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# Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies

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A Foresight Study of the Independent  
Science and Partnership Council

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Thomas Reardon

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# **Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies**

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## **1. Introduction**

“Five interlinked transformations” of the agrifood system are occurring rapidly in Asia: (1) urbanization; (2) diet change; (3) food market transformation, (4) rural factor market transformation, (5) agricultural technology and farm scale (land size) change. The changes are linked in mutually causal ways in all directions – so that we are witnessing the transformation of an integrated system rather than piecemeal, independent changes. This makes the transformation more powerful, more rapid, and more complicated in its impacts and implications for agricultural research strategies.

The transformations are occurring in waves over developing regions and countries within the regions over the past decades, and between types of zones inside the countries. Hence, East Asia (outside Japan) started these transformations earliest, with some of the parts of the set of five transformations starting earlier than other parts there. The second in line was much of Southeast Asia. The third in line were the transition countries, in particular China and Vietnam. The fourth in line were the South Asian countries and recently the Southeast Asian countries that had not been in the second wave. Within each of these regions, there are further waves by countries, such as India initiating the integrated set of transformations earlier than Nepal.

Finally, and a major focus in this paper, is that the transformations are highly correlated with the type of zone – whether: (1) “dynamic, commercial zones” in the 8-10 hour market catchment areas of large and medium cities (and within zones, around towns); (2) “intermediate zones” that are in the pathway, over time, of urban centers’ economic “pull” of supply from rural areas, and that are relatively medium-high potential in agroclimatic terms, but in a situation of medium to under-realization of potential in terms of current performance; and (3) hinterland, traditional,

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semi-subsistence zones” further from cities and in more remote and agroclimatically unfavored areas.

This paper focuses on emerging evidence from surveys and broad trend information of the inter-related five transformations, examined in turn. South Asia is the focus of the paper per the terms of reference for this conference contribution, but to a minimum extent the paper is set in a comparative context with the rest of Asia. Indeed, the underlying trend appears to be that there is a “moving average” where like types of zones are transforming, at various paces, in ways that move them toward convergence with “lead geese” that earlier flew that path. The paper ends with an initial assessment of implications for agricultural development strategies for the different types of zones and farmer strata, countries, and regions.

## **2. First transformation: Urbanization and Rur-urbanization: Patterns, Determinants, Effects**

a) **There is rapid aggregate urbanization occurring in Asia.** Estimates of the urban share by Asian Development Bank show a 60% urban share in population by 2025, from only 20% in 1960 (James et al. 2008); estimates by the United Nations (2011) show Asia is at an urban share of 45% by 2011, and estimate that that share will rise to 56% by 2030 and 64% by 2050; they also estimate that the Asian rural population rose from 1.63 billion in 1970 to 2.31 in 2011, but then will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050.

### **b) Fast Urbanization countries in East and Southeast Asia, but Constrained urbanization countries in South Asia**

In 1960, 1990, and 2005, India had an urban population share of 18%, 26%, and 29%; in China those figures were 16%, 27, and 40%; in Indonesia, 15%, 31, and 48%.<sup>2</sup> Both China and Indonesia look to be on the “urbanization take-off” path of earlier fast-developers, for example South Korea; South Korea in 1960 had (at 28%) an urban share like India today or India in 1990, or China in 1990; by 1970 South Korea had 41% (like China today), and then South Korea rose quickly to 74% in 1990 and 81% by 2005. South Korea achieved a shift in urban share in 20 years that it took 90 years for the US to achieve.

The figures above show India as on a “slow urbanization path,” compared to other large and medium countries in East and Southeast Asia. McKinsey (Ablett et al. 2007) has made the assumption that the slow urbanization will continue in India, as it projects that India will still only have a 37% urbanization rate by 2025 – not even to China’s rate today. This rate of growth in the urban share has been modest. Of course, the absolute increase and current urban population are large: India’s urban population grew six-fold from 1948 to 2001 (Mathur 2005); the urban population in 2006 was 318 million, the size of the US, and by 2025, is projected to be 523 million, larger than the 2008 EU population.

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<sup>2</sup> For urbanization rates, see [www.nationmaster.com](http://www.nationmaster.com).

The question of “why has India’s urbanization been so slow” has been a keen point of debate among demographers and urban sociologists and economists for the past half century. While there is some consensus around why urbanization was slow from 1900 to 1950 (slow economic growth and disruptions), the juxtaposition of rapid industrialization and slow urbanization in the decade of the 1950s and 1960s and again in the 1990s and 2000s has puzzled urban experts in those decades. Several points have dominated the debate, leading us to believe that India’s urbanization process is already faster than is officially stated, and will be faster in the future than in the past.

First, there has been criticism of the criteria used in the censuses to classify areas as urban or rural and thus create an under-estimate of the urban share (Bose 1974). Moreover, in 2001 the number of “villages” (ranked as rural) with more than 10,000 inhabitants surpassed in 2001 for the first time (in the census) the number of official “towns” and “urban areas” having greater than 10,000 population. It is posited that if these large villages that are the size of (officially urban) towns were reclassified (as many do not want to do because of tax advantages of continuing as “rural”), there would be a significant jump in the statistical share of urban in India population (Marius-Gnanou and F. Moriconi-Ebrard, 2007).

Second, the debate has noted that urbanization in India was, in the 1960s-1980s, highly “large city” centric, and that the high rates of unemployment in those cities discouraged rural urban migration, but that towns and medium cities did not have the economic base to grow quickly in the 1960s/1970s (Bose 1974). This point was revived in the 2000s, linked to persistent poor infrastructure, poverty, and absorptive capacity of large cities in India (Mathur 2005).

However, starting in the 1980s and into the 1990s and 2000s the secondary and tertiary cities have “taken off” (especially in the economically dynamic states, see the next point) and led to an increase in urbanization. There are 5,161 cities and towns in India as of the 2001 census. There is no standard categorization of these, but typically used is a four-way taxonomy, of Tier 1, 2, 3, and 4 cities. McKinsey uses a classification with a cutoff of 4 million or more population for Tier 1 cities (e.g., Mumbai, Delhi), Tier 2 cities (26 cities with greater than 1 million and less than 4 million, such as Surat or Indore), Tier 3 cities with more than 500,000 population and less than 1 million (such as Amritsar or Goa), and Tier 4, or small towns. In this set, there is relative concentration: Tiers 1 and 2 have 44% of the urban population. But the trend now is toward relative rapid development of the Tier 2 and 3 cities. Moreover, the middle class is spread over the city categories: two-thirds of the middle class is outside of tier 1 cities, and tier 3 cities have as many middle class as tier 2, and a number of tier 3 cities have higher average incomes than tier 2 cities and even some tier 1 cities. There is, however, a greater average household income comparing the first three tiers and the fourth tier (Weinstein, 1991, Bhalla, 1997, New York Times, 2007, and Ablett et al. 2007).

Third, as there is extreme heterogeneity of economic performance and growth rates over India’s states, there is in turn great heterogeneity over states of urbanization rates; thus, the major Indian states that have grown rapidly have urbanization rates in excess of 40% (like China), and those with lagging growth rates have far lower urbanization rates (Mathur, 2005). In turn, urban

growth is in part conditioned by rural growth; hence, for example, in one of the states with the most dynamic agriculture (Punjab), one also finds among the fastest urbanization with growth of Tier 2 and Tier 3 cities, noted above.

c) **Measuring urban population growth alone understates urbanization's importance to the overall food economy from the demand side - because the urban areas share in the total food economy exceeds its share in population.** I have roughly estimated (using figures for urban share, propensity to consume food from income, and income disparities between rural and urban areas) that already half to two-thirds of the food economy in Asia is urban, in the sense of the share of the value of total food consumed in the countries. Typically, the total food expenditure per person in urban areas is greater than that of rural areas (for example in India in 1999 it was 42% higher, Dev et al. 2004), and thus the population share of urban areas understates the share of urban areas in the total value of food consumed in the country. An example of that kind of reasoning has been done for India for all consumption: Ablett et al. (2007) note that by 2006, while 29% of population is in cities, 43% of overall consumption is in cities (given higher average incomes than in rural areas). They project this share to be 62% by 2025.

d) **Urbanization of population per se understates the role of urban areas in the overall food economy from the supply side - as half to two-thirds of the food supply chain "value added" is off-farm (in wholesale and retail, in mills, in cold storage), much of it clusters in towns and cities in Asia especially in the dynamic zones. There appears to be "rur-urbanization" of the food supply chains in Asia.** Moreover, towns, as nodal points of rural road networks, inter-urban highway and rail interfaces, and electricity-endowed platforms, serve as the staging grounds for clusters of services that are crucial to agricultural development in surrounding rural areas. For example, Rashid et al. (2012) analyze clusters of fish/shrimp related enterprises in towns and secondary cities in Bangladesh, involving nodes of numerous feed mills, hatcheries, nurseries, traders, processors, ice makers, repair shops, and so on.

e) An extension of the above is that **urban population growth as an aggregate concept underplays the effect of urban areas on rural areas depending on the proximity or density of urban areas** (proximity of one city to another, even with rural areas intervening between them) **and the development of rural infrastructure, particularly roads and rails, connecting the cities.** South Asia and China, much of Southeast Asia both on the mainland and on the main islands of archipelagic countries, is peppered densely with cities so that rural areas are constantly close to cities in most zones where most of the rural population resides.

The latter effect is presumably magnified by the **huge investments in rural infrastructure and rural-urban links**, particularly roads and rail made by Asian governments in the past 1-2 decades. For example, over 1991 to 2005, road density increased rapidly in South Asia, per the following annual growth rates: Bangladesh, 4.4%; India, 4.6%; Nepal, 12.6%, and Pakistan, 3.8% (ADB, 2012). In the next section we also examine the massive investments in wholesale market infrastructure that Asian governments have made.

An important variation on the above theme is the development of **highway corridors between cities**. Bhalla (1981; 1997) analyzed the development of rural nonfarm enterprises and employment along major highways connecting large cities in India, sources of derived demand for services and products; she found what we can call “internal coastlines” to be very intense areas of nonfarm development, often involving attracting enterprises from villages well away from the highway.

f) **Urbanization per se abstracts from the “type of city” – that is whether its growth is linked or not to the surrounding rural area.** This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007, who makes this link). On the one hand, the urban area may have developed either as an emanation from those linkages, such as in the case of the growth of towns and cities in Shandong or West Java, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as a relative enclave *vis* the surrounding rural area (like resort based towns on the coast of Cambodia, or mining towns in hinterland agricultural areas. In the latter case, urbanization per se may have little effect for the local agricultural area.

g) **Hypotheses concerning general impacts of urbanization on rural areas include:**

g.1.) De facto “de-protection” of rural areas as part of general transaction cost reduction; thus also creating dynamic areas linked to the cities;

g.2.) Facilitation in towns and secondary cities of various clusters and agglomeration of services crucial to capital-led intensification of agriculture, which can also help the survival of small farms.

g.3) Facilitation of development of rural nonfarm activity (and short-distance commuting migration) which in turn affects technology and farm size as discussed below.

g.4) Facilitation of the transformation of food supply chains and agricultural diversification, discussed below.

### **3. Second transformation: Diet Change in Asia**

a) **Income increases (via “Bennett’s Law, Bennett, 1954) and lifestyle changes accompanying urbanization that increase the opportunity cost of women’s time, lead to changes in product composition of demand.**

**These include an increase in the level and shares of: (1) non-grains (meat, fish, dairy, edible oils, fruit, vegetables), with derived demand for feed-grain for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home.** There is abundant evidence that these shifts are occurring in Asia (Pingali 2007; Timmer 2013).

**The corollary is that the share and in some cases the level of cereals consumption is declining.** For the India case, the Government of India (2010) shows that the share of cereal consumption in the urban food basket has declined from 36% in 1972 to 23% in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32%. Weighting by urban and rural population (thus abstracting from income differences), Reardon and Minten (2012) find that roughly 29% of India's food economy was in cereals in 2006, versus roughly 52% in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins.

India appears to be going along a diet change continuum that has further expression in the Southeast Asia case, such as in Indonesia, for which Timmer (2013) shows that by 2011 only 10 percent of the food budget goes to rice (on average—it is higher for the poor), so 90 percent of the food budget is spent on other commodities and value added from processing and convenience.

**The same changes take place in rural areas of Asia, but typically just less fast and far.** This manifests itself in cross section: Ahmed (2013) shows a decline in the share of rice as a share of total energy intake as a function of income strata in the poorest zones of rural Bangladesh. It also manifests itself over time: This was noted above for the case of cereals in rural India; moreover, Timmer (2013) shows a decline in rice consumption per capita in all but the lowest quintile in rural areas of Indonesia over the past two decades. The decline is slower than in urban areas, but still significant.

**The converse of the above point is that the consumption of non-grains is growing faster and/or further in urban areas than in rural areas.** In India for instance, Dev et al. (2004) show, in constant 1999/2000 rupees, in rupees per capita per month, that: (1) cereals in rural areas dropped from 137 to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; (5) Overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410.

b) **Rice is still important in Asia.** Rice is currently and traditionally important in the food consumption basket of Asian countries. For example, nearly all the food grain consumed in Bangladesh was rice, and rice comprised about half the food grain consumed in China and India. However, there are differences between rural and urban areas. For example, in China, in 2004, urban residents consumed 51 kilograms (kg) of rice per capita, while rural residents consumed 93 kg.

c) **However... rice consumption is in a gradual, absolute decline in Asia.** The importance of rice as a share in the diet of most Asian consumers has been declining during the past several decades, as analyzed by Timmer and Dawe (2010). The share of rice in calories for all Asian

countries in the FAO's food balance data sheets was at its highest in 1970 in the midst of the Green Revolution, at 38.2%, and then trended down to 29.3% by 2007 (FAOSTAT 2012). The shift has been marked in China, for example, from rice being 38.7% of calories in 1970 to 26.8% in 2007) and Bangladesh (from 75.1% in 1970 to 69.8% in 2007), Indonesia, from 58% in 1961 to 47% in 2009, and India, from 32.4% in 1970 to 29.9% in 2007. The downward drift was very slow until 1990 and then much faster (as Asian incomes increased) (Timmer and Dawe 2010, and Timmer 2013).

**By 2007, only 30% of calories in Asian consumers' diets came from rice (comprising 5% of their food budget in money terms).** The calories from rice changed in the PRC (from a low of 444 in 1961 to a high of 872 in 1990, then dropped to 799 by 2007) and India (from a low in the 600s in the 1960s–1970s to a high of 781 in 1990, then dropped to 703 in 2007). The calories from rice rose slightly in Bangladesh in absolute terms (from a high in the 1,500s in the 1960s–1970s, down to 1,311 in 1980 and 1,473 in 1990, and up to 1,591 in 2007), as Bangladesh rode through the Green Revolution, a prolonged crisis, and a long recovery.

Timmer and Dawe (2010) noted that the decline had accelerated in the last decade, and should be expected to continue for some time because (1) the income elasticity of rice demand is falling over time; (2) as rural-to-urban migration occurs and incomes rise, the elasticity trends downward; and (3) the income elasticity is lower in urban than in rural areas and among richer than poorer consumers. This general decline of course disguises heterogeneity among age groups, regions within countries, and across the economies themselves, but the overall trend is clear.

**d) But there has been a rise in wheat consumption – and wheat imports.** Wheat is still minor in most Asian countries compared with rice (except in India and China). But the rise of wheat from a low base to a significant presence in consumption is especially marked in Southeast Asia, as Timmer (2013) shows: from 1 million metric tons of imports of wheat in 1961 to 13 million tons by 2010; wheat was 2.8% of the level of rice consumption in 1961, and by 2009 was up to 11.5%. Senauer et al. (1986) documented the early stages of this rise of wheat in Sri Lanka in the 1980s. In both cases, the rise of wheat brought increases in imports as Sri Lanka and Southeast Asian countries do not produce them significantly. By contrast, wheat consumption in China and India are important but they are also major producers of wheat and imports are minor. Of course, some countries like Bangladesh are still focused on rice and the imports of wheat are minor.

**e) Note that the current changes in cereal consumption (secular decline of rice, rise of wheat) and tuber consumption (rapid decline of sweet potatoes, rise of white potatoes) are not the first time consumption composition changes have taken place. In the 1960's through 1980s, as a rough approximation, there was a decline in coarse grains, especially millet and sorghum, in India (ICRISAT 1982) – displaced by the rise of rice and wheat and somewhat maize (as it was doing in Africa at the same time, see Reardon 1993).**

**f) Diet patterns are malleable in Asia, with “traditional food culture” appearing to be only moderately constraining of shifts.** Several points stand out.



**f.1) Many non-traditional food products have quickly become “traditional” and widely diffused in Asia.** (1) Central/South America’s products (potatoes, tomatoes, chili peppers, sweet corn, pineapple, papaya) have become leading produce items in Asia (potatoes are the leading vegetable in India, Bangladesh, China, Indonesia - all places they are utterly non-traditional and recent). (2) Shifts from Africa to Asia also are common: sorghum and millet (ICRISAT 1982) were introduced into India from Africa and highly diffused into large tracts of India where only recently (mainly in the past half century) did rice and wheat (and pulses) enter and displace those “traditional” crops. Oil-palms were brought to Southeast Asia from Nigeria in 1961, to become major crop in Southeast Asia and major edible oil in much of Asia. (3) Dairy, non-traditional in the great majority of East/Southeast Asia (except in the far north in the grasslands such as in Inner Mongolia or Mongolia), emerged as a significant sector in many countries of the region in only the past few decades.

