), and improved seeds (e.g. Pray and Naseem, 2007). The third theme is transformation downstream in the domestic food system, especially the ‘supermarket revolution’ (Reardon *et al.*, 2003; Traill, 2006) and diet diversification and shift towards highly processed foods with attendant health challenges (Pingali, 2006; Popkin, 2014).

In comparison, there has been far less attention paid, in research and more noticeably in policy debates, to the rapid transformation of the mid-stream segments of agri-food value chains,<sup>1</sup> by which we mean processing, storage, wholesaling, and logistics. These segments are increasingly important: for example, Reardon *et al.* (2012) show that share of the midstream segments in total margins in rice and potato food value chains to the capital cities of Bangladesh, China, and India averages 32 per cent for rice and 42 per cent for potatoes. Those pieces of the food system are too important to stay ‘hidden’ from the debate.

Moreover, as we further explore in this paper, there is emerging evidence that there is rapid change in the midstream’s structure and conduct/behaviour; we illustrate this mainly for developing Asia (with comparative mention of similar trends in Latin America and, in incipience, in Africa). This change is driven mainly by private-sector investment by both large and small enterprises, encouraged by transformation in upstream and downstream in the food system, and facilitated by policy reforms. In an interesting parallel, a similar phenomenon was observed in the mid-1990s in the US by Schertz and Daft (1994) in their book about the ‘quiet revolution’ in food and agricultural markets, where they noted how rapid transformation of the midstream segments had not only occurred rapidly through the 1970s and 1980s, but that it had also remained hidden to policy debate that in the US had also been focused upstream on the farm and input sectors.

This paper focuses on the transformation of the midstream of food value chains in developing countries. We focus on domestic food system transformation rather than international food value chains involving developing countries, because domestic food production constitutes roughly 90–95 per cent of the food economy of the region, and international trade in food is only about 5–10 per cent. We also illustrate mainly with Asian evidence of midstream transformation, simply because the midstream transformation started earlier and has gone furthest in Asia and Latin America, with Africa just starting on what appears to be a similar road of food system transformation (Reardon *et al.*, 2013); moreover, between Asia and Latin America, there has been more recent empirical survey work on the midstream transformation in Asia.

The paper is organized into three parts. The first part sets the stage by discussing the conditioners of the transformation. The second part focuses on the first of two broad axes of the transformation, namely the structural transformation of the mid-stream which is itself integrated into change in the overall structure of the food system (including geographic lengthening combined with dis-intermediation in food value

<sup>1</sup> We use the term ‘value chain’ rather than ‘supply chain’ for simplicity of terms; the former has been associated with quality differentiation and value added, with viewing the value chain from the consumer perspective, and the latter, supply chains, from the supplier perspective with a focus on efficiency and logistics and coordination aspects of moving products from ‘farm to fork’. However, we believe, along with Feller *et al.* (2006), that there should be an integration of these terms and concepts as food systems need to and do (with varying performance levels) deliver both value and efficiency.

chains). The final part focuses on the second of the broad axes of transformation, that of conduct/behaviour of the midstream segment, including firms' choice of technologies, institutions (such as standards and contracts), and organization (such as vertical and horizontal integration and coordination).

Two caveats are relevant here. First, it is beyond the scope of the paper to assess how these transformations affect consumers and farmers and other welfare and performance aspects; those are important topics for further research. Second, the paper is mainly qualitative and illustrative, with the use of as much empirical data as are available for the patterns; but developing countries in general, with few exceptions, mainly track crop output and exports but have much less data and detail on the other segments of the value chain. Data sources on part of the midstream, in particular processing, like the United Nations Industrial Development Organization (UNIDO), do not offer sufficient disaggregation to track the midstream segments in detail. So we had to rely on key indicators of change and case information.

## **II. Broad determinants of transformation of the midstream of the value chains**

Reardon and Timmer (2014) develop a framework to describe the transformation of food systems in terms of five simultaneous and inter-linked spatio-economic transformations in Asia: (i) urbanization; (ii) diet change; (iii) transformation of the midstream and downstream components of the agrifood system; (iv) technological and commercial transformation of the farm segment; (v) transformation of the upstream components of the agrifood system with accompanying rural factor market (labour, credit, land) transformation. They note that urbanization and diet change are the demand-side forces pulling the whole set of transformations; factor market and farm technology change are the upstream supply-side forces feeding the rest of the changes; and the agrifood system spans all the segments and intermediates or links supply and demand.

Because the present paper focuses on the midstream transformation 'nestled' among and conditioned by the upstream and downstream transformations, we briefly discuss here the latter two; but for succinctness and because the downstream forces are more important than upstream changes in affecting the midstream segments, we start with a review of recent findings on urbanization and diet change (and do not treat here the upstream changes already mentioned in the introduction). Moreover, we outline several 'policy meta conditioners' of all five transformations, in particular, public-sector investments in hard and soft infrastructure, and policy interventions including direct public-sector intervention in the midstream, and, after intervention, liberalization and privatization of midstream. We consider those four sets of conditioners in turn.