**f.2) Traditionally “vegetarian” areas, such as the (mainly-Hindu) India and (mainly Buddhist) Southeast Asia have rapidly growing fish, poultry, and even red meat consumption.** For example, 31% of Indians are strict vegetarians, and thus in a sense may be “structurally constrained” in diet habits, but the working hypothesis is that many of the rest will increase at least fish and poultry consumption as incomes grow.

**f.3) New forms of consumption and buying** (in processed form, from away-from-home sources, and from modern retail or fast food chains, as discussed further below) **also have spread very quickly**, even though these are highly non-traditional (just as they were in the “West” only 50-80 years before);

**f.4) There has been a proliferation of grain and potato varieties amenable to longer storage, easier processing, and long-distance shipment**, such as in the case of potatoes in India (Reardon et al. 2012a).

**g) Shift toward more consumption of non-grain foods and more processed foods is conditioned by supply side factors that vary a lot over time, over countries, and over product types – but factors that in Asia in the past 20 years have been very amenable to the shift, as follows.**

**g.1) One such supply side factor is in general NOT imports – imports are not driving diet change. Imports as a source of food are minor as a share of total food consumed. Exceptions are the rise of wheat imports, although even that is a tiny share of total food, and of soy imports for livestock production.** Asia’s situation of near full self-sufficiency in food (measured merely as the share of domestic production in total food consumption) is in contrast to a greater dependence on imports that has been more important in for example Africa (for West Africa for the issue of growing cereal imports especially of cereals not produced in the region, see Reardon 1993). For more on this subject for Southeast Asia, see Timmer (2013).

g.2) **Domestic farm side supply of nongrains is rapidly increasing: farmers are undertaking agricultural diversification** toward fruits, vegetables, fish, meat, and dairy has been proceeding apace in Asian countries, such as noted in Pingali (2006) for a number of Asian countries, Joshi et al. (2004) for all South Asian countries, and Birthal et al. (2012) for India.

Rao et al. (2006) note for India that there is a **strong correlation between agricultural diversification on the one hand, and the urban share and road and population density of the district in India**; urbanization and infrastructure development have thus encouraged that diversification over the past several decades. There have been large investments in irrigation in horticultural areas such as in Gujarat in India and Comilla in Bangladesh, and in fish and shrimp ponds in Bangladesh (Rashid et al. 2012), Indonesia (Yi et al. 2012), India, and China. There have been massive investments by farmers in inexpensive clay greenhouses in Shandong (Wang et al. 2012).

g.3) **Domestic supply chain development after the farm-gate is facilitating the supply of non-grain products to Asian cities. Supply chain actors (off-farm) have invested enormous sums in the aggregate in rural-urban supply chains for non-grain products: storage, packing, logistics/shipping, and commercial services.** The emerging evidence is abundant concerning the rapid development of these services in Asia, both in the modern large-scale sector and in the informal, small-scale sector. Examples include the very rapid emergence especially in the 2000s of potato cold storage facilities in western Uttar Pradesh (to serve the Delhi market, where fully two-thirds of potato consumption is now from cold storages in nearby production areas) (Reardon et al. 2012a) and even in poor areas of Bihar (Minten et al. 2011). There has also been a rapid emergence of cold storage and logistics companies that operate increasingly pan-India; part of this has been from FDI from Japan and the US and others (Reardon and Minten 2012). Domestic and multinational packaging companies are also important to this trend. For example, the Swedish multinational Tetrapak, so important in dairy packaging that spurred dairy sector development in Latin America in the 1980s/1990s (see Farina et al. 2005) is making large investments in a number of Asian countries for milk and juice packaging in the 2000s.

g.4) **The growth of non-grain supply chains (as well as grain supply chains) has hastened and been facilitated by intra-country (inter-region) market integration as cities across a given country demand similar products** (northern India, before a wheat consumer (and before that a sorghum and millet consumer) starts demanding more rice, southern India and southern China demand more potatoes (produced in the mountain/hills and northern areas of the countries); fish is marketed over regions in Bangladesh, from the pond-strewn and river-laced south to the drier north; japonica rice is shipped increasingly from northern China into southern China even as the consumption of indica rice wanes).

**Probably over time food market integration and development of pan-region supply chains will be and is being hastened and facilitated by the spread of fast food chains in urban areas:** Northern India cuisine has spread by this vector to Southern India, and vice versa; as has the consumption of French fries (see Scott and Suarez (2012) for latter in China). This is similar to what happened in the US.

**h) Quality demanded of farmers and by consumers increases also with urbanization, in several ways:**

**h.1) Demand does not only differentiate over broad categories – but within categories over niches, commodities, and differentiated products which create new series of niches which are then commoditized, as in the “product cycle”.** This is a cycle of cost then quality competition, cost then quality competition, and so on. A good example of this is the kiwi fruit: it started as a wild/local niche fruit in China, then moved to commoditized phase after introduction into New Zealand (and Italy and California and others) to then commoditize in China too; the kiwi was then differentiated into various varieties (such as golden kiwi) as part of the third phase of the cycle, product differentiation, “climbing the value ladder.” This same process can be seen in the fish sector in Bangladesh (Rashid et al. 2012).

**The product cycle often manifests itself in geographical differentiation over the phases.** For example, land shifts from rice into commodity vegetables near Jakarta in the early 1990s; by the late 1990s, the commodity vegetable production had shifted to cheaper land and labor areas in West Java (and shipped back to Jakarta), while the vegetable areas near Jakarta had started to enter the product differentiation phase, for the local market and for emerging supermarkets. By the mid/late 2000s, the areas near Jakarta (with much higher land and labor costs by then) started to shift to export vegetables and high end products such as hydroponic vegetables, and “supermarket” quality vegetables had shifted to West Java, and commodity vegetables such as bulk potatoes and cabbage started to shift to cheap land areas in Sumatra. There are many similar cases in various parts of Asia (and elsewhere).

**h.2) Food safety is gradually introduced as a requirement, especially for fresh produce and dairy and meat products.** This tends to be first introduced for export markets, for situations where public and private standards are introduced, and for high-end supermarket chains, and in the wake of crises such as the melamine crisis in China or the bird flu crisis in various countries of Asia. An example of a regulatory initiative is China’s first comprehensive Food Safety Law of 2009.

**h.3) Branding cum quality differentiation of products is also gradually being introduced.** In our study of rice in China, India, and Bangladesh, it was particularly in China where mill branding and packaging has developed rapidly recently (Reardon et al. 2012a). In Bangladesh, there has been a differentiation of rice quality over the past decade (with the price premiums mainly captured by millers and traders), see Minten et al.

2013a, and incipient branding in fruit value chains in India, even originating in poor zones like Bihar (Minten et al. 2013b). **I surmise that in Asia over the next decade, the rise of branding (especially by large and medium food companies) will go hand in hand with the rise of consciousness of and public concern about food safety – as it did in the first half of the 1900s in the US** (see Levenstein 2013).

h.4) **There has also been a shift in some cases toward varieties that can ship further or have longer shelf life (such as potato varieties in India, see Reardon et al. 2012a), that are easier to mill, and so on.** That is, varietal development and transformation of the food system are sometimes linked.

i) **Hypotheses concerning general implications for rural areas of urbanization *cum* diet change:**

i.1) **inducement for diversification of agriculture from grains to non-grains, and from commodity grain to differentiated quality grains.**

i.2) **inducement to shift the product and variety mix in agricultural zones as part of product differentiation and the product cycle** (for example, the rise of horticulture in the market-catchment areas of large cities in India and Bangladesh, such as found by Rao et al. 2006).

#### **4. Third Transformation: Food System Transformation in Asia**

The food system (a general term for food supply chains and markets) transformation is taking place along several lines in Asia. Here we will focus on the transformation of the “post-farmgate” segments of the supply chain: wholesale/brokerage/logistics/cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are formed in these segments).

The transformation of the post farmgate segments is intimately connected with urbanization both in terms of the drivers being especially in urban areas, because the majority of the food supply chain in Asia is from rural to urban, and because many of the post-farmgate activities are in towns and secondary cities and primary cities.

In this section I briefly review key evidence on the food system transformation in Asia, drawing from Reardon and Timmer (2012), Reardon et al. (2012abc), and Reardon et al. (2009) which in turn contain reviews of the detailed evidence and literature, much of which was formed in the 2000s.

**A first important qualifier** to the discussion is that the **transformation of food systems in the Asia mega-region took and takes place unevenly – a) in spatial terms**, spreading in waves over regions, sub-regions, countries, and within countries, over tiers of urban areas, and over dynamic versus hinterland rural zones, **and b) in product terms**, happening earliest and fastest

in processed, then semi-processed, then fresh/raw products. Thus, countries like India, and a few years ago, China, are in the earlier phases of transformation, doing them very fast, but doing them with a lag after earlier sets of transformations took place in parts of Southeast Asia like Thailand or Northeast Asia like South Korea, and of course all lagged compared to the “lead goose” both in early industrialization and in food system transformation, developed Japan. The food system transformation is thus broadly correlated with the path of overall economic development, but mediated and conditioned by policy processes that delay or constrain various processes, such as for example retail FDI liberalization that occurred early in Southeast Asia, recently in China, and only a few months ago in India.

**Despite the heterogeneity** of distribution of these conditioners of transformation – over products, over firms, over countries, over regions, over time – and the consequent unevenness in the diffusion of transformation - **there is still surprising regularity and timing of “waves” of diffusion**, which occurred geographically (over countries and within countries, over income classes, and over products), for all the three agrifood industry segments.

**A second important qualifier is that there has been a dual-revolution in food, comprising –**

a) a **“modern revolution” - large scale, largely retail and second-stage processing sector focused transformation, with an important component of FDI** (Reardon and Timmer 2007);

b) a **“Quiet Revolution” – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services – in its great majority domestic capital based** (Reardon et al. 2012a).

Throughout the discussion below of the food system transformation, I have as under-pinning points the above qualifiers concerning the above heterogeneity and duality of the transformation. The key findings concerning the transformation are as follows.

a) **Reardon and Timmer (2007) emphasize that there have been two “broad phases” of agrifood industry transformation over the past 50 years: “pre-liberalization/pre-globalization” (mainly 1960s- mid 1980s) and “liberalization/ globalization” (mainly mid-1980s to now).** Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or later in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

b) **Overlaying the above two broad phases are a series of waves of transformation of food systems. The waves are as follows.**

b.1) **The first wave** tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, **East Asia outside China** (and Japan, which I exclude from this discussion as being already developed). The start of wholesale sector transformation (with major investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation “took off” from the early 1990s.

b.2) **The second wave** tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in **much of Southeast Asia (outside Vietnam, Cambodia, and Laos)**, wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

b.3) **The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others.** Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam. As we show below, the retail revolution only took off in earnest mid 2000s in India and Vietnam, and then grew rapidly. In India, although FDI liberalization in retail occurred only at the end of 2012, the sales of modern retail’s leading food-selling chains leapt from 200 million USD in 2001 to 5 billion in 2010, with a 49% annual sales growth for modern food retail (Reardon and Minten 2011) – mainly driven by domestic conglomerates, themselves creatures of the economic boom. This latter also happened in South Korea.

b.4) One can say that there is a fourth wave that includes **other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are on the initial phases of processing and retail transformation.** There were some striking anomalies in the third wave. For example, India had as early a public-sector transformation of the three segments as any first wave country, and kept this public-sector apparatus to the present, not only intact but enlarged – while transition countries like China, Russia, Vietnam had already moved to privatizing the state processing, wholesale, and retailing in the 1990s and 2000s.

b.5) **Diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi-processed, then fresh products.**

c) **There are several key findings in empirical studies concerning the two-stage transformation of the wholesale/logistics segment.**

c.1) **There has been a trend of rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector.** State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then “feeder” or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India. The growth of public markets was spectacular. For example, China’s wholesale market volume increased 11,000 percent from 1990 to 2000 (Huang et al. 2007; Ahmadi-Esfahani and Locke, 1998), and India’s regulated wholesale markets went from 450 in 1948 to 5500 in 2008. A similar rapid growth had occurred in the first- and second-wave countries in the 1960s-1970s.

c.2) **The large investments in public wholesale markets partially transformed this segment - substantially “de-fragmenting” and integrating markets, by providing “economies of agglomeration”** and channeling wholesale from field brokers into a network of covered markets with in situ wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets. In some countries, domestic regulations have held back the transformation of the wholesale market sector. For example, in parts of India, Minten et al. 2010 note that there has been a limitation (through licensing) of the number of wholesalers in markets.

c.3) **The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries opened the door to progressive “dis-intermediation”** in the rural areas and in supply chains.

This has involved two important trends.

**First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers** – such as development (at least in its incipience) or further development of contract farming by processors and collection centers by supermarket chains.

**Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, has spurred “disintermediation”, of the decline of village traders in diverse settings** (with evidence in horticulture and cereals and fish in various Asian countries), and development of direct purchase from farmers by wholesale market traders who often formerly had to procure via village trader networks (see Reardon et al. (2012a) for cases of rice and potatoes in India, China, and Bangladesh, and Dao (2013) for the case of southern Vietnam for rice, Huang et al. (2007) for vegetables in Shandong, and Natawidjaja et al. (2007) for tomatoes on Java in Indonesia).

Rather, wholesale market traders based in towns and cities now dominate wholesale with the farmers, buying directly and “dis-intermediating” the supply chain by displacing the traditional

village trader. For rice, these same works show the rapid decline especially in the past decade of village mills, which if persisting are relegated to custom milling for local farmers for home consumption, a minority share of their output disposal in the dynamic zones. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns and cities in the province or even in the receiving consumption-cities. And as the urban areas assume the majority of the value of consumption, the urban retailer takes on more importance in the total food supply chain than does the rural retailer, such as the haat in the dynamic zones of India, as shown in the recent surveys.

By contrast, we have found that while less-dynamic areas are starting to follow the above trends, they are doing it with a strong lag and much more slowly than the dynamic areas; see for example field survey analyses of Reardon et al. (2012b) for eastern versus dynamic western Uttar Pradesh and Madhya Pradesh and dynamic eastern Andhra Pradesh versus western Andhra Pradesh.

**Moreover, as in the case of modern cold storages in India, these firms act as de facto wholesale market venues, displacing the “mandis” (regulated wholesale markets).** This change appears to be good for Asian farmers as it allows greater choice of buyer. We have also observed (in the study countries of India, China, and Bangladesh, in rice and potato) a great reduction, even in most places a near disappearance, of “tied output-credit markets” where traders pay advances to farmers and expect their output to be sold to that trader. Interestingly, the main and only places we observed a continuation of this traditional “tied” system was in the hinterland zones (that resemble the “traditional image”). (See Reardon et al. 2012b,c).

**c.4) There has even been an incipient emergence of various “off-market” actors specialized in meeting the sourcing requirements of modern processors and supermarkets.**

**The first of the modern wholesale actors are the “dedicated wholesalers” (such as Bimandiri in Indonesia).** These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers. They add value (relative to the simple spot market of the traditional wholesale segment) by managing the relation, collecting, sorting, grading, packing or processing, and delivering.

**The second of the modern wholesale actors are modern logistics companies.** Commonly they undertake a variety of logistics 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 Indian supermarket chains, Reardon and Minten 2011). FDI has been an important driver of the rise of these second type of firms; **this was spurred with the liberalization of FDI in “distribution” (logistics and wholesale)** as part of general liberalization in the 1990s and 2000s. In China and India, for example, this occurred in the 2000s, and was immediately followed by a rush of foreign companies investing.



**A third element of the modernizing wholesale sector is the “cash & carry” chain.** This is in direct competition with the traditional wholesalers and “stockist” networks, supplying traditional retail and traditional HORECA. Global chains operating in this segment include Metro, Walmart (Sam’s Club), Makro, and others.

**d) There are several key findings in the recent empirical literature on the two-stage transformation of agrifood processing in Asia.**

**d.1) The general debate about food systems appears to me to little realize how high a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 16.8% of food undergoes no processing (like fresh whole fruit); that share is 15.3% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as “first processing” with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

**d.2) The processed food<sup>3</sup> sector has grown quickly in the past several decades; this growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments.** These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

**d.3) The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today, very small.** Although the parastatal grain processing sector has been important in urban food security debates for decades, the government’s direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was often larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

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<sup>3</sup> Processed foods are from cereals and pulses, tubers, fish, meat, dairy/eggs, edible oils, and condiments. These are either minimally (semi-) processed or fully processed. They are sold both packaged (bagged, boxed, wrapped, bottled) and non-packaged (like loose flour).

Only a few countries' governments still have substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al. 2007), and far lower yet in other regions.

**d.4) Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multinationalization, and technological, institutional, and organizational change.**

**In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.**

**On the one hand, there was a proliferation of small and medium scale enterprise (SME)** grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. An example of such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

**On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of processing FDI, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants.** The FDI came first mainly from Western Europe and the US (with global firms like Nestle, Kraft, Danone, seeking less saturated markets with higher profit rates, Gehlhar and Regmi 2005), then Japan, and eventually from regional multinationals such as Thailand's CP or Singapore's Wilmar into China and other Southeast Asian countries and India (last year CP created the largest shrimp processing firm in the world in Indonesia), Philippine's San Miguel into Vietnam and Del Monte Asia (Philippines). Some of this has been in the feed sector; the largest feed company in China (New Hope) is now the lead feed miller in Bangladesh (Rashid et al. 2012).

**The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.**

**d.5) There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. The drivers of this consolidation are as follows.**

**In some cases, such as India, the processing sector was "reserved" to SMEs, 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, regulations affecting the segment appeared to accelerate the pressures on SMEs.** For example, re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food businesses have been important examples imposing special burdens on small firms who lacked the investment surplus and access to bank loans to shift location, register their firm, and adopt all the measures (such as hygiene facilities and cement floors) needed to conform to new laws. This has occurred in poultry and egg companies in Vietnam with avian flu regulations. There is mounting evidence that consumers are drawn to supermarkets as a result of food safety concerns about small processors and traditional markets (for Thailand, see Posri and Chadbunchachai, 2006).

**We expect that the new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector.** There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities just as in the US in the 1910s-1920s (Levenstein, 1988).

**Finally, while the “pie” of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in out-competing many small firms.** The large processing firms have several advantages. Through private standards and “resource provision contracts” with suppliers, they can increase the quality and consistency of their intermediate inputs from farmers, driving down costs, controlling for plant size. Also, large firms can borrow more cheaply than small, and foreign firms more cheaply than domestic. Furthermore, in many categories of processing, larger plants have economies of scale. Moreover, a critical mass of output is needed to defend a brand, and the brand provides a competitive attribute over non-branded product, especially where credence goods like food safety are involved. To these can be added economies of scope, as more lines can be added and thus the company can create a “one stop shop” for retailers to source the diversity they require.

**e) There are several key findings in the empirical literature regarding the two-stage transformation of food retail in developing Asia.**

**e.1) As with processing, many governments had several types of public sector cum cooperative retail mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India and Vietnam and China.** At the end of that period, with structural adjustment or liberalization, most were dismantled or privatized, although some continued into the 1990s/2000s and “morphed” into competitors with modern-private chains.

**e.2) In the 1990’s and 2000s occurred the “take-off” of private-sector modern retail – what has become known as the “supermarket revolution” (Reardon et al. 2003).**

**In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries** (Reardon et al. 2012b): (1) the first wave, with take-off in the early 1990s, was in East Asia (outside Japan and China); the share of modern retail in food retail went from roughly 5-10% in 1990 to some 50-60% by the late 1990s; (2) the second wave, in the mid-late

1990s, was in Southeast Asia (outside transition countries like Vietnam); the share reached some 20-50% by the late 2000s; (3) the third wave, in the late 1990s and 2000s, has been mainly in China, Vietnam, and India. The share climbed to some 5-20% by end 2000s, in a rapid rise.

**There has been a steep crescendo in modern retail growth in the third wave countries in the 2000s.** For example, Reardon et al. 2012b, using raw data from the leading retail data source, Planet Retail, calculated leading modern retail sales (for chains selling food) growth rates in representative Asian countries in the three waves. The rates of growth vary over the “waves” as one would expect: the East Asian “first wave” countries (South Korea and Taiwan) indeed show slower modern-retail sales growth rates (a compound growth rate of 11.2% over the 8 years from 2001 to 2009), the second wave (Indonesia, Malaysia, Philippines, Thailand) in the middle (a compound growth rate of 17.9% annually), and the third wave (China, India, Vietnam) the highest (40.9% compound growth rate), as expected due to the most recent starters advancing fastest and the earliest relatively saturated<sup>4</sup>. These rates can be compared to approximately 5% annual growth in real GDP over 2000-2008 in the first and second wave countries, and 7.5-10% in the third wave countries. Even at these rapid GDP growth rates, modern retail sales grew 2-3 times as fast in the first and second wave, and 4-5 times as fast in the third wave. This implies that modern retail’s share of the retail pie continues to expand.

**e.3) Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce<sup>5</sup>. These paths are essentially the same as occurred “historically” (in the 20<sup>th</sup> century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been used to buying them only in wetmarkets, from hawkers, and from tiny shops.**

**f) The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets’ sales, reflecting, as we noted above, the consumption basket), and recently and incipiently, in fresh produce procurement.** The modernization provides a cost advantage to the large and an acceleration of

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<sup>4</sup> The calculations are based on sales data for leading chains from [www.planetretail.net](http://www.planetretail.net)

<sup>5</sup> For example, in “third wave” China, Goldman and Vanhonacker (2006) found that modern retailers already have a retail market share of 79 percent in packaged and processed goods, 55 percent in baked goods, 46 percent in meat, 37 percent in fruit, 35 percent in poultry, 33 percent in fish, and 22 percent in vegetables in large cities. Compare that to the more advanced (“first wave”) case of Hong Kong, which may represent the average Asian consumer sometime in the medium-term future. Hong Kong supermarkets have a 59 percent share in fruit retail and a 55 percent share in vegetables (thus, a share similar to supermarket penetration of produce retail in Brazil), 52 percent in meat, 39 percent in poultry, and 33 percent in fish (Coca-Cola Retailing Research Council Asia 2005). See Ho (2005) re modern retail penetration of rice retail in Hong Kong.

consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2011). This procurement change is discussed below as part of the treatment of effects on producers.

**g) The general implications for rural areas of urbanization cum food industry/supply chain transformation emerge as follows from the literature.**

**g.1) The foremost impact of the transformation of retail has been on the processing sector, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding of small processors;** as modern retailers take a larger and larger share of processed foods markets, this procurement trend will mean that concentrating retail will spill over to **accelerate and magnify the trend of consolidation in the processing sector; the latter trend is also encouraged and forced by a host of other trends that we have noted, and illustrated in the case of India.**

**g.2) Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries,** except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (discussed above for the Bimandiri case in Indonesia) who in turn tend to buy from sets of preferred suppliers. Occasionally, such as in the case of Reliance in India or Cargill (a domestic chain) in Sri Lanka, the chain buys via collection centers from farmers.

**g.3) There have been several reviews recently of the impacts of processors' contracting and supermarket chains' direct sourcing, on farmers** (See Barrett et al. 2012; Reardon et al. 2009). The key findings are as follows.

**(1) There seems to be a general tendency for modern processors and retailers to source from dynamic, close-by zones, rather than hinterland and (agroclimatically) un-favored zones.** This tendency then merely reinforces the prior and ongoing "exclusion" of hinterland zones from the fruits of the growth of urban markets.

**(2) There is no clear pattern – but rather mixed findings – regarding whether small or very small farmers are excluded** from supermarket sourcing or processor contracting. The small set of studies of this question in Asia, like elsewhere, find that sometimes they are excluded (mainly where the buyers have fitting and easy alternative suppliers among larger farmers or sometimes from imports), and sometimes they are included (especially where small farmers are the main source of the produce).

**(3) There appears some tendency for non-land asset-poor farmers, regardless of their land size, to be excluded.** This finding makes sense in that the non-land assets are typically the key conditioners of quality and consistency by the farmers – such as irrigation. As quality and safety requirements of buyers gradually rise, from private

demand or from food safety regulation or from import competition, this source of exclusion may rise.

(4) **There is some evidence that large processors and retailers “help” small producers who face constraints of information, credit, and inputs. The modern buyers are thus helping to resolve “idiosyncratic market failures” facing small or non-land asset poor farmers.** This is often just a private initiative of companies; sometimes it is helped and encouraged by government programs, such as the Government of China’s program to help supermarket chains buy direct from farmers. Note that this “helping hand” is not confined to large firms; we found for example that modern cold storage firms, medium sized companies, also provide credit and input sales to potato farmers in western Uttar Pradesh.

## **5. Fourth Transformation: The Rise of the Rural Nonfarm Labor Market**

a) **Rural nonfarm employment (RNFE) has grown over the three decades to be an important share of rural employment and incomes in Asia.**

**RNFE income is important to rural Asians.** Hagglade, Hazell, and Reardon, henceforth HHR (2007, 2010) note that, based on the review of a number of surveys in various Asian countries<sup>6</sup>, that the average share of rural nonfarm employment, RNFE (employment in manufactures and services, in rural areas) is **40% of total rural incomes; migration income is an additional 11% of total rural incomes; these two (local versus migratory nonfarm income) sum to 51% of rural incomes.**

**RNFE income shares in total incomes are usually higher than “full time” RNFE shares in total employment.** For example, HHR find in a review of full time employment censuses in Asia that the share of local RNFE in total employment is only 24%, well below the 40% income. On average over countries, employment shares are some 20% below income shares. **This is because of much of the RNFE is part time and diversification of income is preponderant.** For example, Davis et al. (2010) for Bangladesh, Nepal, and Pakistan, that many households (52%, 53%, and 36%) earn diversified sources, where no one source exceeds 75% of their total income.

**RNFE income has grown over the past several decades, illustrated here by India’s experience.** There is little systematic data over countries to show this; but individual country cases show this. I illustrate the point here with data from India. Lanjouw and Murgai (2009) show a shift, using NSSO rural household survey data over 1983 to 2004, in the share of total rural employment that is in nonfarm self-employment, going from 10.9 to 14.5%; for casual - wage RNFE, from 5.2 to 9.6%; for “regular RNFE” (salaried RNFE), from 6.4 to 7.3%. Summing these, they show the RNFE employment share from 22% to 31% over this period; note that this is “as full time;” recall the caveat above that this understates the share of this employment in income due to diversified incomes or non-specialization). By contrast, the share

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<sup>6</sup> Bangladesh, China, India, South Korea, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

of the “cultivator” as full time employment dropped from 38.4 to 31.9%, and farm wage labor earners, from 24.3 to 21.8%.

Kumar et al. (2011) show that from 1983 to 1994, 60% of rural job growth was from the farm sector; but from 1994 to 2005, 60% of rural job growth came from the RNFE sector. From 2004 to 2010, total rural employment dropped 5 million even while 13 million new RNFE jobs were added.

Corroborating RNFE’s growth in India from a macro perspective, Himanshu et al. (2011) show that from 1983 to 2004, the RNFE GDP grew 7.1% per year (with a jump from 6.4% per year in 1983-1993, and then 7.7% a year from 1993 to 2004); compare those rates with the agriculture GDP that grew 2.6% per year over those 20 years.

Himanshu (2011) also goes down to the micro level by showing data from a single village taken in some sense as representative, that of Palanpur, where from 1983 to 2008/9 the share of RNFE in total village income rose from 34% to 67%. These changes are similar to those shown in HHR, who review survey studies in India that average to show a change in the share of income from RNFE rising from 26% in 1968 to 36% in 1980 to 46% in 2000.

**RNFE employment in general is much more important to rural Asians than migration employment and farm wage labor.** In popular and also research discussion of “off-farm income” in Asia the assumption is that most comes from migration income and from farm wage labor income. This was shown for migration above.<sup>7</sup> For the case of farm wage labor, Davis et al. (2010), for Bangladesh, Nepal, and Pakistan, show that the share of rural income from farm wage labor is 20, 13, and 9%, respectively, while that of RNFE (wage and self-employment) income is 36%, 30%, and 40% for the three countries, respectively. The ratios of farm

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<sup>7</sup> There are some exceptions to that general finding that migration is much less important than migration income. On the one hand, there are some countries, or rather areas within some countries, where migration income outside the local area is an important share of income and employment. For example, in western and central China, income outside cropping can be a third to half of income, and of that non-cropping income, an important share can be from migration; but note that the literature shows that much of that is still “local” in the sense that it is within the local area around the village, within the province: roughly 40% of employment in migration is outside the local province, and 60% is local semi-migration, sometimes called commuting. The converse is also the case, illustrated by the situation in India; much (with estimates around 50-60%) of “rural” nonfarm employment is actually not in the rural areas per se but in commuting to local towns. This spatial aspect has been under-researched so these estimates are based on just a few studies. On the other hand, there are some countries where migration is important but is very concentrated in terms of participation (a small share of households migrate, but those that do earn a substantial amount of their income from that); this is the case in Bangladesh for example.

participation rates for RNFE versus farm wage labor employment for the three countries are 53/35, 52/38, and 58/20%.

**Rural income diversification (away from just dependence on grain income) from the rise in RNFE far exceeded such diversification from the shift from grains to horticulture and other non-grain cash crops.** Kumar et al. 2011 show that the shift in the share of (full time) employment in RNFE over 1983 to 2004 (from 19% to 32%) can be compared with the shift from 1.9 to 3.5% of employment in horticulture and 4.3 to 9.8% of employment from cash crops. Of course the same caveat as noted above comes into play, that these shares of full time or majority employment understate the shares of these categories in total income due to activity diversification.

**b) RNFE is bimodal - composed of low return (equivalent of subsistence cropping) and high return (poverty alleviating) activities.**

RNFE activities tend to be mainly services (commerce/transport, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR 2010). The activities are a mix of: (1) **casual wage employment** (for relatively low wage, sometimes often below or at the agricultural wage (as in Bangladesh) or modestly above the farm wage (as in India); (2) **salaried “regular” employment** (like a government employee like a rural teacher); (3) **self-employment** (such as owning/managing a micro/small enterprise making cheese).

**The casual wage jobs, and the self-employment jobs (although these vary markedly in returns) are typically relatively low return jobs, while the salaried employment (and some self-employment) are high return job.** It is important to note that the returns can differ very widely across these activities; for example, for Bangladesh, Hossain (1986) showed a long list of RNFE activities ranging from earnings of 4 taka/day to 27.5 taka/day.

**Low return activities typically have much lower entry requirements (in terms of physical, financial, and human capital) than high return activities. One tends to see a strong correlation between poorer households and diversification into low-return off-farm activities,** such as farm wage labor, low return self-employment, and casual wage RNFE (HHR, 2007). For example, for India, Lanjouw and Shariff (2004), echoed with later data by Lanjouw and Murgai (2009), show that households in the various income quintiles (ranging from 1146 to 11,226 rupees) have very different income diversification profiles: the lowest has 38% cropping, 28% farm wage labor, 16% casual RNFE, 11% self-employment RNFE (of the less remunerative kind), 4% salaried RNFE, for 32% of their income from RNFE (and 2% from remittances). The highest quintile had 65% cropping, a mere 2% from farm wage labor and another mere 2% from casual RNFE, but fully 15% for (fourth quintile and 8% for 5<sup>th</sup> quintile) in self-employment (of the more remunerative kind), and fully 21% in salaried RNFE, for a total share of RNFE of 39% for the fourth quintile and 31% for the richest quintile.

**c) Drivers: Push and Pull Factors (differing by dynamic and hinterland zones) and links to types of RNFE generated**



**An important reason for the discussion of the types of RNFE is that the growth of RNFE can be thought of as a mix of the proliferation of low-return RNFE analog to subsistence farming, more of a “refuge” activity (Elbers and Lanjouw, 2001) and the development of high-return RNFE that can alleviate poverty and also feed into investment funds for agriculture.**

**HHR (2007) note correlations: (1) between low-return RNFE activities and “un-favored” zones with low aggregate demand for goods and services from nonfarm sectors; and (2) between high-return RNFE activities and zones with high aggregate demand.** High demand for nonfarm products tends to be generated, as Engels Law would predict, from higher incomes and purchasing power, and from investable surplus to invest in nonfarm activity.

**There is some controversy over whether it is necessary for aggregate demand to come from agricultural development** (as Hossain 1988 and Hazell and Haggblade 1991 emphasize, in their analysis of consumption and production linkages from agriculture in Bangladesh and India), or income from nonfarm activity that developed based on an earlier round of agricultural development (HHR 2007) **or some other source of income, such as proximity to cities or highways between cities or towns (as we discuss below)** or some enclave such as a rural tourism complex, or even from large inflows of migration income.

**The converse is that zones with low aggregate demand can manifest low-return RNFE diffusion.** That low aggregate demand can be from poor agriculture without other sources of income (HHR), or growing agriculture in a zone with poor links to cities (such as shown for Bangladesh by Deichmann et al. 2009, discussed further below), or export markets so that the farmers cannot “realize” sufficient profit from the agricultural development; the most extreme case is where production causes a glut and a price decline. One can find then a paradox of a combination of growing or high level of RNFE (of the low return variety) and stagnant agricultural zones.

**This paradox can explain some findings in India that seem to contradict the “farm development is needed for RNFE development”:** (1) Foster and Rosenzweig (2003) found RNF growing fastest in zones with lower agricultural wages (presumably from weaker agricultural growth and thus derived demand for labor); Lanjouw and Murgai (2009) found that self-employment is greatest in zones with low agricultural productivity in India. (This is similar to findings in Latin America; see Elbers and Lanjouw 2001 and Reardon et al. 2001.)