### **(i) Urbanization**

First, rapid urbanization has emerged quickly and relatively recently in much of Asia. By 2010 the urban population share reached 32 per cent in south Asia, 44 per cent in south-east Asia, and 54 per cent in east Asia. But population shares alone underestimate

the importance of urbanization for the food economy: urban consumers have lower shares of food in total household expenditure compared with the rural population, but their incomes are sufficiently higher that their *per capita* food expenditure is higher. India exemplifies this: Ablett *et al.* (2007) note that by 2006, while only 29 per cent of India's population was in cities, urban consumers accounted for 43 per cent of all market expenditures on food consumption, while in more urbanized countries of east and south-east Asia, urban consumers are responsible for roughly two-thirds to even three-quarters of all food expenditures. For example, 74 per cent of fruit in Indonesia is consumed in cities (Reardon and Timmer, 2014; Reardon *et al.*, 2014a).

The process of urbanization conditions the rural non-farm economy and thus in turn the rural part of midstream activities. On the one hand, there appears to be more rapid growth of the rural non-farm economy in the market catchment areas of mega and intermediate cities (see, for example, Deichmann *et al.* (2009) for Bangladesh and Fafchamps and Shilpi (2003) for Nepal). This 'radiation' is magnified as a positive function of rural infrastructure. The correlate is that in more hinterland areas the process is occurring less quickly.

On the other hand, much rural non-farm activity is directly or indirectly linked to the midstream segments, such as transport and wholesale of agrifood products (Haggblade *et al.*, 2007). But the radiating effects of urbanization can also cause competition for food-system-related rural non-farm employment. Reardon *et al.* (2007b) note that this competition can be especially in the midstream segments, as the intermediate cities are directly (themselves) and indirectly (as conduits for products from mega-cities) a channel for urban manufactured food products and services into rural areas, pitting urban firms with economies of scale against small traditional food firms in the informal urban and rural areas.

Moreover, recent research (such as Reardon *et al.* (2012) in Asia) tends to show that areas nearer cities experience more rapid transformation of food value chains, including the development of the midstream. A city's food market catchment area can be national or further, but it appears that in a certain radius the city's demand pull is strongly felt and the profits from the urban market induce substantial local investment by midstream firms.

## (ii) Diet transformation

Second, diets have been rapidly changing in Asia (Pingali, 2007)<sup>2</sup> in three ways, all important for the development of the midstream segments.

The first change in diets, as incomes have risen, has been a shift in the food expenditure shares, with a decline in the share of rice (Timmer and Dawe, 2010) and an increase in the shares of meat/fish, dairy, horticulture products, and edible oils, and an increase in corn and soya use for feeding animals. This is consistent with 'Bennett's Law' (Bennett, 1954). In India, for example, by 2010 the total value of dairy consumption was greater than that of grains (Kumar *et al.*, 2013). This has happened earlier and faster in urban areas, inducing rapid development of wholesale and logistics from rural to urban areas for products intensive in handling.

<sup>2</sup> Diets have been changing and urbanization proceeding in a similar way, just with a lag, in Africa, see Tschirley *et al.* (2015) for eastern and southern Africa and Hollinger and Staatz (2014) for West Africa.

The second change in diets is that rural consumption has rapidly ‘commercialized’ (i.e. the share of purchased food in total food consumed has risen). This bolsters demand for marketing and logistic services, again part of the midstream. Mellor (1976) noted that many rural households benefited from a reduction in food prices due to the Green Revolution in India because so many were net buyers. This left unanswered how important purchases are in the food budget, and thus how important rural marketing is from the demand side. New evidence shows that it is very important. Reardon *et al.* (2014a), based on analysis of Living Standards Measurement Study (LSMS) data in Bangladesh, Indonesia, Nepal, and Vietnam, show that rural households on average buy a large share of their diet. Purchased food in total food consumed was found to be about 80 per cent in rural Bangladesh and Indonesia, 72 per cent in rural Vietnam, and 58 per cent in Nepal.

The trend counterpart to an increase in purchased food by rural households is the rise in the generation of cash by rural households, from rural non-farm employment as noted above, and from commercialization of farming (Pingali and Rosegrant, 1995). The latter has proceeded very far; Reardon *et al.* (2014b) found in surveys of rice farmers in Bangladesh, China, India, and Vietnam, that the marketed surplus rate is about 85 per cent on average, even very high for very small farms.

The third change in diets is that, with the rise of incomes and the rising opportunity cost of women’s time with urbanization, there has been a rapid penetration of both low and high processed foods (such as wheat noodles, see Timmer (2015)), as well as prepared foods sold in restaurants. This has occurred first and most forcefully in urban areas but with a lag and only somewhat less in rural areas. This is a major fillip for the supply-side development of processing and marketing as part of the midstream. For example, Reardon *et al.* (2014a) find that even in rural areas processed food has diffused, with 59 per cent of total rural food expenditure in Bangladesh, Indonesia, Nepal, and Vietnam accounted for by processed food, of which 69 per cent is ‘low processed’ and 31 per cent ‘high processed’. The overall processing share rises with development level and with the degree of urbanization: the simple average over the four countries for urban areas was 73 per cent of total food expenditures. Morisset and Kumar (2008) had a similar finding for India.