Note however that even low return nonfarm wage employment can be higher than the farm wage (as Himanshu et al. 2011) note for India, so that the growth of that RNFE can increase farm wages, as Lanjouw and Murgai (2009) find.

**d) Spatiality: RNFE develops especially in proximity to cities and towns**

**This is a key point that links our discussion of urbanization and that of RNFE in Asia.**

Renkow (2007) analyzed conceptually the links between RNFE development clustering around cities and towns, and the presence of agglomeration economies from urban and rur-urban areas as a centripetal force of RNFE toward proximity to urban areas, and congestion diseconomies in urban areas as centrifugal forces to push NFE from cities into surrounding rural areas.

**There have been so far several empirical studies that have tested this hypothesis and confirmed it, showing RNFE clusters near cities/towns; this suggests that RNFE may grow with towns and thus urbanization in general.**

(1) For Nepal, Fafchamps and Shilpi (2003) found RNFE spatially concentrated around cities and towns – specifically within 4 hours of large towns and cities, and within 1 hour of the village/rural town market. They also found “von Thünen” patterns for crop production – with vegetable production concentrated within 1-3 hours of cities and towns, and commercial paddy within 3-5 hours. Paddy marketing and fertilizer use fell off very sharply or disappeared beyond 5 hours around cities and towns as one entered the deeper hinterland areas.

(2) For Bangladesh, Deichmann et al. (2008) found that in the areas near cities and towns, the RNFE share of rural incomes was 56%, versus only 41% in the hinterlands. The hinterland features RNFE of the low-return type, while RNFE near towns is higher-return wage and self-employment. Moreover, Deichmann et al. cross the analysis of effects of urban proximity and agricultural potential and find that high potential farm areas that are near to cities have a lot of high-return wage and self-employment RNFE – but that if the high potential farm area is far from the city (and thus aggregate demand sources and agglomeration economies), the share of high return RNFE is low and low return RNFE by far predominates, often just focused on local services; they note that 28% of the latter is at a return below even the low farm labor wage.

(3) For India, similar to Deichmann et al., Lanjouw and Murgai (2009) found that the urban share of the zone is correlated with a higher incidence of “regular RNFE” (high return wage employment) and self-employment, but not casual, low wage RNFE.

(4) For India, Hazell, Ramaswami, and Rajagopalan (1991) found that rural road density radiating from cities and towns heightens the production- and consumption-linkage effects (in creating RNFE) of agricultural development from the Green Revolution.

(5) An extension of the Hazell et al. (1991) findings about the effects of roads can be found in Bhalla’s (1997) finding that major highway “corridors” between big cities in India form magnets and nodes for RNFE development along and around them; in fact she showed that over decades, these infrastructural linear nodes draw RNFE such as small manufacturing from more hinterland areas, and increase the average size of the firm and increase thus the overall wage employment share in RNFE.

(6) Kumar et al. (2011) show for some states in India that fully 57% of the RNFE jobs are actually commuting and/or temporary local migration from more rural to rur-urban areas and rural towns to work.

**However, urbanization in/near rural areas can be a two-edged sword for RNFE: urban manufactures, produced for mass markets using large scale plants enjoying economies of scale, may compete with RNFE-supplied manufactures.** The cities and towns in rural areas, and the rural roads and inter-city highways are conduits from urban industry to rural areas of these products. This can challenge small scale rural manufacturing with both cost and quality and variety competition. An example is the large-scale food manufacturer in Indonesia, Indofood, selling basic processed food items through convenience store chains into rural towns into rural areas and crowding out cottage-industry goods (Reardon, Stamoulis, Pingali, 2007).

#### **e) Effects and Correlates of RNFE growth on Agriculture and Farm Labor Markets in South Asia: Hypotheses and Findings**

##### **e.1) RNFE (and other factors) drive up the farm wage (in turn inducing mechanization)**

**Farm wages have risen over the past three decades. With the Green Revolution, there was at first a period (in the 1970s) of farm employment increase but without wage increase as labor-intensive high yielding varieties diffused (Lipton with Longhurst, 1989), and then a period of moderate wage increase (with greatly varying rates over zones), and then evidence of acceleration in the past 5-10 years in various countries of a sharp upswing.** In India, Lanjouw and Murgai (2009) note that, in 1993 terms, farm wages doubled from 1983 to 2004/5. Gupta and Sidhartha (2011) note that farm wages rose quickly in the second half of the 2000s. These two India pieces emphasized that the wage growth rates differed markedly over zones. Zhang et al. (2011) note that farm wage rates grew steeply from 2003 on in China, and Zhang et al. (2013) note the same for Bangladesh in the late 2000s, in what they describe as evidence of a Lewis Turning Point.

**The studies in India, China, and Bangladesh note that farm wage growth was driven by: (1) RNFE and migration tightening the labor market; (2) farm productivity growth in some zones.**

**The rise of the farm wage has in turn spurred the spread of farm mechanization, even on small farms. We discuss this further below.**

**e.2) RNFE and migration remittances in turn appears to facilitate purchase of farm machines (such as Estudillo and Otsuka 1998 and Takahashi and Otsuka 2009 show for Luzon, Philippines in a panel study) and other lumpy investments that permit diversification (such as pumps for fish ponds or irrigation for fruit orchards).**

**e.3) RNFE and migration remittances are one way (beside labor- and capital-led intensification, discussed below) for farm households to continue to farm very small farms – as part time farmers (HHR 2007).**

## **6. Fifth Transformation: Farm Technology and Scale Change and Rise of Intermediate Factor Markets**

### **6.1. Farm Technology Intensification and Rise of Intermediate Factor Markets**

a) **In general** over Asia over the past three decades, there has been “intensification-cum-commercialization/diversification”: (1) farms have commercialized; (2) the agricultural sector has diversified (into non-grains, mirroring the diet diversification) while individual farms have specialized (into cropping, or livestock, poultry, aquaculture); (3) farms have shifted from non-purchased to purchased input use (from human to animal to machine power, from manure, byproducts, and residues to chemical fertilizer, and to use of more pesticides and herbicides) (Pingali and Rosegrant, 1995, as well as in analyses of the Green Revolution stages in Cassman and Pingali, 1995, Estudillo and Otsuka, 1998.) These changes occurred earliest and fastest in the “classical Green Revolution” zones, particularly lowland rice systems and irrigated wheat areas. It should be noted however that in these areas as early as the mid-1990s/early 2000s there were warnings that yield growth had begun to plateau despite this intensification (see Cassman and Pingali as well as Lipton (2000)).

**A second wave of this intensification-cum-commercialization occurred, also mainly still in rice and wheat and horticulture areas, in zones that in the 2000s were “catching up” with the initial Green Revolution zones;** this is depicted for example in recent studies in western and central Uttar Pradesh in India, northern Bangladesh, and northeast China in rice and potato (see Reardon et al. 2012a). There was another source of intensification with the development of horticulture in the 1990s-2000s (see for India, Joshi et al., 2004, and BIRTHAL et al. 2012).

b) **The increase over several decades of the farm wage (discussed above) drove a continuous rise in the use of farm machinery** – first for “power” replacement of human and animal power, for example in land preparation, and then “control” replacement for harvesting and weeding (with the latter also and especially addressed by the **rise of the use of herbicide**) (Pingali and Rosegrant 1995).

**RNFE (and thus urbanization, by extension, given our discuss above) appears to have two way effects with the increase in the use of farm machines.** On the one hand, **RNFE and migration remittances are associated with ownership of machines**, as RNFE provides cash to buy the machines (as credit for machine purchase is usually limited); Takahashi and Otsuka (2009) illustrate this in the case of Central Luzon in the Philippines over 1979 to 2003. On the other hand, **using farm machines also frees labor for both migration to cities and local RNFE**; a similar effect comes from using RNFE cash to replace home labor on farms with hired farm labor, as shown in Takahashi and Otsuka).

**Empirical studies find that RNFE is poorly correlated with use (rather than ownership) of farm machinery – mainly because of the existence of active rental markets for farm machines,** that appear to have grown quickly over time (for discussion of this in rice zones, see for example a study of the Philippines by Takahashi and Otsuka (2009), and for rice and potato in Bangladesh, China, and India, see Reardon et al. (2012a).

**Rental of farm machines has further developed recently with the spread of outsource-services of teams of labor with large harvesting machines in China that go from province to province harvesting rice** (see a study of a cluster of such operations based in Jiangsu, each serving hundreds of farmers spanning many provinces over months per year of harvesting, discussed in Yang et al. 2013). **This allows economies of scale on the machine side to small farmers (analogous to small farmers on the output market side to deal with post-harvest services that are increasing in scale – thus small farms wedged between consolidating and scale-increasing services on each side of them in the supply chain.**

**A similar arrangement in fruit farming in the unique analysis of “sprayer traders”** found by dela Cruz et al. (2010) on Luzon in the Philippines: teams of labor equipped with pruning and spraying and harvesting equipment service numerous small mango farms both in all the steps of production but also in harvesting and marketing the mangoes. Small farmers thus benefit from equipment expensive for them, labor supply concentrated and managed in one site in a timely way, as well as special skills and expertise of these teams.

**c) Beside the rise of the machinery purchase, rental, and outsourced services markets, there has been a rapid development of “intermediate factor markets” (Johnson et al. 2003) in Asia, such as those of chemical fertilizer and improved seeds, and in some cases private water markets.**

**The development of the supply side of these intermediate factor markets appears to have mirrored the development of output markets discussed in Reardon and Timmer (2012), with a first phase of “modernization” developed as a public sector action (such as the widespread construction of wholesale markets and public grain depots) and then a second phase of private sector (traditional and modern) development of output market facilities and services. In the input supply sector there is a parallelism:** in the 1960s-1980s Asian governments developed fertilizer and seed depots for subsidized input sales to Asian farmers; in the 1990s and 2000s these diminished in importance with a second phase of development of private sector (traditional and modern) input sales outlets. Our surveys showed that farmers in India, Bangladesh, and China source from very little to a minority of their external inputs from state outlets (see Reardon et al. 2012a). An exception is that pesticides/herbicides markets have traditionally mainly been private sector (traditional or modern) rather than state distribution systems.

**d) A very important point for this paper is that both the “capital-led intensification” (to use Lele and Stone’s 1989 phrase) noted above, and commercialization and diversification, have diffused very unevenly over Asian rural areas, as we emphasized for all the**

**transformations in the introduction to this paper.** The reasons for this unevenness meld with a discussion of drivers of the intensification cum mechanization, and we discuss them both in turn here.

**d.1) The most obvious unevenness comes from agroecological differentiation over zones, unmitigated by infrastructure** – for example, zones with low rainfall that have little irrigation (Rajasthan), or zones with high rainfall that have little drainage tiling (eastern Uttar Pradesh) are disadvantaged.

**Geography, performance, and potential are, however, not static, but rather are malleable:** in the past decade, the western area of Gujarat has shifted toward an intensive, multiple cropping grain area, and the eastern area, to a horticulture area, with the installation of large power grids that allowed a shift to extensive use of irrigation. Another example we can derive is comparing Lipton with Longhurst (1989) characterization of Madhya Pradesh as lagging the Punjab in the 1980s, with Reardon et al. (2012a,b) findings of rapid intensification in the western and central areas of MP in the 2000s.

**d.2) Areas well served by rural roads, and those closer to urban areas, have lower transaction costs of getting inputs, and higher use rates, as discussed above.** Striking findings of differences in external input use between hinterland and non-hinterland areas are found in the Fafchamps/Shilpi (2007) study on Nepal, and Reardon et al. (2012b) study in three states in India, comparing dynamic/connected and hinterland areas. There is however the methodological issue of controlling for agroecology when examining the impact of urban distance and rural road density; hinterland areas can often be mountainous or arid areas. That is why the study by Deichmann et al. (2011) in Bangladesh is particularly interesting for its crossing of distance to city with agroecological indices (in studying RNFE; this method needs more application to technology diffusion).

**e) Areas that are generating RNFE and migration remittances can also exhibit capital-led intensification.** This is a more complex and sometimes ambiguous relation. On the one hand, nonfarm income can generate cash to invest in farm machines and inputs, and even hired labor, as Takahashi and Otsuka (2009) illustrate; this may be even more marked in areas with credit constraints. On the other hand, in some areas nonfarm activity can be a substitute for intensification, relieving the need for it (including where agroecological conditions make it impractical) by diversifying income.

## **6.2. Farm Size Distribution Change – and its links to factor market and agricultural technology change**

**a) There is evidence of aggregate decline in farm size in Asian countries.** Eastwood et al. (2010) examined aggregate data from Bangladesh and India, China, India, and South Korea over 1950 to 1990, and found a gradual decline in average farm size.

**b) Asian farm sizes average small but nevertheless there is substantial variation over farm sizes.** Using data from the 1990s, Eastwood et al. show that: (1) South Asian farm sizes average 1.4 ha, with a Gini coefficient of 54%. 92% of the farms are under 2 ha, but fully 60% of the area under farming is of farms great than 2 ha; (2) in East Asia, the average is 1 ha, the Gini is 50%, 92% are under 2 ha, and nearly 40% of the land is of farms above 2 ha; (3) in Southeast Asia, the average is 1.8 ha, with a 60% Gini coefficient; while 57% of the farms are under 2 ha, only 77% of the land is of farms over 2 ha.

**In these figures I have deliberately emphasized three things: (1) the average farm size is indeed small; (2) but the Gini coefficients are fairly large; (3) and in South and Southeast Asia, 60% and 77% of the farmland is operated by farms over 2 ha. These broad findings open the door to exceptions that we have observed in recent field surveys in several countries – where the average farm size in the country is small, but in several study zones the average size is larger, and the share to medium and large farms is substantial.** I return to that below.

**c) The literature generally hypothesizes the following reasons for the persistence of small farms,** and even the average decline of farm size, in Asia:

(c.1) families are growing and divide up their land to sons (Eastwood et al.);

(c.2) land reform in India has been somewhat effective in the long term (Eastwood et al. 2010);

(c.3) RNFE (and remittances from migration) allows small farms to persist as they can be part time farmers (HHR 2007);

(c.4) labor-led and then capital-led intensification allows small farms to grow in productivity and compensate for land constraints;

(c.5) irrigation allows multiple cropping;

(c.6) high-value agricultural diversification such as into vegetables allows even small farms to be viable (Joshi et al. 2004);

(c.7) ability to outsource harvest, land preparation, and spraying-trading services by machine service providers allows small farmers to enjoy input side economies of scale (see above).

(c.8) Some countries, such as China, have had strictures on land transactions (Deininger and Jin 2009).

d) Here I illustrate the above trends with the case of India. The text table below shows both the average decline but paradoxically also the persistence (although with some aggregate decline) of the major farming role of medium/large farmers.

Text Table: Changes in the size and distribution of landholdings in India			
Farm category	1980-81	1991-92	2002-03
% share in holdings			
Small (LTE 2 ha)	75.3	80.6	86.0
Medium (2-4 ha)	14.2	12.0	9.0
Large (GT 4 ha)	10.5	7.4	5.0
Total (millions farmers)	71.0	93.5	101.3
NOTE % of medium/ large in farmers	24.7	19.4	14%
% share in area operated			
Small	28.1	34.3	43.5
Medium	23.6	24.1	22.5
Large	48.4	41.6	34.0
Total (millions ha)	118.6	125.1	107.7
NOTE share of medium + large in operated area	72%	65.7%	56.5%
% of rented-in area	7.18	8.52	6.5%
Average size of holding (ha)			
Small	0.62	0.57	0.53
Medium	2.77	2.69	2.66
Large	7.69	7.53	7.23
All holdings	1.67	1.34	1.06
Source: Government of India (2006)			

The table shows that: (a) the average landholding is declining; (b) the share of the medium and large farmers in total area is declining; (c) but the latter still farm the majority of land: 14% of farmers are medium/large, but farm 57% of the operated land.

e) **Is there any reason to believe that while the above picture over 20 years shows a farm size decline, that a 40 year long table might not map to a U curve of farm size? Or if this does not occur for the country or countries as aggregates, it may occur in substantial regions of countries?**

**While this section is speculative, I offer reasons for a hypothesis that average land size may indeed climb in at least some areas of Asia, even South Asia, over the next two decades.**

e.1) Recent survey evidence in “dynamic zones” of intensifying and diversifying farming, near to cities, shows average farm sizes are higher than average, and rental rates are high



and growing fast. An example of this is in Western and Central Uttar Pradesh (even controlling for Punjabi settlement areas in those zones); see Reardon et al. (2012a) and vegetable areas in West Java (Natawidjaja et al. 2007). Small farmers in these areas are selling or renting out part or all of their grain farms to larger grain farmers or large vegetable or fruit farmers, and then relying on RNFE and migration labor markets. I surmise that as urbanization proceeds, and provides more spillover effects of RNFE development, strong product market development, and migration opportunities, this apparent concentration process will continue in these dynamic areas.

e.2) The above could be accelerated as cost side pressures (such as on energy and water) and demand side pressures (for product quality) affect the viability of at least the marginal farms. Reardon et al. (2012a,b) found in India distinct differences between marginal farms, and small and medium farms in these zones.

e.3) Gradually regulations restricting land transactions will ease, for example in China; this is extrapolating from the gradual but steady reductions in limitation to rent land (Deininger and Jin 2009) and recent experiments in land titling for sale in some parts of China.

e.4) Agribusiness investments in tracts of land (such as FDI in farm land in Cambodia or Lao PDR, or purchase or rental of large tracts of land by domestic agribusinesses such as the Reliance mango plantations in India, or the “long lease of township farmland” by agribusinesses in China) could increase and lead to concentration of land in some areas.

e.5) Food industry and agribusiness sectors are consolidating in Asia. I have noted above that, outside of land investments, this upstream and downstream consolidation does not necessarily imply pressure for consolidation in the farm sector. Agricultural services like mechanization services can lower costs to small farms; processors and supermarkets can implement hub and spoke models to source from small farms via collection centers and specialized wholesalers, or they can rely for some time on the wholesale markets. The way that consolidation downstream can eventually put pressure on farm sector consolidation may be through a combination of forces that led to farm concentration in traditionally small-scale farm sectors like poultry or pig or fish operations in developed countries. The pressures can be to cut costs in ways that eventually just using own labor cannot support, and farm equipment investments are needed, and even more plausibly, that pressure to augment product safety and quality may come from the consolidated downstream firms. One can see this pressure already in the dairy and pig sectors in China, and the fish sector in Bangladesh.

e.6) The mechanization trends displacing farm labor, and the convergence of use rates of chemicals and improved seed, may reduce yield advantages that smaller farmers have in some places. Already, in the intensified agriculture zones we have studied in India, China, and Bangladesh, there is little yield difference over farm size strata.

e.7) There is some evidence of concentration of RNFE, as capital requirements for viable businesses increase under competition from urban areas. This concentration in the labor market may translate into concentration forces in the land market. (This point was argued in Africa by Reardon et al. 2000.)

f) However, that there does indeed appear to be evidence of a “poverty trap” below a certain land threshold, such as we see in our India field surveys, below 1 ha, and in certain poor agroecological and hinterland areas. These traps may not be amenable in the longer run to any of the possible land concentration forces noted and may fragment further.