### (iii) Infrastructure investment

Third, government investment in hard and soft rural infrastructure has helped to increase the length and volume and reduce the seasonality of food value chains. In turn, this has encouraged urban diet change and magnified impacts on rural areas. ‘Distance’ to urban areas is not just a physical distance but an economic distance, in the sense that road infrastructure, toll highways, and train and bus routes condition the transport cost of a given distance. In most countries in the region there have been large expenditures by governments on transport and electricity infrastructure in the past several decades.<sup>3</sup> Wholesale market infrastructure is another important public-sector investment. For example, China’s wholesale market volume increased 11,000 per cent from 1990 to 2000 (Huang *et al.*, 2007; Ahmadi-Esfahani and Locke, 1998), and India’s

<sup>3</sup> See for example Fan and Chan-Kang (2005) for analysis of massive rural road investments in China in the 1980s–1990s.

regulated wholesale markets went from 450 in 1948 to 5,500 in 2008 (Reardon *et al.*, 2012). The latter has been reinforced by the establishment of the ‘soft infrastructure’ of commercial regulations and public standards.

There have also been a large number of modest investments from the small–medium-scale private sector—by truckers, warehouse owners, millers, cold storage operators, wholesale traders, and rural brokers. These have been mainly aimed at accessing the urban market; even in Vietnam, a country where rice exports are substantial, most of the investments and transformation are occurring in the domestic rice value chain, not just the minor part of the rice sector which is traded.

#### **(iv) Government policy: first intervention then liberalization**

Fourth, there have been direct and indirect government market interventions in the agrifood system, including in the midstream sector. A first ‘round’ included public- and large private-sector investments before the 1950s from colonial enterprises, especially in south-east Asia (for the export-oriented agrifood industrial enclaves and plantations), and in a new wave in the 1950s–1970s by national governments. Upstream, these interventions included government input and credit parastatals; at the midstream with the provision of public wholesale markets (first for grains and then for ‘wet goods’ such as fish, meat, and fruits/vegetables) and distribution agencies and processing parastatals; and downstream with export marketing boards; and some public-sector retail facilities such as the state grain stores in India and China.

A ‘second round’ of food system transformation occurred following the withdrawal by most governments in the region from direct intervention. While the privatization of agricultural parastatals and trade liberalization have received the most public attention (see Rashid *et al.*, 2008), an equally important part of this round was the opening up of the sector to FDI, including substantial flows into the midstream segment. Asia has thus seen cross-border investments from large global firms such as Cargill, and regional firms such as Thailand’s Charoen Pokphand (CP), the Philippines’ San Miguel, and China’s Shuanghui Group (that in 2013 bought what was the largest pork processor in the world, Smithfield Foods of the US), which have paved the way for a surge in new investments as well as merger and acquisition activity by large domestic firms and eventually SMEs.

### **III. Transformation in the midstream**

In this section we explore the dynamics of the transformation of the midstream agrifood sector in developing Asia from ‘traditional’ to ‘modern’ by examining change in the structure and conduct of the overall food system and of the midstream segment in particular.

A qualification is in order before we lay out the axes of transformation. The transformation itself has exhibited a substantial degree of variation over space and products in the speed and form of this transformation depending in part on countries’ overall levels of development. The transformation has taken place unevenly over countries in the Asian region (as in other developing regions). In the earlier phase, from the 1950s to the 1980s, this unevenness was less acute in the first round (1950s–1980s) when the



primary drivers were public-sector direct action (such as the erection of parastatals). By contrast, since the 1980s when the key drivers were urbanization and liberalization, experiences across countries were less evenly spread.

The process of the structural transformation of midstream value chains roughly reflects the order/ranking of countries in terms of urbanization, industrialization, levels of income *per capita*, and liberalization of policy. Thus the process started in Japan and Taiwan and South Korea followed by the early-liberalizing countries of south-east Asia, Malaysia, Indonesia, the Philippines, and Thailand. These countries were followed by the transition-cum-late-liberalizing countries of China and Vietnam and finally India and the smaller poorer countries of Cambodia, Laos, and Myanmar.

There is also unevenness in the transformation within countries, particularly between rural and urban sectors. But, as noted above, within rural areas there is a sharp difference in the progress of the transformation processes in dynamic/near-city zones compared with remote, hinterland areas. The exception is development of first-stage processing enclaves in the hinterland areas (such as for tea, rubber, oil palm, and cassava processing in large plantations in frontier areas of Cambodia, Laos, and Myanmar; see [Byerlee, 2014](#)).

Moreover, there are many instances of a ‘migration’ of the transformation into the hinterland areas as the dynamic urban areas ‘climb the value ladder’ and the production of cheap food products and rural processing and wholesale are pushed further out to areas with cheaper land.