## **7. Implications for Asian Agricultural Research and Development Strategies of the above 5 inter-linked transformations**

The paper has emphasized that the agrifood sector of Asia is undergoing rapid transformation. The change is so rapid because there are five mutually reinforcing and encouraging transformations occurring at once. I have shown the connections among them in all directions.

Moreover, the paper has emphasized that while a significant part of the transformation is driven by the “private sector”, popularly thought to mean the large and multinational players in the food business, in fact a very large part of the transformation has been due to private domestic investments by small and medium firms and farms in the traditional systems. The state has played a role at the margin in the recent decades, having played an initiating and formative role in the transformation before that.

Finally, the paper has emphasized the extreme differentiation over countries and over zones within countries, pointing to the existence of 3 rural Asia's. (1) The rural Asia zones that are transforming fastest and with the least external needs and help are the dynamic zones around the cities and towns, a substantial part of rural Asia. Capital-led intensification and RNFE development often develop in these zones and complement each other to spur growth. (2) On the other extreme is the most hinterland zone, where agriculture is poor, infrastructure is poor, and aggregate demand is low, leading to RNFE being mainly low return and subsistence. This is the zone with the most need, but also unfortunately appears to be in line for a long period of lagging, and export of labor and perhaps acquisition by large firms for land extensive operations. (3) In between is a substantial area in Asia that has “high potential but low performance”. This area was perfectly identified in the Deichmann et al. study in Bangladesh as having strong agricultural potential but being relatively far from cities.

I have called these latter, “intermediate zones” “the missing middle” in my prior work in Africa. It appears that these zones have the highest promise for return to research and development efforts to promote sustainable capital-led intensification, RNFE, and at the same time to build the infrastructural base to connect to sources of demand, mainly in the growing cities and towns, even rur-urban areas.

I have also emphasized that while there is a small farm domination in numbers, this disguises two trends of strategic importance. The first is that there is substantial heterogeneity in the farm population, with marginal farmers, and asset poor small farmers (as compared with small farmers) least sharing in the benefits of the transformation. The second is that small-medium and medium farmers dominate output supply, and may in the longer run set the cost and quality competition bar for the smaller and poorer farmers to meet, and be challenged by.

The above points imply the need for differentiated strategies for the geographic and socioeconomic strata.

A final set of points focus on the need for research and development strategies to help the farm areas of Asia to meet demand trends. The overwhelming fact is that the urban food economy is already the majority of food demand in Asia, and in several decades, will be the vast majority of demand. That means that meeting urban demand, and developing the rural-urban supply chains to do so, will be of major importance. This will mean more research and development on post-farmgate segments of the supply chain – processing, logistics/distribution, and retail.

Moreover, the nature of that demand is shifting gradually and steadily toward non-grains for the majority of food needs. Much more focus will need to be made on horticulture, aquaculture, meat, oilseeds, dairy, and feedgrains. There will also need to be more focus on attributes beyond yields (even as yields continue to be important for overall food costs): quality attributes for modern markets, food safety, and ability to withstand climate shocks.

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# Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies

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A Foresight Study of the Independent  
Science and Partnership Council

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Thomas Reardon

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The **Independent Science and Partnership Council** (ISPC) aims to strengthen the quality, relevance, and impact of science in the Consultative Group on International Agricultural Research (CGIAR).

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# **Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies**

**Thomas Reardon**

**March 2013<sup>1</sup>**

## **1. Introduction**

“Five interlinked transformations” of the agrifood system are occurring rapidly in Asia: (1) urbanization; (2) diet change; (3) food market transformation, (4) rural factor market transformation, (5) agricultural technology and farm scale (land size) change. The changes are linked in mutually causal ways in all directions – so that we are witnessing the transformation of an integrated system rather than piecemeal, independent changes. This makes the transformation more powerful, more rapid, and more complicated in its impacts and implications for agricultural research strategies.

The transformations are occurring in waves over developing regions and countries within the regions over the past decades, and between types of zones inside the countries. Hence, East Asia (outside Japan) started these transformations earliest, with some of the parts of the set of five transformations starting earlier than other parts there. The second in line was much of Southeast Asia. The third in line were the transition countries, in particular China and Vietnam. The fourth in line were the South Asian countries and recently the Southeast Asian countries that had not been in the second wave. Within each of these regions, there are further waves by countries, such as India initiating the integrated set of transformations earlier than Nepal.

Finally, and a major focus in this paper, is that the transformations are highly correlated with the type of zone – whether: (1) “dynamic, commercial zones” in the 8-10 hour market catchment areas of large and medium cities (and within zones, around towns); (2) “intermediate zones” that are in the pathway, over time, of urban centers’ economic “pull” of supply from rural areas, and that are relatively medium-high potential in agroclimatic terms, but in a situation of medium to under-realization of potential in terms of current performance; and (3) hinterland, traditional,

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semi-subsistence zones” further from cities and in more remote and agroclimatically unfavored areas.

This paper focuses on emerging evidence from surveys and broad trend information of the inter-related five transformations, examined in turn. South Asia is the focus of the paper per the terms of reference for this conference contribution, but to a minimum extent the paper is set in a comparative context with the rest of Asia. Indeed, the underlying trend appears to be that there is a “moving average” where like types of zones are transforming, at various paces, in ways that move them toward convergence with “lead geese” that earlier flew that path. The paper ends with an initial assessment of implications for agricultural development strategies for the different types of zones and farmer strata, countries, and regions.

## **2. First transformation: Urbanization and Rur-urbanization: Patterns, Determinants, Effects**

a) **There is rapid aggregate urbanization occurring in Asia.** Estimates of the urban share by Asian Development Bank show a 60% urban share in population by 2025, from only 20% in 1960 (James et al. 2008); estimates by the United Nations (2011) show Asia is at an urban share of 45% by 2011, and estimate that that share will rise to 56% by 2030 and 64% by 2050; they also estimate that the Asian rural population rose from 1.63 billion in 1970 to 2.31 in 2011, but then will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050.

### **b) Fast Urbanization countries in East and Southeast Asia, but Constrained urbanization countries in South Asia**

In 1960, 1990, and 2005, India had an urban population share of 18%, 26%, and 29%; in China those figures were 16%, 27, and 40%; in Indonesia, 15%, 31, and 48%.<sup>2</sup> Both China and Indonesia look to be on the “urbanization take-off” path of earlier fast-developers, for example South Korea; South Korea in 1960 had (at 28%) an urban share like India today or India in 1990, or China in 1990; by 1970 South Korea had 41% (like China today), and then South Korea rose quickly to 74% in 1990 and 81% by 2005. South Korea achieved a shift in urban share in 20 years that it took 90 years for the US to achieve.

The figures above show India as on a “slow urbanization path,” compared to other large and medium countries in East and Southeast Asia. McKinsey (Ablett et al. 2007) has made the assumption that the slow urbanization will continue in India, as it projects that India will still only have a 37% urbanization rate by 2025 – not even to China’s rate today. This rate of growth in the urban share has been modest. Of course, the absolute increase and current urban population are large: India’s urban population grew six-fold from 1948 to 2001 (Mathur 2005); the urban population in 2006 was 318 million, the size of the US, and by 2025, is projected to be 523 million, larger than the 2008 EU population.

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<sup>2</sup> For urbanization rates, see [www.nationmaster.com](http://www.nationmaster.com).

The question of “why has India’s urbanization been so slow” has been a keen point of debate among demographers and urban sociologists and economists for the past half century. While there is some consensus around why urbanization was slow from 1900 to 1950 (slow economic growth and disruptions), the juxtaposition of rapid industrialization and slow urbanization in the decade of the 1950s and 1960s and again in the 1990s and 2000s has puzzled urban experts in those decades. Several points have dominated the debate, leading us to believe that India’s urbanization process is already faster than is officially stated, and will be faster in the future than in the past.

First, there has been criticism of the criteria used in the censuses to classify areas as urban or rural and thus create an under-estimate of the urban share (Bose 1974). Moreover, in 2001 the number of “villages” (ranked as rural) with more than 10,000 inhabitants surpassed in 2001 for the first time (in the census) the number of official “towns” and “urban areas” having greater than 10,000 population. It is posited that if these large villages that are the size of (officially urban) towns were reclassified (as many do not want to do because of tax advantages of continuing as “rural”), there would be a significant jump in the statistical share of urban in India population (Marius-Gnanou and F. Moriconi-Ebrard, 2007).

Second, the debate has noted that urbanization in India was, in the 1960s-1980s, highly “large city” centric, and that the high rates of unemployment in those cities discouraged rural urban migration, but that towns and medium cities did not have the economic base to grow quickly in the 1960s/1970s (Bose 1974). This point was revived in the 2000s, linked to persistent poor infrastructure, poverty, and absorptive capacity of large cities in India (Mathur 2005).

However, starting in the 1980s and into the 1990s and 2000s the secondary and tertiary cities have “taken off” (especially in the economically dynamic states, see the next point) and led to an increase in urbanization. There are 5,161 cities and towns in India as of the 2001 census. There is no standard categorization of these, but typically used is a four-way taxonomy, of Tier 1, 2, 3, and 4 cities. McKinsey uses a classification with a cutoff of 4 million or more population for Tier 1 cities (e.g., Mumbai, Delhi), Tier 2 cities (26 cities with greater than 1 million and less than 4 million, such as Surat or Indore), Tier 3 cities with more than 500,000 population and less than 1 million (such as Amritsar or Goa), and Tier 4, or small towns. In this set, there is relative concentration: Tiers 1 and 2 have 44% of the urban population. But the trend now is toward relative rapid development of the Tier 2 and 3 cities. Moreover, the middle class is spread over the city categories: two-thirds of the middle class is outside of tier 1 cities, and tier 3 cities have as many middle class as tier 2, and a number of tier 3 cities have higher average incomes than tier 2 cities and even some tier 1 cities. There is, however, a greater average household income comparing the first three tiers and the fourth tier (Weinstein, 1991, Bhalla, 1997, New York Times, 2007, and Ablett et al. 2007).

Third, as there is extreme heterogeneity of economic performance and growth rates over India’s states, there is in turn great heterogeneity over states of urbanization rates; thus, the major Indian states that have grown rapidly have urbanization rates in excess of 40% (like China), and those with lagging growth rates have far lower urbanization rates (Mathur, 2005). In turn, urban

growth is in part conditioned by rural growth; hence, for example, in one of the states with the most dynamic agriculture (Punjab), one also finds among the fastest urbanization with growth of Tier 2 and Tier 3 cities, noted above.

c) **Measuring urban population growth alone understates urbanization's importance to the overall food economy from the demand side - because the urban areas share in the total food economy exceeds its share in population.** I have roughly estimated (using figures for urban share, propensity to consume food from income, and income disparities between rural and urban areas) that already half to two-thirds of the food economy in Asia is urban, in the sense of the share of the value of total food consumed in the countries. Typically, the total food expenditure per person in urban areas is greater than that of rural areas (for example in India in 1999 it was 42% higher, Dev et al. 2004), and thus the population share of urban areas understates the share of urban areas in the total value of food consumed in the country. An example of that kind of reasoning has been done for India for all consumption: Ablett et al. (2007) note that by 2006, while 29% of population is in cities, 43% of overall consumption is in cities (given higher average incomes than in rural areas). They project this share to be 62% by 2025.

d) **Urbanization of population per se understates the role of urban areas in the overall food economy from the supply side - as half to two-thirds of the food supply chain "value added" is off-farm (in wholesale and retail, in mills, in cold storage), much of it clusters in towns and cities in Asia especially in the dynamic zones. There appears to be "rur-urbanization" of the food supply chains in Asia.** Moreover, towns, as nodal points of rural road networks, inter-urban highway and rail interfaces, and electricity-endowed platforms, serve as the staging grounds for clusters of services that are crucial to agricultural development in surrounding rural areas. For example, Rashid et al. (2012) analyze clusters of fish/shrimp related enterprises in towns and secondary cities in Bangladesh, involving nodes of numerous feed mills, hatcheries, nurseries, traders, processors, ice makers, repair shops, and so on.

e) An extension of the above is that **urban population growth as an aggregate concept underplays the effect of urban areas on rural areas depending on the proximity or density of urban areas** (proximity of one city to another, even with rural areas intervening between them) **and the development of rural infrastructure, particularly roads and rails, connecting the cities.** South Asia and China, much of Southeast Asia both on the mainland and on the main islands of archipelagic countries, is peppered densely with cities so that rural areas are constantly close to cities in most zones where most of the rural population resides.

The latter effect is presumably magnified by the **huge investments in rural infrastructure and rural-urban links**, particularly roads and rail made by Asian governments in the past 1-2 decades. For example, over 1991 to 2005, road density increased rapidly in South Asia, per the following annual growth rates: Bangladesh, 4.4%; India, 4.6%; Nepal, 12.6%, and Pakistan, 3.8% (ADB, 2012). In the next section we also examine the massive investments in wholesale market infrastructure that Asian governments have made.

An important variation on the above theme is the development of **highway corridors between cities**. Bhalla (1981; 1997) analyzed the development of rural nonfarm enterprises and employment along major highways connecting large cities in India, sources of derived demand for services and products; she found what we can call “internal coastlines” to be very intense areas of nonfarm development, often involving attracting enterprises from villages well away from the highway.

f) **Urbanization per se abstracts from the “type of city” – that is whether its growth is linked or not to the surrounding rural area.** This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007, who makes this link). On the one hand, the urban area may have developed either as an emanation from those linkages, such as in the case of the growth of towns and cities in Shandong or West Java, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as a relative enclave *vis* the surrounding rural area (like resort based towns on the coast of Cambodia, or mining towns in hinterland agricultural areas. In the latter case, urbanization per se may have little effect for the local agricultural area.

g) **Hypotheses concerning general impacts of urbanization on rural areas include:**

g.1.) De facto “de-protection” of rural areas as part of general transaction cost reduction; thus also creating dynamic areas linked to the cities;

g.2.) Facilitation in towns and secondary cities of various clusters and agglomeration of services crucial to capital-led intensification of agriculture, which can also help the survival of small farms.

g.3) Facilitation of development of rural nonfarm activity (and short-distance commuting migration) which in turn affects technology and farm size as discussed below.

g.4) Facilitation of the transformation of food supply chains and agricultural diversification, discussed below.

### **3. Second transformation: Diet Change in Asia**

a) **Income increases (via “Bennett’s Law, Bennett, 1954) and lifestyle changes accompanying urbanization that increase the opportunity cost of women’s time, lead to changes in product composition of demand.**

**These include an increase in the level and shares of: (1) non-grains** (meat, fish, dairy, edible oils, fruit, vegetables), **with derived demand for feed-grain for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home.** There is abundant evidence that these shifts are occurring in Asia (Pingali 2007; Timmer 2013).