The transformation of both the retail segment and the midstream segment occurs in general at different rates over product categories. The first wave was in grains and traditional export crops, where transformation was driven by government-led reforms, and in plantation cropping and processing, in tea, rubber, and oil palm. Next came processed foods in general, and grains and edible oils and condiments such as soy sauce in particular—products that could be shipped and stored at low cost—followed by the feedstock sector linked to the booming demand for livestock, fish and, eventually, milk. Next were semi-processed perishables such as meat, fish, and dairy products, and finally, fresh fruits and vegetables. The economic logic of the sequence is a combination of perishability (and thus the challenges that brings to value chains) and the emergence and growth of substantial demand in urban areas for these products in direct or derived demand.

Although the above discussion emphasizes the sheer heterogeneity of the transformation, there is nonetheless a series of clear patterns of change in developing Asia (mirrored in other developing regions) in the structure and conduct of food value chains in general and the midstream as our particular focus. These are discussed below.

### **(i) Structure change: spatial elongation and de-seasonalization of value chains**

We noted above how urbanization combined with rural infrastructure improvement (and very low dependence on imports) make it that food value chains need to get longer and longer within a country, or for smaller countries within a sub-region, to supply the growing large cities and the rapidly emerging intermediate cities. This means that the logistics/transport and rural and urban wholesale sub-segments expand in parallel

with the spatial lengthening of the value chain. The China rice sector is illustrative: the share of the midstream in the value chain of rice to Hangzhou in southern China mainly from southern and middle regions is about 25 per cent of total margins (Wang *et al.*, 2013); for the much longer value chain to Beijing from the north-east provinces the share of the midstream is about 50 per cent (Reardon *et al.*, 2010).

Von Thünen (1826) founded our now-traditional conceptualization of the standard pattern of correlations between spatial length of a rural–urban value chain and product categories. He noted that farm product composition changed over space as one went away from a city, as a function of land and other farm costs and transport costs; von Thünen noted that perishable, high-value products, such as vegetables and dairy, tended in that era to be produced in a concentric ring near cities, followed by a ring for timber, then extensive grains, and then hinterland.

While these spatial-cum-product composition patterns were also typical in developing countries as recently as several decades ago, and in the poorest areas are still, they are beginning to change, partly as a function of the transformation of the midstream segments. The latter has begun to alter the geography and seasonality of farming and value chains to cities. We briefly discuss this by midstream sub-segment as follows.

- (1) Development of transport via road and rail has extended the market catchment area of rice and wheat, and of semi-perishables such as potatoes and apples.
- (2) Development of the fish freezing industry has recently spurred long domestic value chains in fish, for example in China from southern China to Beijing.
- (3) Development of the poultry, hog, and fish feed industry has allowed intensive production further or even far from cities; for example, Yi *et al.* (2015) discuss the rise of intensive shrimp farming off Java, in islands with improved water conditions; feed is produced on Java, sent by boat to these islands, then shrimp is harvested and shipped to export points and cities. Fish farming is blossoming in clusters around Bangladesh, with feed produced near Dhaka then trucked to these clusters and fish put in barrels of ice and shipped back to Dhaka. NaRanong (2008) tells a similar story for chicken production in Thailand.
- (4) Development of medium and large-scale output processing has allowed both economies of scale and location of plants further from cities; Schneider (2011) notes for China that as small-scale pig production dropped from 95 to 27 per cent of pigs over 1985 to 2007, the scale of pig processing plants soared and moved away from peri-urban areas. Highly processed foods made by Indofoods in Jakarta or San Miguel in Manila are consistently available in most parts—at least of the main islands, where three-quarters of the food economies are—of Indonesia and the Philippines, respectively.
- (5) Development of medium and large-scale feed processing mills in maize and soya areas has induced the movement of chicken production from peri-urban areas out to these crop areas, such as in Thailand in the 1990s (Rushton *et al.*, 2005).
- (6) Development of the cold storage industry has recently and quickly expanded and de-seasonalized value chains of potatoes, for example, to cities in India (Das Gupta *et al.*, 2010) and Bangladesh.



## **(ii) Structure and conduct change: at first a proliferation of intermediaries, followed by dis-intermediation in value chains**

In Asia, as in other developing regions, the traditional foundations of the food value chain were rooted in farmers' sales to a nearby village or rural town or neighbour. As rural towns and cities grew, there was a proliferation of intermediaries in the midstream; rural–urban brokers emerged in dendritic structures to collect from rural areas then sell on to villages then to semi-wholesalers in district towns who then on-sold to cities (see, for example, [Skinner \(1964\)](#) for China or [Lele \(1971\)](#) for India).

The subsequent stage, starting in the 1960s/1970s, has been a 'first wave of dis-intermediation' in the midstream. As rural–urban value chains developed and lengthened, and intermediaries proliferated, the image grew in the policy debate and research literature in the Asian region (and other developing regions) of 'many hands' stretching along the long rural–urban value chains. Often in policy debates the terms 'speculation,' 'exploitation,' and 'inefficiency' became attached to rural brokers and wholesalers; that image (empirically supported or not) served to spur support for the establishment of marketing and processing parastatals in the 1960s–1970s as a form of 'state-led dis-intermediation' of grain value chains to cities.

The emerging evidence points to a process in the 1980s–2000s in which state establishment of parastatal processors and marketing in the 1960s–1970s and investment in rural and urban wholesale markets and roads in the 1970s–1990s in urban and then rural areas, led to a 'second wave' of grass-roots private-sector-led restructuring of rural distribution. Wholesalers from rural wholesale markets and even urban markets began to buy directly (via transporters) from farmers; mills got bigger and started to buy directly from farmers; trucking firms proliferated and eased local logistics constraints. The result in many places has been that small rural brokers have been progressively sidelined then eliminated, with many recent surveys showing this in rice, mangoes, tomatoes, potatoes, and other; see for example [Huang \*et al.\* \(2007\)](#) for tomatoes in Shandong.

A 'third wave' of disintermediation in value chains and restructuring of the distribution segment has emerged in the 1990s and especially the 2000s. This can be seen from two angles, procurement and marketing.

From the angle of procurement, the third wave has involved the emergence—either from inside wholesale markets or outside wholesale markets—of modern 'specialized-dedicated wholesalers' ([Reardon and Berdegue, 2002](#)). These buy direct from first- and second-stage processors and farmers as agents of supermarkets (such as Bimandiri on Java, see [Natawidjaja \*et al.\* \(2007\)](#)) and processors. On the other hand, this has involved midstream and downstream firms buying directly from each other (such as large retail chains in Beijing buying directly from large mills in north-east China). This latter is sometimes facilitated by the firms of two segments of the food industry delivering between their 'distribution centres' to reduce transaction costs. This can extend over countries in the region to affect international trade by 'internalizing' trade in intra-firm transactions as in 'new trade theory' (see [Reardon \*et al.\*, 2007a](#)).

Dis-intermediation of local procurement agents can be supplanted by—reintermediated—via enlisting the assistance of non-local agents. An emerging and important form of this is 'follow sourcing', where product or service providers for a food industry firm 'follow' that firm to the new market to which that firm locates. An example is TNT Logistics 'following' Tesco to Thailand, or Baakavor 'following' Tesco to China

(Reardon *et al.*, 2003, 2007a). This ‘following’ also occurs across provinces, as food industry firms spread their operations over zones; an example is cold chain services suppliers in China following KFC diffusion in China (Bell and Shelman, 2010).

From the angle of marketing, the third wave of dis-intermediation has involved large processors’ obviating the traditional channel of broker-stockists to distribute directly to small retail stores (as well as to supermarkets) with their own delivery vans or third-party logistic companies. An example is Yili distributing its dairy products directly to shops and supermarkets in Beijing (Abrami *et al.*, 2008).

Where the product is perishable this appears to be increasingly done with the help of integrated logistics firms undertaking a variety of tasks—wholesaling (intermediation), warehouse management, ICT system integration into retail and distribution systems of companies, cold chain development, and packaging. They may also forward-integrate into retail management of specific divisions (such as Radhakrishna Foodland in India becoming an external ‘channel captain’ managing fresh produce for second-tier India supermarket chains). This has been via multinational companies such as the Japanese Snowman Frozen Foods Ltd. It has also occurred via domestic investment which has been emerging in this sub-segment, sometimes from transport company roots (such as CONCOR in India for the rail segment), maritime company roots (such as Adani did in India), and hotel roots—in short, companies that had some transport functions that then were extended into logistics for modern agrifood companies. Some were conglomerates that had food operations and saw the unmet demand for modern logistics and added logistics; in India, Pantaloon (the leading retailer) started a major logistics company (see Reardon *et al.* (2012) for India cases).

### **(iii) Structural change: a consolidation of the midstream segments of the value chains**

Consolidation in the midstream segment of agrifood value chains has followed a number of paths across Asia.

The first path is a monotonically increasing concentration curve where the segment starts (traditionally) fragmented, as a set of small-scale firms, and then gradually or quickly concentrates because of foreign or local investment by large firms or by organic growth of the small firms—but without passing through a stage of state-induced consolidation via parastatal formation. Most perishable product value chains are examples of this—chicken, fish, pork, and fruit and vegetables.<sup>4</sup>

The second path, such as one finds in the rice sector, is a J-curve over time of concentration (with time on the horizontal axis and concentration on the vertical axis), where the traditional phase is as usual only small-scale firms, and the first stage of consolidation is induced by government establishment of parastatals. However, the parastatals dominate only a part of the market; alongside them are small-scale operators (informal

<sup>4</sup> In recent Asian literature the example of vegetables presents itself; cf Gorton *et al.* (2011) for Thailand; Moustier (2009) for Vietnam; as does that of chicken and pork (with Thailand having gone very far in the concentration from the late 1970s to present, see NaRanong (2008); China being in mid-path (see Schneider, 2011), and, with the case of dairy, India being at the early stage with small and marginal farms still producing 68 per cent of the milk but medium/large private-sector firms undertaking 58 per cent of the processing of marketed milk by 2010 (Kumar *et al.*, 2013).

or formal depending on whether the ‘parallel market’ is legal) (Roemer and Jones, 1991). After the dissolution of the parastatals there was then sometimes a proliferation of small formal or informal firms in their stead.