**The corollary is that the share and in some cases the level of cereals consumption is declining.** For the India case, the Government of India (2010) shows that the share of cereal consumption in the urban food basket has declined from 36% in 1972 to 23% in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32%. Weighting by urban and rural population (thus abstracting from income differences), Reardon and Minten (2012) find that roughly 29% of India's food economy was in cereals in 2006, versus roughly 52% in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins.

India appears to be going along a diet change continuum that has further expression in the Southeast Asia case, such as in Indonesia, for which Timmer (2013) shows that by 2011 only 10 percent of the food budget goes to rice (on average—it is higher for the poor), so 90 percent of the food budget is spent on other commodities and value added from processing and convenience.

**The same changes take place in rural areas of Asia, but typically just less fast and far.** This manifests itself in cross section: Ahmed (2013) shows a decline in the share of rice as a share of total energy intake as a function of income strata in the poorest zones of rural Bangladesh. It also manifests itself over time: This was noted above for the case of cereals in rural India; moreover, Timmer (2013) shows a decline in rice consumption per capita in all but the lowest quintile in rural areas of Indonesia over the past two decades. The decline is slower than in urban areas, but still significant.

**The converse of the above point is that the consumption of non-grains is growing faster and/or further in urban areas than in rural areas.** In India for instance, Dev et al. (2004) show, in constant 1999/2000 rupees, in rupees per capita per month, that: (1) cereals in rural areas dropped from 137 to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; (5) Overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410.

b) **Rice is still important in Asia.** Rice is currently and traditionally important in the food consumption basket of Asian countries. For example, nearly all the food grain consumed in Bangladesh was rice, and rice comprised about half the food grain consumed in China and India. However, there are differences between rural and urban areas. For example, in China, in 2004, urban residents consumed 51 kilograms (kg) of rice per capita, while rural residents consumed 93 kg.

c) **However... rice consumption is in a gradual, absolute decline in Asia.** The importance of rice as a share in the diet of most Asian consumers has been declining during the past several decades, as analyzed by Timmer and Dawe (2010). The share of rice in calories for all Asian

countries in the FAO's food balance data sheets was at its highest in 1970 in the midst of the Green Revolution, at 38.2%, and then trended down to 29.3% by 2007 (FAOSTAT 2012). The shift has been marked in China, for example, from rice being 38.7% of calories in 1970 to 26.8% in 2007) and Bangladesh (from 75.1% in 1970 to 69.8% in 2007), Indonesia, from 58% in 1961 to 47% in 2009, and India, from 32.4% in 1970 to 29.9% in 2007. The downward drift was very slow until 1990 and then much faster (as Asian incomes increased) (Timmer and Dawe 2010, and Timmer 2013).

**By 2007, only 30% of calories in Asian consumers' diets came from rice (comprising 5% of their food budget in money terms).** The calories from rice changed in the PRC (from a low of 444 in 1961 to a high of 872 in 1990, then dropped to 799 by 2007) and India (from a low in the 600s in the 1960s–1970s to a high of 781 in 1990, then dropped to 703 in 2007). The calories from rice rose slightly in Bangladesh in absolute terms (from a high in the 1,500s in the 1960s–1970s, down to 1,311 in 1980 and 1,473 in 1990, and up to 1,591 in 2007), as Bangladesh rode through the Green Revolution, a prolonged crisis, and a long recovery.

Timmer and Dawe (2010) noted that the decline had accelerated in the last decade, and should be expected to continue for some time because (1) the income elasticity of rice demand is falling over time; (2) as rural-to-urban migration occurs and incomes rise, the elasticity trends downward; and (3) the income elasticity is lower in urban than in rural areas and among richer than poorer consumers. This general decline of course disguises heterogeneity among age groups, regions within countries, and across the economies themselves, but the overall trend is clear.

**d) But there has been a rise in wheat consumption – and wheat imports.** Wheat is still minor in most Asian countries compared with rice (except in India and China). But the rise of wheat from a low base to a significant presence in consumption is especially marked in Southeast Asia, as Timmer (2013) shows: from 1 million metric tons of imports of wheat in 1961 to 13 million tons by 2010; wheat was 2.8% of the level of rice consumption in 1961, and by 2009 was up to 11.5%. Senauer et al. (1986) documented the early stages of this rise of wheat in Sri Lanka in the 1980s. In both cases, the rise of wheat brought increases in imports as Sri Lanka and Southeast Asian countries do not produce them significantly. By contrast, wheat consumption in China and India are important but they are also major producers of wheat and imports are minor. Of course, some countries like Bangladesh are still focused on rice and the imports of wheat are minor.

**e) Note that the current changes in cereal consumption (secular decline of rice, rise of wheat) and tuber consumption (rapid decline of sweet potatoes, rise of white potatoes) are not the first time consumption composition changes have taken place. In the 1960's through 1980s, as a rough approximation, there was a decline in coarse grains, especially millet and sorghum, in India (ICRISAT 1982) – displaced by the rise of rice and wheat and somewhat maize (as it was doing in Africa at the same time, see Reardon 1993).**

**f) Diet patterns are malleable in Asia, with “traditional food culture” appearing to be only moderately constraining of shifts.** Several points stand out.



**f.1) Many non-traditional food products have quickly become “traditional” and widely diffused in Asia.** (1) Central/South America’s products (potatoes, tomatoes, chili peppers, sweet corn, pineapple, papaya) have become leading produce items in Asia (potatoes are the leading vegetable in India, Bangladesh, China, Indonesia - all places they are utterly non-traditional and recent). (2) Shifts from Africa to Asia also are common: sorghum and millet (ICRISAT 1982) were introduced into India from Africa and highly diffused into large tracts of India where only recently (mainly in the past half century) did rice and wheat (and pulses) enter and displace those “traditional” crops. Oil-palms were brought to Southeast Asia from Nigeria in 1961, to become major crop in Southeast Asia and major edible oil in much of Asia. (3) Dairy, non-traditional in the great majority of East/Southeast Asia (except in the far north in the grasslands such as in Inner Mongolia or Mongolia), emerged as a significant sector in many countries of the region in only the past few decades.

**f.2) Traditionally “vegetarian” areas, such as the (mainly-Hindu) India and (mainly Buddhist) Southeast Asia have rapidly growing fish, poultry, and even red meat consumption.** For example, 31% of Indians are strict vegetarians, and thus in a sense may be “structurally constrained” in diet habits, but the working hypothesis is that many of the rest will increase at least fish and poultry consumption as incomes grow.

**f.3) New forms of consumption and buying** (in processed form, from away-from-home sources, and from modern retail or fast food chains, as discussed further below) **also have spread very quickly**, even though these are highly non-traditional (just as they were in the “West” only 50-80 years before);

**f.4) There has been a proliferation of grain and potato varieties amenable to longer storage, easier processing, and long-distance shipment**, such as in the case of potatoes in India (Reardon et al. 2012a).

**g) Shift toward more consumption of non-grain foods and more processed foods is conditioned by supply side factors that vary a lot over time, over countries, and over product types – but factors that in Asia in the past 20 years have been very amenable to the shift, as follows.**

**g.1) One such supply side factor is in general NOT imports – imports are not driving diet change. Imports as a source of food are minor as a share of total food consumed. Exceptions are the rise of wheat imports, although even that is a tiny share of total food, and of soy imports for livestock production.** Asia’s situation of near full self-sufficiency in food (measured merely as the share of domestic production in total food consumption) is in contrast to a greater dependence on imports that has been more important in for example Africa (for West Africa for the issue of growing cereal imports especially of cereals not produced in the region, see Reardon 1993). For more on this subject for Southeast Asia, see Timmer (2013).

g.2) **Domestic farm side supply of nongrains is rapidly increasing: farmers are undertaking agricultural diversification** toward fruits, vegetables, fish, meat, and dairy has been proceeding apace in Asian countries, such as noted in Pingali (2006) for a number of Asian countries, Joshi et al. (2004) for all South Asian countries, and Birthal et al. (2012) for India.

Rao et al. (2006) note for India that there is a **strong correlation between agricultural diversification on the one hand, and the urban share and road and population density of the district in India**; urbanization and infrastructure development have thus encouraged that diversification over the past several decades. There have been large investments in irrigation in horticultural areas such as in Gujarat in India and Comilla in Bangladesh, and in fish and shrimp ponds in Bangladesh (Rashid et al. 2012), Indonesia (Yi et al. 2012), India, and China. There have been massive investments by farmers in inexpensive clay greenhouses in Shandong (Wang et al. 2012).

g.3) **Domestic supply chain development after the farm-gate is facilitating the supply of non-grain products to Asian cities. Supply chain actors (off-farm) have invested enormous sums in the aggregate in rural-urban supply chains for non-grain products: storage, packing, logistics/shipping, and commercial services.** The emerging evidence is abundant concerning the rapid development of these services in Asia, both in the modern large-scale sector and in the informal, small-scale sector. Examples include the very rapid emergence especially in the 2000s of potato cold storage facilities in western Uttar Pradesh (to serve the Delhi market, where fully two-thirds of potato consumption is now from cold storages in nearby production areas) (Reardon et al. 2012a) and even in poor areas of Bihar (Minten et al. 2011). There has also been a rapid emergence of cold storage and logistics companies that operate increasingly pan-India; part of this has been from FDI from Japan and the US and others (Reardon and Minten 2012). Domestic and multinational packaging companies are also important to this trend. For example, the Swedish multinational Tetrapak, so important in dairy packaging that spurred dairy sector development in Latin America in the 1980s/1990s (see Farina et al. 2005) is making large investments in a number of Asian countries for milk and juice packaging in the 2000s.

g.4) **The growth of non-grain supply chains (as well as grain supply chains) has hastened and been facilitated by intra-country (inter-region) market integration as cities across a given country demand similar products** (northern India, before a wheat consumer (and before that a sorghum and millet consumer) starts demanding more rice, southern India and southern China demand more potatoes (produced in the mountain/hills and northern areas of the countries); fish is marketed over regions in Bangladesh, from the pond-strewn and river-laced south to the drier north; japonica rice is shipped increasingly from northern China into southern China even as the consumption of indica rice wanes).

**Probably over time food market integration and development of pan-region supply chains will be and is being hastened and facilitated by the spread of fast food chains in urban areas:** Northern India cuisine has spread by this vector to Southern India, and vice versa; as has the consumption of French fries (see Scott and Suarez (2012) for latter in China). This is similar to what happened in the US.

**h) Quality demanded of farmers and by consumers increases also with urbanization, in several ways:**

**h.1) Demand does not only differentiate over broad categories – but within categories over niches, commodities, and differentiated products which create new series of niches which are then commoditized, as in the “product cycle”.** This is a cycle of cost then quality competition, cost then quality competition, and so on. A good example of this is the kiwi fruit: it started as a wild/local niche fruit in China, then moved to commoditized phase after introduction into New Zealand (and Italy and California and others) to then commoditize in China too; the kiwi was then differentiated into various varieties (such as golden kiwi) as part of the third phase of the cycle, product differentiation, “climbing the value ladder.” This same process can be seen in the fish sector in Bangladesh (Rashid et al. 2012).

**The product cycle often manifests itself in geographical differentiation over the phases.** For example, land shifts from rice into commodity vegetables near Jakarta in the early 1990s; by the late 1990s, the commodity vegetable production had shifted to cheaper land and labor areas in West Java (and shipped back to Jakarta), while the vegetable areas near Jakarta had started to enter the product differentiation phase, for the local market and for emerging supermarkets. By the mid/late 2000s, the areas near Jakarta (with much higher land and labor costs by then) started to shift to export vegetables and high end products such as hydroponic vegetables, and “supermarket” quality vegetables had shifted to West Java, and commodity vegetables such as bulk potatoes and cabbage started to shift to cheap land areas in Sumatra. There are many similar cases in various parts of Asia (and elsewhere).

**h.2) Food safety is gradually introduced as a requirement, especially for fresh produce and dairy and meat products.** This tends to be first introduced for export markets, for situations where public and private standards are introduced, and for high-end supermarket chains, and in the wake of crises such as the melamine crisis in China or the bird flu crisis in various countries of Asia. An example of a regulatory initiative is China’s first comprehensive Food Safety Law of 2009.

**h.3) Branding cum quality differentiation of products is also gradually being introduced.** In our study of rice in China, India, and Bangladesh, it was particularly in China where mill branding and packaging has developed rapidly recently (Reardon et al. 2012a). In Bangladesh, there has been a differentiation of rice quality over the past decade (with the price premiums mainly captured by millers and traders), see Minten et al.

2013a, and incipient branding in fruit value chains in India, even originating in poor zones like Bihar (Minten et al. 2013b). **I surmise that in Asia over the next decade, the rise of branding (especially by large and medium food companies) will go hand in hand with the rise of consciousness of and public concern about food safety – as it did in the first half of the 1900s in the US** (see Levenstein 2013).

h.4) **There has also been a shift in some cases toward varieties that can ship further or have longer shelf life (such as potato varieties in India, see Reardon et al. 2012a), that are easier to mill, and so on.** That is, varietal development and transformation of the food system are sometimes linked.

i) **Hypotheses concerning general implications for rural areas of urbanization *cum* diet change:**

i.1) **inducement for diversification of agriculture from grains to non-grains, and from commodity grain to differentiated quality grains.**

i.2) **inducement to shift the product and variety mix in agricultural zones as part of product differentiation and the product cycle** (for example, the rise of horticulture in the market-catchment areas of large cities in India and Bangladesh, such as found by Rao et al. 2006).

#### **4. Third Transformation: Food System Transformation in Asia**

The food system (a general term for food supply chains and markets) transformation is taking place along several lines in Asia. Here we will focus on the transformation of the “post-farmgate” segments of the supply chain: wholesale/brokerage/logistics/cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are formed in these segments).

The transformation of the post farmgate segments is intimately connected with urbanization both in terms of the drivers being especially in urban areas, because the majority of the food supply chain in Asia is from rural to urban, and because many of the post-farmgate activities are in towns and secondary cities and primary cities.

In this section I briefly review key evidence on the food system transformation in Asia, drawing from Reardon and Timmer (2012), Reardon et al. (2012abc), and Reardon et al. (2009) which in turn contain reviews of the detailed evidence and literature, much of which was formed in the 2000s.

**A first important qualifier** to the discussion is that the **transformation of food systems in the Asia mega-region took and takes place unevenly – a) in spatial terms**, spreading in waves over regions, sub-regions, countries, and within countries, over tiers of urban areas, and over dynamic versus hinterland rural zones, **and b) in product terms**, happening earliest and fastest

in processed, then semi-processed, then fresh/raw products. Thus, countries like India, and a few years ago, China, are in the earlier phases of transformation, doing them very fast, but doing them with a lag after earlier sets of transformations took place in parts of Southeast Asia like Thailand or Northeast Asia like South Korea, and of course all lagged compared to the “lead goose” both in early industrialization and in food system transformation, developed Japan. The food system transformation is thus broadly correlated with the path of overall economic development, but mediated and conditioned by policy processes that delay or constrain various processes, such as for example retail FDI liberalization that occurred early in Southeast Asia, recently in China, and only a few months ago in India.

**Despite the heterogeneity** of distribution of these conditioners of transformation – over products, over firms, over countries, over regions, over time – and the consequent unevenness in the diffusion of transformation - **there is still surprising regularity and timing of “waves” of diffusion**, which occurred geographically (over countries and within countries, over income classes, and over products), for all the three agrifood industry segments.

**A second important qualifier is that there has been a dual-revolution in food, comprising –**

a) a **“modern revolution” - large scale, largely retail and second-stage processing sector focused transformation, with an important component of FDI** (Reardon and Timmer 2007);

b) a **“Quiet Revolution” – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services – in its great majority domestic capital based** (Reardon et al. 2012a).

Throughout the discussion below of the food system transformation, I have as under-pinning points the above qualifiers concerning the above heterogeneity and duality of the transformation. The key findings concerning the transformation are as follows.

a) **Reardon and Timmer (2007) emphasize that there have been two “broad phases” of agrifood industry transformation over the past 50 years: “pre-liberalization/pre-globalization” (mainly 1960s- mid 1980s) and “liberalization/ globalization” (mainly mid-1980s to now).** Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or later in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

b) **Overlaying the above two broad phases are a series of waves of transformation of food systems. The waves are as follows.**

b.1) **The first wave** tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, **East Asia outside China** (and Japan, which I exclude from this discussion as being already developed). The start of wholesale sector transformation (with major investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation “took off” from the early 1990s.

b.2) **The second wave** tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in **much of Southeast Asia (outside Vietnam, Cambodia, and Laos)**, wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

b.3) **The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others.** Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam. As we show below, the retail revolution only took off in earnest mid 2000s in India and Vietnam, and then grew rapidly. In India, although FDI liberalization in retail occurred only at the end of 2012, the sales of modern retail’s leading food-selling chains leapt from 200 million USD in 2001 to 5 billion in 2010, with a 49% annual sales growth for modern food retail (Reardon and Minten 2011) – mainly driven by domestic conglomerates, themselves creatures of the economic boom. This latter also happened in South Korea.

b.4) One can say that there is a fourth wave that includes **other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are on the initial phases of processing and retail transformation.** There were some striking anomalies in the third wave. For example, India had as early a public-sector transformation of the three segments as any first wave country, and kept this public-sector apparatus to the present, not only intact but enlarged – while transition countries like China, Russia, Vietnam had already moved to privatizing the state processing, wholesale, and retailing in the 1990s and 2000s.

b.5) **Diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi-processed, then fresh products.**

c) **There are several key findings in empirical studies concerning the two-stage transformation of the wholesale/logistics segment.**

c.1) **There has been a trend of rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector.** State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then “feeder” or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India. The growth of public markets was spectacular. For example, China’s wholesale market volume increased 11,000 percent from 1990 to 2000 (Huang et al. 2007; Ahmadi-Esfahani and Locke, 1998), and India’s regulated wholesale markets went from 450 in 1948 to 5500 in 2008. A similar rapid growth had occurred in the first- and second-wave countries in the 1960s-1970s.

c.2) **The large investments in public wholesale markets partially transformed this segment - substantially “de-fragmenting” and integrating markets, by providing “economies of agglomeration”** and channeling wholesale from field brokers into a network of covered markets with in situ wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets. In some countries, domestic regulations have held back the transformation of the wholesale market sector. For example, in parts of India, Minten et al. 2010 note that there has been a limitation (through licensing) of the number of wholesalers in markets.

c.3) **The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries opened the door to progressive “dis-intermediation”** in the rural areas and in supply chains.