A further (final?) phase of consolidation in the J-curve (or the U-curve below) is the private-sector-led consolidation after liberalization from FDI and from large extra-regional capital (such as Cargill), large regional capital (such as Thailand’s Charoen Popkhand’s investments in Cambodia), and large domestic capital. In turn, domestic or regional firms grown large by this process are recently beginning to make the same kind of jump to extra-regional investments as did the US and western European companies after a similar but earlier process of consolidation in their regions. An example is the recent purchase by China’s pork farming and processing giant, Shuanghui, of what had been the largest pork processing/production firm in the world, the US-based Smithfield Foods (Xia, 2015).

This latter wave, private-sector led, of consolidation of the midstream features the pushing out or acquisition or sometimes mergers of large midstream firms with the small and medium firms. In a sense, the new wave of concentration in the midstream is an expanded but repeated version of the earlier state-led concentration of the midstream, but now mainly with private-sector dominance. There are exceptions to the latter, such as in giant state-owned processing firms (such as COFCO in China; Collinson and Rugman (2007)) and government distribution of grain in India (but extremely little in other Asian countries) (Rashid *et al.*, 2008).

A third path is a U-curve over time of concentration. This is where a sector has been traditionally concentrated; then there may be a phase of relative de-concentration, either from liberalization or from new zones/areas being brought into production; finally there is a phase where there are mergers and acquisitions from large domestic capital or multinationals. Illustrations of this are, of course, the estate/export crops in several countries; rubber in Myanmar is an example (Byerlee *et al.*, 2014). An interesting variation on this third path is where concentration may be occurring in the ‘commodity’ branch of the product while in parallel there is a proliferation of small and medium firms producing differentiated products to compete with the commodity. An illustration of this is a concentrated brewing sector with a ‘commodity’ beer, parallel to a number of micro-breweries offering quality-differentiated products.

Note that some parts of the midstream can be concentrating while others are lagging, or the overall midstream is concentrating while other segments of the value chain lag in concentration or are even fragmenting further. For example, tea plantations and processing, say, in Indonesia can be concentrated, but at least initially the retail of tea can be of low concentration, through many small shops. It appears that in most sectors in developing Asia (and other developing regions), processing concentrates first (due mainly to economies of scale in processing), followed by retail, and then by wholesale.

However, the unevenness of concentration over parts of the midstream and over segments of the value chains appears gradually to be diminishing. This is driven by shared drivers of concentration, as well as competition in the post-liberalization era after the 1980s. Moreover, there is evidence that the concentration in one value chain segment ‘induces’ concentration in the others through favouring scale in choice of client or supplier. This can be termed ‘symbiosis’ among the modern agrifood industry segments, as follows.

On the one hand, large processors reduce transaction costs for modern retailers by facilitating dis-intermediation, delivering to the distribution centres or stores of the retailers

(such as large rice mills in north-east China delivering directly to supermarket chains in Beijing; see [Reardon \*et al.\*, 2012](#)). Large processors can adapt packaging and variety to the needs of the retailers; their inventory systems reduce the chance of retail stock-out.

On the other hand, modern retailers facilitate development of market size and scope economies for large processors. Supermarkets tend to carry a limited set of brands per product category, and these tend to be mainly from medium and large processors, and a smattering of small company brands for non-commodity products. Modern retailers develop markets for processed products as they tend to sell them cheaper than traditional stores once procurement systems are modernized ([Minten \*et al.\* \(2010\)](#) for India).

Additionally, large processors and supermarket chains provide the initial key markets for modern wholesalers (the ‘dedicated wholesalers’ noted above) and modern logistics firms. These firms are competing with traditional wholesalers to serve the modern retailers and processors—and do so by offering often better transport services (with modern cross-docking and refrigerated vehicles), warehousing management, and services not usually found in traditional distribution segments, such as operating packing houses, packaging, ICT systems, and cold chains, and managing contract farming, merchandise inventory, and international networks.

#### **(iv) Conduct change: a shift from labour-intensive to capital-intensive technologies in midstream firms**

Across many developing Asian countries, there has been a shift from small-scale to increased scale of processing plants, and of wholesale and logistics and storage operations. This is roughly correlated with the concentration paths, as well as the waves of transformation over countries and products noted above. For example, there were large rice processing units during the state-led period in several of the countries; then after privatization there was a proliferation of smaller plants; and then with technological change (and consolidation), there was an exit of smaller mills (such as in rice in China and Vietnam) and a rapid rise of larger mills owned by large rice milling companies ([Reardon \*et al.\*, 2012](#)).