This has involved two important trends.

**First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers** – such as development (at least in its incipience) or further development of contract farming by processors and collection centers by supermarket chains.

**Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, has spurred “disintermediation”, of the decline of village traders in diverse settings** (with evidence in horticulture and cereals and fish in various Asian countries), and development of direct purchase from farmers by wholesale market traders who often formerly had to procure via village trader networks (see Reardon et al. (2012a) for cases of rice and potatoes in India, China, and Bangladesh, and Dao (2013) for the case of southern Vietnam for rice, Huang et al. (2007) for vegetables in Shandong, and Natawidjaja et al. (2007) for tomatoes on Java in Indonesia).

Rather, wholesale market traders based in towns and cities now dominate wholesale with the farmers, buying directly and “dis-intermediating” the supply chain by displacing the traditional

village trader. For rice, these same works show the rapid decline especially in the past decade of village mills, which if persisting are relegated to custom milling for local farmers for home consumption, a minority share of their output disposal in the dynamic zones. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns and cities in the province or even in the receiving consumption-cities. And as the urban areas assume the majority of the value of consumption, the urban retailer takes on more importance in the total food supply chain than does the rural retailer, such as the haat in the dynamic zones of India, as shown in the recent surveys.

By contrast, we have found that while less-dynamic areas are starting to follow the above trends, they are doing it with a strong lag and much more slowly than the dynamic areas; see for example field survey analyses of Reardon et al. (2012b) for eastern versus dynamic western Uttar Pradesh and Madhya Pradesh and dynamic eastern Andhra Pradesh versus western Andhra Pradesh.

**Moreover, as in the case of modern cold storages in India, these firms act as de facto wholesale market venues, displacing the “mandis” (regulated wholesale markets).** This change appears to be good for Asian farmers as it allows greater choice of buyer. We have also observed (in the study countries of India, China, and Bangladesh, in rice and potato) a great reduction, even in most places a near disappearance, of “tied output-credit markets” where traders pay advances to farmers and expect their output to be sold to that trader. Interestingly, the main and only places we observed a continuation of this traditional “tied” system was in the hinterland zones (that resemble the “traditional image”). (See Reardon et al. 2012b,c).

**c.4) There has even been an incipient emergence of various “off-market” actors specialized in meeting the sourcing requirements of modern processors and supermarkets.**

**The first of the modern wholesale actors are the “dedicated wholesalers” (such as Bimandiri in Indonesia).** These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers. They add value (relative to the simple spot market of the traditional wholesale segment) by managing the relation, collecting, sorting, grading, packing or processing, and delivering.

**The second of the modern wholesale actors are modern logistics companies.** Commonly they undertake a variety of logistics 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 Indian supermarket chains, Reardon and Minten 2011). FDI has been an important driver of the rise of these second type of firms; **this was spurred with the liberalization of FDI in “distribution” (logistics and wholesale)** as part of general liberalization in the 1990s and 2000s. In China and India, for example, this occurred in the 2000s, and was immediately followed by a rush of foreign companies investing.



**A third element of the modernizing wholesale sector is the “cash & carry” chain.** This is in direct competition with the traditional wholesalers and “stockist” networks, supplying traditional retail and traditional HORECA. Global chains operating in this segment include Metro, Walmart (Sam’s Club), Makro, and others.

**d) There are several key findings in the recent empirical literature on the two-stage transformation of agrifood processing in Asia.**

**d.1) The general debate about food systems appears to me to little realize how high a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 16.8% of food undergoes no processing (like fresh whole fruit); that share is 15.3% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as “first processing” with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

**d.2) The processed food<sup>3</sup> sector has grown quickly in the past several decades; this growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments.** These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

**d.3) The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today, very small.** Although the parastatal grain processing sector has been important in urban food security debates for decades, the government’s direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was often larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

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<sup>3</sup> Processed foods are from cereals and pulses, tubers, fish, meat, dairy/eggs, edible oils, and condiments. These are either minimally (semi-) processed or fully processed. They are sold both packaged (bagged, boxed, wrapped, bottled) and non-packaged (like loose flour).

Only a few countries' governments still have substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al. 2007), and far lower yet in other regions.

**d.4) Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multinationalization, and technological, institutional, and organizational change.**

**In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.**

**On the one hand, there was a proliferation of small and medium scale enterprise (SME)** grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. An example of such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

**On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of processing FDI, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants.** The FDI came first mainly from Western Europe and the US (with global firms like Nestle, Kraft, Danone, seeking less saturated markets with higher profit rates, Gehlhar and Regmi 2005), then Japan, and eventually from regional multinationals such as Thailand's CP or Singapore's Wilmar into China and other Southeast Asian countries and India (last year CP created the largest shrimp processing firm in the world in Indonesia), Philippine's San Miguel into Vietnam and Del Monte Asia (Philippines). Some of this has been in the feed sector; the largest feed company in China (New Hope) is now the lead feed miller in Bangladesh (Rashid et al. 2012).

**The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.**

**d.5) There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. The drivers of this consolidation are as follows.**

**In some cases, such as India, the processing sector was "reserved" to SMEs, 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, regulations affecting the segment appeared to accelerate the pressures on SMEs.** For example, re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food businesses have been important examples imposing special burdens on small firms who lacked the investment surplus and access to bank loans to shift location, register their firm, and adopt all the measures (such as hygiene facilities and cement floors) needed to conform to new laws. This has occurred in poultry and egg companies in Vietnam with avian flu regulations. There is mounting evidence that consumers are drawn to supermarkets as a result of food safety concerns about small processors and traditional markets (for Thailand, see Posri and Chadbunchachai, 2006).

**We expect that the new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector.** There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities just as in the US in the 1910s-1920s (Levenstein, 1988).

**Finally, while the “pie” of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in out-competing many small firms.** The large processing firms have several advantages. Through private standards and “resource provision contracts” with suppliers, they can increase the quality and consistency of their intermediate inputs from farmers, driving down costs, controlling for plant size. Also, large firms can borrow more cheaply than small, and foreign firms more cheaply than domestic. Furthermore, in many categories of processing, larger plants have economies of scale. Moreover, a critical mass of output is needed to defend a brand, and the brand provides a competitive attribute over non-branded product, especially where credence goods like food safety are involved. To these can be added economies of scope, as more lines can be added and thus the company can create a “one stop shop” for retailers to source the diversity they require.

**e) There are several key findings in the empirical literature regarding the two-stage transformation of food retail in developing Asia.**

**e.1) As with processing, many governments had several types of public sector cum cooperative retail mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India and Vietnam and China.** At the end of that period, with structural adjustment or liberalization, most were dismantled or privatized, although some continued into the 1990s/2000s and “morphed” into competitors with modern-private chains.

**e.2) In the 1990’s and 2000s occurred the “take-off” of private-sector modern retail – what has become known as the “supermarket revolution” (Reardon et al. 2003).**

**In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries** (Reardon et al. 2012b): (1) the first wave, with take-off in the early 1990s, was in East Asia (outside Japan and China); the share of modern retail in food retail went from roughly 5-10% in 1990 to some 50-60% by the late 1990s; (2) the second wave, in the mid-late

1990s, was in Southeast Asia (outside transition countries like Vietnam); the share reached some 20-50% by the late 2000s; (3) the third wave, in the late 1990s and 2000s, has been mainly in China, Vietnam, and India. The share climbed to some 5-20% by end 2000s, in a rapid rise.

**There has been a steep crescendo in modern retail growth in the third wave countries in the 2000s.** For example, Reardon et al. 2012b, using raw data from the leading retail data source, Planet Retail, calculated leading modern retail sales (for chains selling food) growth rates in representative Asian countries in the three waves. The rates of growth vary over the “waves” as one would expect: the East Asian “first wave” countries (South Korea and Taiwan) indeed show slower modern-retail sales growth rates (a compound growth rate of 11.2% over the 8 years from 2001 to 2009), the second wave (Indonesia, Malaysia, Philippines, Thailand) in the middle (a compound growth rate of 17.9% annually), and the third wave (China, India, Vietnam) the highest (40.9% compound growth rate), as expected due to the most recent starters advancing fastest and the earliest relatively saturated<sup>4</sup>. These rates can be compared to approximately 5% annual growth in real GDP over 2000-2008 in the first and second wave countries, and 7.5-10% in the third wave countries. Even at these rapid GDP growth rates, modern retail sales grew 2-3 times as fast in the first and second wave, and 4-5 times as fast in the third wave. This implies that modern retail’s share of the retail pie continues to expand.

**e.3) Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce<sup>5</sup>. These paths are essentially the same as occurred “historically” (in the 20<sup>th</sup> century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been used to buying them only in wetmarkets, from hawkers, and from tiny shops.**

**f) The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets’ sales, reflecting, as we noted above, the consumption basket), and recently and incipiently, in fresh produce procurement.** The modernization provides a cost advantage to the large and an acceleration of

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<sup>4</sup> The calculations are based on sales data for leading chains from [www.planetretail.net](http://www.planetretail.net)

<sup>5</sup> For example, in “third wave” China, Goldman and Vanhonacker (2006) found that modern retailers already have a retail market share of 79 percent in packaged and processed goods, 55 percent in baked goods, 46 percent in meat, 37 percent in fruit, 35 percent in poultry, 33 percent in fish, and 22 percent in vegetables in large cities. Compare that to the more advanced (“first wave”) case of Hong Kong, which may represent the average Asian consumer sometime in the medium-term future. Hong Kong supermarkets have a 59 percent share in fruit retail and a 55 percent share in vegetables (thus, a share similar to supermarket penetration of produce retail in Brazil), 52 percent in meat, 39 percent in poultry, and 33 percent in fish (Coca-Cola Retailing Research Council Asia 2005). See Ho (2005) re modern retail penetration of rice retail in Hong Kong.

consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2011). This procurement change is discussed below as part of the treatment of effects on producers.

**g) The general implications for rural areas of urbanization cum food industry/supply chain transformation emerge as follows from the literature.**

**g.1) The foremost impact of the transformation of retail has been on the processing sector, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding of small processors;** as modern retailers take a larger and larger share of processed foods markets, this procurement trend will mean that concentrating retail will spill over to **accelerate and magnify the trend of consolidation in the processing sector; the latter trend is also encouraged and forced by a host of other trends that we have noted, and illustrated in the case of India.**

**g.2) Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries,** except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (discussed above for the Bimandiri case in Indonesia) who in turn tend to buy from sets of preferred suppliers. Occasionally, such as in the case of Reliance in India or Cargill (a domestic chain) in Sri Lanka, the chain buys via collection centers from farmers.

**g.3) There have been several reviews recently of the impacts of processors' contracting and supermarket chains' direct sourcing, on farmers** (See Barrett et al. 2012; Reardon et al. 2009). The key findings are as follows.

**(1) There seems to be a general tendency for modern processors and retailers to source from dynamic, close-by zones, rather than hinterland and (agroclimatically) un-favored zones.** This tendency then merely reinforces the prior and ongoing "exclusion" of hinterland zones from the fruits of the growth of urban markets.

**(2) There is no clear pattern – but rather mixed findings – regarding whether small or very small farmers are excluded** from supermarket sourcing or processor contracting. The small set of studies of this question in Asia, like elsewhere, find that sometimes they are excluded (mainly where the buyers have fitting and easy alternative suppliers among larger farmers or sometimes from imports), and sometimes they are included (especially where small farmers are the main source of the produce).

**(3) There appears some tendency for non-land asset-poor farmers, regardless of their land size, to be excluded.** This finding makes sense in that the non-land assets are typically the key conditioners of quality and consistency by the farmers – such as irrigation. As quality and safety requirements of buyers gradually rise, from private

demand or from food safety regulation or from import competition, this source of exclusion may rise.

(4) **There is some evidence that large processors and retailers “help” small producers who face constraints of information, credit, and inputs. The modern buyers are thus helping to resolve “idiosyncratic market failures” facing small or non-land asset poor farmers.** This is often just a private initiative of companies; sometimes it is helped and encouraged by government programs, such as the Government of China’s program to help supermarket chains buy direct from farmers. Note that this “helping hand” is not confined to large firms; we found for example that modern cold storage firms, medium sized companies, also provide credit and input sales to potato farmers in western Uttar Pradesh.

## **5. Fourth Transformation: The Rise of the Rural Nonfarm Labor Market**

a) **Rural nonfarm employment (RNFE) has grown over the three decades to be an important share of rural employment and incomes in Asia.**

**RNFE income is important to rural Asians.** Hagglade, Hazell, and Reardon, henceforth HHR (2007, 2010) note that, based on the review of a number of surveys in various Asian countries<sup>6</sup>, that the average share of rural nonfarm employment, RNFE (employment in manufactures and services, in rural areas) is **40% of total rural incomes; migration income is an additional 11% of total rural incomes; these two (local versus migratory nonfarm income) sum to 51% of rural incomes.**

**RNFE income shares in total incomes are usually higher than “full time” RNFE shares in total employment.** For example, HHR find in a review of full time employment censuses in Asia that the share of local RNFE in total employment is only 24%, well below the 40% income. On average over countries, employment shares are some 20% below income shares. **This is because of much of the RNFE is part time and diversification of income is preponderant.** For example, Davis et al. (2010) for Bangladesh, Nepal, and Pakistan, that many households (52%, 53%, and 36%) earn diversified sources, where no one source exceeds 75% of their total income.

**RNFE income has grown over the past several decades, illustrated here by India’s experience.** There is little systematic data over countries to show this; but individual country cases show this. I illustrate the point here with data from India. Lanjouw and Murgai (2009) show a shift, using NSSO rural household survey data over 1983 to 2004, in the share of total rural employment that is in nonfarm self-employment, going from 10.9 to 14.5%; for casual - wage RNFE, from 5.2 to 9.6%; for “regular RNFE” (salaried RNFE), from 6.4 to 7.3%. Summing these, they show the RNFE employment share from 22% to 31% over this period; note that this is “as full time;” recall the caveat above that this understates the share of this employment in income due to diversified incomes or non-specialization). By contrast, the share

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<sup>6</sup> Bangladesh, China, India, South Korea, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

of the “cultivator” as full time employment dropped from 38.4 to 31.9%, and farm wage labor earners, from 24.3 to 21.8%.

Kumar et al. (2011) show that from 1983 to 1994, 60% of rural job growth was from the farm sector; but from 1994 to 2005, 60% of rural job growth came from the RNFE sector. From 2004 to 2010, total rural employment dropped 5 million even while 13 million new RNFE jobs were added.

Corroborating RNFE’s growth in India from a macro perspective, Himanshu et al. (2011) show that from 1983 to 2004, the RNFE GDP grew 7.1% per year (with a jump from 6.4% per year in 1983-1993, and then 7.7% a year from 1993 to 2004); compare those rates with the agriculture GDP that grew 2.6% per year over those 20 years.

Himanshu (2011) also goes down to the micro level by showing data from a single village taken in some sense as representative, that of Palanpur, where from 1983 to 2008/9 the share of RNFE in total village income rose from 34% to 67%. These changes are similar to those shown in HHR, who review survey studies in India that average to show a change in the share of income from RNFE rising from 26% in 1968 to 36% in 1980 to 46% in 2000.