The increase in scale and the capital/labour ratio has been driven by several factors beyond the most obvious one that there are economies of scale in processing and competition drives firms to seek those economies.

First, there have been large inflows of investment in fixed plant and equipment in the processing sector in the past two decades. For example, investment in fixed plant in this segment in China jumped from 26.3 to 84.7 billion USD from 2007 to 2011 ([National Bureau of Statistics of China, 2012](#)), a ratio of 3.2, while the national nominal GDP rose in that period by a factor of 2.2. China and India explicitly encourage technology upgrading and plant size increase in measures for the food processing industry in their 12th 5-year Plans (covering these past 5 years). Domestic investment is encouraged by policies cheapening credit (as it had been in the Indonesian rice sector in the 1970s; see [Timmer, 1973](#)) as well as by subsidies for land acquisition and fixed period tax exoneration.

That rise in investment was also partly due to the liberalization of foreign investment in food processing in the 1990s and 2000s. For example, China and India liberalized food processing FDI and large inflows occurred. FDI into food processing in India had averaged only US\$117m per year during 2001–12, then went to US\$401m in 2012–13, and then in the first half of 2014–15 jumped to US\$2.15 billion ([Times of India, 2014](#)).

Second, it appears that food safety regulations increased plant size and induced modernization of equipment in developing Asia. This impact is like that of the 1906 Pure Food and Drug Act in the US on processing and distribution firm scale in the US: inducing rapid exit of small firms unable to meet the new requirements (Levenstein, 1988). For example, regulations concerning hygiene and location of poultry processing, production, and retail facilities were put in place during the bird flu crisis in Vietnam and spurred the development of larger-scale and formal plants such as those of Chaoren Popkhand (Figuié *et al.*, 2013). Health regulations had a similar effect on poultry processing in Thailand (McLeod *et al.*, 2009).

Sometimes regulation resisted transformation: for example, India ‘reserved’ most of food processing for small enterprises until 1998, to protect employment. In 1998, as part of overall liberalization, the sector was ‘de-reserved’—and a flood of investment quickly increased the concentration indices and deepened capital (Bhavani *et al.*, 2006).

Moreover, while the modernization and increase in scale of plant and equipment in the midstream is more ‘obvious’ and observable in the case of large firms, it is important to note that there appears to be a massive amount of investment by small and medium-scale firms. This is emphasized in Reardon *et al.* (2012), with widespread investment by small transporters, cold storage and warehouse operators, wholesalers, and processors in the past 10–15 years. This corresponds to the discussion above of the ‘proliferation of SMEs’ phases in structural change trajectory.

The technology shift in the midstream can be rapid and dramatic, in particular when it is linked to increasing urban demand, improving infrastructure, and a policy of encouragement and support. The case of the rapid rise of potato cold storages in Bihar (Minten *et al.*, 2014) and Western Uttar Pradesh near Delhi (Das Gupta *et al.*, 2010) illustrate. We focus on the latter. A survey of cold storages in Agra found that the combination of the rapid development of vegetable demand in Delhi, the improvement of the road link from Agra to Delhi, the introduction of a disease-resistant and long-shelf-life potato variety, the introduction of an electricity grid, the partial subsidizing of irrigation pumps and cold storage equipment, and the economy’s generating investable funds among the intermediate city business sector, led to very rapid and deep change in the cold storage sector in Agra and, in turn, on the seasonality and cost of potatoes in Delhi and intermediation patterns in the rural area. In the early 1990s relatively few farmers grew potatoes in Agra and there were almost no modern cold storages. By the late 1990s cold storages had risen to store 40 per cent of the vastly larger potato output, and by 2009, 80 per cent. Traditional on-farm storage went from ubiquitous to 1 per cent of the potato harvest. Delhi went from sharply seasonal potato consumption (from fresh harvest) to multi-season availability and 65 per cent of consumption from cold-storage potatoes mainly from Agra. Rural brokers were sidelined by the cold storages themselves becoming the main locus of intermediation with urban wholesalers coming to buy potatoes from farmers at the storages.

#### **(v) Conduct change: changing financial relationships between farmers and retailers**

A key policy assumption about the midstream segment in Asia has been the traditional view that ‘tied output-credit markets’ are the ubiquitous way in which traders deal with,

and in a sense entrap and exploit, farmers. This translates to the idea that traders practice of value chain finance, where a trader advances funds to a farmer, extracting the promise from the farmer that he/she will sell the crop to that trader at harvest; it is usually hypothesized that hidden in that advance is a high interest rate, and the entrapment of the farmer so that he/she must accept a low crop price. The idea is that the credit market is missing so that farmers are forced to look to the trader for credit to make ends meet until the harvest, and is thus willing to enter a 'tied output-credit market' arrangement.

These tied arrangements were often the justification for grain parastatals to sideline exploitative traders and for governments to develop agrarian banks to resolve missing credit markets. During the 'structural adjustment decades' of the 1980s–2000s, the hypothesis of the existence and the dominance of traditional value chain finance was not, or very rarely, questioned, and not explored empirically. In fact, one finds masses of attestations to the persistence of the belief in the dominance of this traditional finance in policy debates and academic papers in the past decade. This persistence is important because it casts doubt on whether farmers can gain from the development of the midstream segment of the value chain and the 'market' in general, and whether the market is really 'free' even when it is *de jure* 'liberalized', as the assumption is that these tied arrangements persist.

These ideas have recently been re-examined by [Reardon \*et al.\* \(2014c\)](#) using survey data on potato and rice farming in China, India, Bangladesh, and Vietnam. They find there is little value chain finance 'upstream' in the rice or potato value chain in Asia, in both more and less developed areas. But there is a lot of value chain finance midstream and downstream; however, these intra-midstream (i.e. between two sub-segments of the midstream, such as between processors and wholesalers) or between midstream and downstream (with processors and/or wholesalers on the midstream side, and retailers on the downstream (segment) side) advances and delayed payments are frequent but minor, as they usually involve tight transaction times of a week or so, just the churning of money in the regular relationships and networks of traders and clients and suppliers.

#### **(vi) Conduct change: incipient emergence of market institutions in the form of contracts and private standards**

While structural and technological changes in the midstream are more widespread and advanced, there have nonetheless been some important institutional and organizational changes in agricultural value chains, although these have been concentrated in the initial, emergent stage. They tend to be correlated with the waves of transformation over the countries and products, mainly linked to large and especially multinational companies, and related more to products that are highly perishable, that present potential food safety and thus liability issues. Of course, given that the consumption of perishables, and the role of larger companies is rising, these institutional mechanisms will gradually take on an increasing importance and role. For now, we discuss them briefly as follows.

First, there is some evidence that there has been an incipient shift from solely spot markets to contracts. There is no systematic information on how advanced is the diffusion of contracts among segments in value chains in developing Asia; contract farming linked to processors seems to be emergent only in a few product categories and countries, such as for some export vegetables and fruit, and some processed vegetables, such as



potatoes for French fry production by large companies, or feed grain operations, such as maize in Indonesia (Simmons *et al.*, 2005); in pork and chicken (for example in Thailand; NaRanong, 2008) and milk in some countries and only so far as an emerging segment. In staples, such as rice, there is some anecdotal evidence of contract farming but surveys tend to find little evidence of it. Reardon *et al.* (2014b) reported that in interviews large mills claimed that they were using contracts but farm surveys in their catchment areas showed very few to no contract arrangements with farmers. They find no evidence of contracts in domestic fruit and vegetable or fish value chains, apart from in the export of shrimp or other export-oriented arrangements by multinational companies.

Second, there has been a shift from no public standards, to the emergence of public health standards and the emergence of private standards. Again, there is no systematic assessment of the diffusion of private standards. There appears to be a correlation between how traded a product is into the international market, and/or its degree of processing, and the degree of public standard emergence for the product. Private standards tend to be for internal procurement across borders of multinational retailers, and for some large processing companies such as Nestlé sourcing from an array of countries and selling in the regional market.

Third and more common is the shift from no brands to the spread of branding for packaged and processed foods, and especially in the more advanced parts of developing Asia. Reardon *et al.* (2014b) analyse the evidence from rice retail surveys in urban areas of China, Bangladesh, India, and Vietnam to show that there has been a relatively recent but rapid shift from sale of loose or poly-packed unbranded rice to mill-branded rice in China, and to a lesser extent in India and Bangladesh.

Fourth, as noted above, especially for large retail chains and large processors, there has been emerging organizational change (especially for dry and frozen processed foods; less so for fresh fruits and vegetables, so far)—the emergence of centralized procurement systems of large food industry companies with use of distribution centres, regional and global networks, and specialized dedicated wholesalers.

## IV. Conclusions

The paper shows that there has indeed been rapid growth and transformation of the midstream segments, both in a ‘modern revolution’ with the ingress of large and often foreign companies, but also a ‘quiet revolution’ with a proliferation of SMEs and substantial investment by them. These revolutions have been spurred at first by direct government action, but then after liberalization and privatization, and after a take-off of urbanization, income growth, and diet change, and vast improvement in hard and sometimes in soft infrastructure, by private-sector investment, overwhelmingly important compared to direct government investments, and for the domestic market, overwhelmingly important compared to the internationally traded sectors.

During these processes, agrifood policies have played important roles. Sometimes the roles have been to slow transformation, such as in the market limiting and ‘reserving’ regulations of India, or in the lack of public investment in upgrading wholesale markets, such as in Indonesia. But often policy and public investment have spurred transformation of the midstream—by liberalizing FDI which had a much larger role

than product trade in changing the Asian food value chain midstream; by putting in place ‘enabling conditions’, such as roads and electricity to make profitable the private investments; by sometimes improving upstream supply conditions to the midstream, such as in the introduction of potato varieties that are more storable and shippable; by putting in place commercial regulations that improved the domestic ‘food business climate’, and occasionally by subsidizing equipment and plant investments to upgrade processing and logistics.

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