**RNFE employment in general is much more important to rural Asians than migration employment and farm wage labor.** In popular and also research discussion of “off-farm income” in Asia the assumption is that most comes from migration income and from farm wage labor income. This was shown for migration above.<sup>7</sup> For the case of farm wage labor, Davis et al. (2010), for Bangladesh, Nepal, and Pakistan, show that the share of rural income from farm wage labor is 20, 13, and 9%, respectively, while that of RNFE (wage and self-employment) income is 36%, 30%, and 40% for the three countries, respectively. The ratios of farm

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<sup>7</sup> There are some exceptions to that general finding that migration is much less important than migration income. On the one hand, there are some countries, or rather areas within some countries, where migration income outside the local area is an important share of income and employment. For example, in western and central China, income outside cropping can be a third to half of income, and of that non-cropping income, an important share can be from migration; but note that the literature shows that much of that is still “local” in the sense that it is within the local area around the village, within the province: roughly 40% of employment in migration is outside the local province, and 60% is local semi-migration, sometimes called commuting. The converse is also the case, illustrated by the situation in India; much (with estimates around 50-60%) of “rural” nonfarm employment is actually not in the rural areas per se but in commuting to local towns. This spatial aspect has been under-researched so these estimates are based on just a few studies. On the other hand, there are some countries where migration is important but is very concentrated in terms of participation (a small share of households migrate, but those that do earn a substantial amount of their income from that); this is the case in Bangladesh for example.

participation rates for RNFE versus farm wage labor employment for the three countries are 53/35, 52/38, and 58/20%.

**Rural income diversification (away from just dependence on grain income) from the rise in RNFE far exceeded such diversification from the shift from grains to horticulture and other non-grain cash crops.** Kumar et al. 2011 show that the shift in the share of (full time) employment in RNFE over 1983 to 2004 (from 19% to 32%) can be compared with the shift from 1.9 to 3.5% of employment in horticulture and 4.3 to 9.8% of employment from cash crops. Of course the same caveat as noted above comes into play, that these shares of full time or majority employment understate the shares of these categories in total income due to activity diversification.

**b) RNFE is bimodal - composed of low return (equivalent of subsistence cropping) and high return (poverty alleviating) activities.**

RNFE activities tend to be mainly services (commerce/transport, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR 2010). The activities are a mix of: (1) **casual wage employment** (for relatively low wage, sometimes often below or at the agricultural wage (as in Bangladesh) or modestly above the farm wage (as in India); (2) **salaried “regular” employment** (like a government employee like a rural teacher); (3) **self-employment** (such as owning/managing a micro/small enterprise making cheese).

**The casual wage jobs, and the self-employment jobs (although these vary markedly in returns) are typically relatively low return jobs, while the salaried employment (and some self-employment) are high return job.** It is important to note that the returns can differ very widely across these activities; for example, for Bangladesh, Hossain (1986) showed a long list of RNFE activities ranging from earnings of 4 taka/day to 27.5 taka/day.

**Low return activities typically have much lower entry requirements (in terms of physical, financial, and human capital) than high return activities. One tends to see a strong correlation between poorer households and diversification into low-return off-farm activities,** such as farm wage labor, low return self-employment, and casual wage RNFE (HHR, 2007). For example, for India, Lanjouw and Shariff (2004), echoed with later data by Lanjouw and Murgai (2009), show that households in the various income quintiles (ranging from 1146 to 11,226 rupees) have very different income diversification profiles: the lowest has 38% cropping, 28% farm wage labor, 16% casual RNFE, 11% self-employment RNFE (of the less remunerative kind), 4% salaried RNFE, for 32% of their income from RNFE (and 2% from remittances). The highest quintile had 65% cropping, a mere 2% from farm wage labor and another mere 2% from casual RNFE, but fully 15% for (fourth quintile and 8% for 5<sup>th</sup> quintile) in self-employment (of the more remunerative kind), and fully 21% in salaried RNFE, for a total share of RNFE of 39% for the fourth quintile and 31% for the richest quintile.

**c) Drivers: Push and Pull Factors (differing by dynamic and hinterland zones) and links to types of RNFE generated**



**An important reason for the discussion of the types of RNFE is that the growth of RNFE can be thought of as a mix of the proliferation of low-return RNFE analog to subsistence farming, more of a “refuge” activity (Elbers and Lanjouw, 2001) and the development of high-return RNFE that can alleviate poverty and also feed into investment funds for agriculture.**

**HHR (2007) note correlations: (1) between low-return RNFE activities and “un-favored” zones with low aggregate demand for goods and services from nonfarm sectors; and (2) between high-return RNFE activities and zones with high aggregate demand.** High demand for nonfarm products tends to be generated, as Engels Law would predict, from higher incomes and purchasing power, and from investable surplus to invest in nonfarm activity.

**There is some controversy over whether it is necessary for aggregate demand to come from agricultural development** (as Hossain 1988 and Hazell and Haggblade 1991 emphasize, in their analysis of consumption and production linkages from agriculture in Bangladesh and India), or income from nonfarm activity that developed based on an earlier round of agricultural development (HHR 2007) **or some other source of income, such as proximity to cities or highways between cities or towns (as we discuss below)** or some enclave such as a rural tourism complex, or even from large inflows of migration income.

**The converse is that zones with low aggregate demand can manifest low-return RNFE diffusion.** That low aggregate demand can be from poor agriculture without other sources of income (HHR), or growing agriculture in a zone with poor links to cities (such as shown for Bangladesh by Deichmann et al. 2009, discussed further below), or export markets so that the farmers cannot “realize” sufficient profit from the agricultural development; the most extreme case is where production causes a glut and a price decline. One can find then a paradox of a combination of growing or high level of RNFE (of the low return variety) and stagnant agricultural zones.

**This paradox can explain some findings in India that seem to contradict the “farm development is needed for RNFE development”:** (1) Foster and Rosenzweig (2003) found RNF growing fastest in zones with lower agricultural wages (presumably from weaker agricultural growth and thus derived demand for labor); Lanjouw and Murgai (2009) found that self-employment is greatest in zones with low agricultural productivity in India. (This is similar to findings in Latin America; see Elbers and Lanjouw 2001 and Reardon et al. 2001.)

Note however that even low return nonfarm wage employment can be higher than the farm wage (as Himanshu et al. 2011) note for India, so that the growth of that RNFE can increase farm wages, as Lanjouw and Murgai (2009) find.

**d) Spatiality: RNFE develops especially in proximity to cities and towns**

**This is a key point that links our discussion of urbanization and that of RNFE in Asia.**

Renkow (2007) analyzed conceptually the links between RNFE development clustering around cities and towns, and the presence of agglomeration economies from urban and rur-urban areas as a centripetal force of RNFE toward proximity to urban areas, and congestion diseconomies in urban areas as centrifugal forces to push NFE from cities into surrounding rural areas.

**There have been so far several empirical studies that have tested this hypothesis and confirmed it, showing RNFE clusters near cities/towns; this suggests that RNFE may grow with towns and thus urbanization in general.**

(1) For Nepal, Fafchamps and Shilpi (2003) found RNFE spatially concentrated around cities and towns – specifically within 4 hours of large towns and cities, and within 1 hour of the village/rural town market. They also found “von Thünen” patterns for crop production – with vegetable production concentrated within 1-3 hours of cities and towns, and commercial paddy within 3-5 hours. Paddy marketing and fertilizer use fell off very sharply or disappeared beyond 5 hours around cities and towns as one entered the deeper hinterland areas.

(2) For Bangladesh, Deichmann et al. (2008) found that in the areas near cities and towns, the RNFE share of rural incomes was 56%, versus only 41% in the hinterlands. The hinterland features RNFE of the low-return type, while RNFE near towns is higher-return wage and self-employment. Moreover, Deichmann et al. cross the analysis of effects of urban proximity and agricultural potential and find that high potential farm areas that are near to cities have a lot of high-return wage and self-employment RNFE – but that if the high potential farm area is far from the city (and thus aggregate demand sources and agglomeration economies), the share of high return RNFE is low and low return RNFE by far predominates, often just focused on local services; they note that 28% of the latter is at a return below even the low farm labor wage.

(3) For India, similar to Deichmann et al., Lanjouw and Murgai (2009) found that the urban share of the zone is correlated with a higher incidence of “regular RNFE” (high return wage employment) and self-employment, but not casual, low wage RNFE.

(4) For India, Hazell, Ramaswami, and Rajagopalan (1991) found that rural road density radiating from cities and towns heightens the production- and consumption-linkage effects (in creating RNFE) of agricultural development from the Green Revolution.

(5) An extension of the Hazell et al. (1991) findings about the effects of roads can be found in Bhalla’s (1997) finding that major highway “corridors” between big cities in India form magnets and nodes for RNFE development along and around them; in fact she showed that over decades, these infrastructural linear nodes draw RNFE such as small manufacturing from more hinterland areas, and increase the average size of the firm and increase thus the overall wage employment share in RNFE.

(6) Kumar et al. (2011) show for some states in India that fully 57% of the RNFE jobs are actually commuting and/or temporary local migration from more rural to rur-urban areas and rural towns to work.

**However, urbanization in/near rural areas can be a two-edged sword for RNFE: urban manufactures, produced for mass markets using large scale plants enjoying economies of scale, may compete with RNFE-supplied manufactures.** The cities and towns in rural areas, and the rural roads and inter-city highways are conduits from urban industry to rural areas of these products. This can challenge small scale rural manufacturing with both cost and quality and variety competition. An example is the large-scale food manufacturer in Indonesia, Indofood, selling basic processed food items through convenience store chains into rural towns into rural areas and crowding out cottage-industry goods (Reardon, Stamoulis, Pingali, 2007).

#### **e) Effects and Correlates of RNFE growth on Agriculture and Farm Labor Markets in South Asia: Hypotheses and Findings**

##### **e.1) RNFE (and other factors) drive up the farm wage (in turn inducing mechanization)**

**Farm wages have risen over the past three decades. With the Green Revolution, there was at first a period (in the 1970s) of farm employment increase but without wage increase as labor-intensive high yielding varieties diffused (Lipton with Longhurst, 1989), and then a period of moderate wage increase (with greatly varying rates over zones), and then evidence of acceleration in the past 5-10 years in various countries of a sharp upswing.** In India, Lanjouw and Murgai (2009) note that, in 1993 terms, farm wages doubled from 1983 to 2004/5. Gupta and Sidhartha (2011) note that farm wages rose quickly in the second half of the 2000s. These two India pieces emphasized that the wage growth rates differed markedly over zones. Zhang et al. (2011) note that farm wage rates grew steeply from 2003 on in China, and Zhang et al. (2013) note the same for Bangladesh in the late 2000s, in what they describe as evidence of a Lewis Turning Point.

**The studies in India, China, and Bangladesh note that farm wage growth was driven by: (1) RNFE and migration tightening the labor market; (2) farm productivity growth in some zones.**

**The rise of the farm wage has in turn spurred the spread of farm mechanization, even on small farms. We discuss this further below.**

**e.2) RNFE and migration remittances in turn appears to facilitate purchase of farm machines (such as Estudillo and Otsuka 1998 and Takahashi and Otsuka 2009 show for Luzon, Philippines in a panel study) and other lumpy investments that permit diversification (such as pumps for fish ponds or irrigation for fruit orchards).**

**e.3) RNFE and migration remittances are one way (beside labor- and capital-led intensification, discussed below) for farm households to continue to farm very small farms – as part time farmers (HHR 2007).**

## **6. Fifth Transformation: Farm Technology and Scale Change and Rise of Intermediate Factor Markets**

### **6.1. Farm Technology Intensification and Rise of Intermediate Factor Markets**

a) **In general** over Asia over the past three decades, there has been “intensification-cum-commercialization/diversification”: (1) farms have commercialized; (2) the agricultural sector has diversified (into non-grains, mirroring the diet diversification) while individual farms have specialized (into cropping, or livestock, poultry, aquaculture); (3) farms have shifted from non-purchased to purchased input use (from human to animal to machine power, from manure, byproducts, and residues to chemical fertilizer, and to use of more pesticides and herbicides) (Pingali and Rosegrant, 1995, as well as in analyses of the Green Revolution stages in Cassman and Pingali, 1995, Estudillo and Otsuka, 1998.) These changes occurred earliest and fastest in the “classical Green Revolution” zones, particularly lowland rice systems and irrigated wheat areas. It should be noted however that in these areas as early as the mid-1990s/early 2000s there were warnings that yield growth had begun to plateau despite this intensification (see Cassman and Pingali as well as Lipton (2000)).

**A second wave of this intensification-cum-commercialization occurred, also mainly still in rice and wheat and horticulture areas, in zones that in the 2000s were “catching up” with the initial Green Revolution zones;** this is depicted for example in recent studies in western and central Uttar Pradesh in India, northern Bangladesh, and northeast China in rice and potato (see Reardon et al. 2012a). There was another source of intensification with the development of horticulture in the 1990s-2000s (see for India, Joshi et al., 2004, and BIRTHAL et al. 2012).

b) **The increase over several decades of the farm wage (discussed above) drove a continuous rise in the use of farm machinery** – first for “power” replacement of human and animal power, for example in land preparation, and then “control” replacement for harvesting and weeding (with the latter also and especially addressed by the **rise of the use of herbicide**) (Pingali and Rosegrant 1995).

**RNFE (and thus urbanization, by extension, given our discuss above) appears to have two way effects with the increase in the use of farm machines.** On the one hand, **RNFE and migration remittances are associated with ownership of machines**, as RNFE provides cash to buy the machines (as credit for machine purchase is usually limited); Takahashi and Otsuka (2009) illustrate this in the case of Central Luzon in the Philippines over 1979 to 2003. On the other hand, **using farm machines also frees labor for both migration to cities and local RNFE**; a similar effect comes from using RNFE cash to replace home labor on farms with hired farm labor, as shown in Takahashi and Otsuka).

**Empirical studies find that RNFE is poorly correlated with use (rather than ownership) of farm machinery – mainly because of the existence of active rental markets for farm machines,** that appear to have grown quickly over time (for discussion of this in rice zones, see for example a study of the Philippines by Takahashi and Otsuka (2009), and for rice and potato in Bangladesh, China, and India, see Reardon et al. (2012a).

**Rental of farm machines has further developed recently with the spread of outsource-services of teams of labor with large harvesting machines in China that go from province to province harvesting rice** (see a study of a cluster of such operations based in Jiangsu, each serving hundreds of farmers spanning many provinces over months per year of harvesting, discussed in Yang et al. 2013). **This allows economies of scale on the machine side to small farmers (analogous to small farmers on the output market side to deal with post-harvest services that are increasing in scale – thus small farms wedged between consolidating and scale-increasing services on each side of them in the supply chain.**

**A similar arrangement in fruit farming in the unique analysis of “sprayer traders”** found by dela Cruz et al. (2010) on Luzon in the Philippines: teams of labor equipped with pruning and spraying and harvesting equipment service numerous small mango farms both in all the steps of production but also in harvesting and marketing the mangoes. Small farmers thus benefit from equipment expensive for them, labor supply concentrated and managed in one site in a timely way, as well as special skills and expertise of these teams.

**c) Beside the rise of the machinery purchase, rental, and outsourced services markets, there has been a rapid development of “intermediate factor markets” (Johnson et al. 2003) in Asia, such as those of chemical fertilizer and improved seeds, and in some cases private water markets.**

**The development of the supply side of these intermediate factor markets appears to have mirrored the development of output markets discussed in Reardon and Timmer (2012), with a first phase of “modernization” developed as a public sector action (such as the widespread construction of wholesale markets and public grain depots) and then a second phase of private sector (traditional and modern) development of output market facilities and services. In the input supply sector there is a parallelism:** in the 1960s-1980s Asian governments developed fertilizer and seed depots for subsidized input sales to Asian farmers; in the 1990s and 2000s these diminished in importance with a second phase of development of private sector (traditional and modern) input sales outlets. Our surveys showed that farmers in India, Bangladesh, and China source from very little to a minority of their external inputs from state outlets (see Reardon et al. 2012a). An exception is that pesticides/herbicides markets have traditionally mainly been private sector (traditional or modern) rather than state distribution systems.

**d) A very important point for this paper is that both the “capital-led intensification” (to use Lele and Stone’s 1989 phrase) noted above, and commercialization and diversification, have diffused very unevenly over Asian rural areas, as we emphasized for all the**

**transformations in the introduction to this paper.** The reasons for this unevenness meld with a discussion of drivers of the intensification cum mechanization, and we discuss them both in turn here.

**d.1) The most obvious unevenness comes from agroecological differentiation over zones, unmitigated by infrastructure** – for example, zones with low rainfall that have little irrigation (Rajasthan), or zones with high rainfall that have little drainage tiling (eastern Uttar Pradesh) are disadvantaged.

**Geography, performance, and potential are, however, not static, but rather are malleable:** in the past decade, the western area of Gujarat has shifted toward an intensive, multiple cropping grain area, and the eastern area, to a horticulture area, with the installation of large power grids that allowed a shift to extensive use of irrigation. Another example we can derive is comparing Lipton with Longhurst (1989) characterization of Madhya Pradesh as lagging the Punjab in the 1980s, with Reardon et al. (2012a,b) findings of rapid intensification in the western and central areas of MP in the 2000s.

**d.2) Areas well served by rural roads, and those closer to urban areas, have lower transaction costs of getting inputs, and higher use rates, as discussed above.** Striking findings of differences in external input use between hinterland and non-hinterland areas are found in the Fafchamps/Shilpi (2007) study on Nepal, and Reardon et al. (2012b) study in three states in India, comparing dynamic/connected and hinterland areas. There is however the methodological issue of controlling for agroecology when examining the impact of urban distance and rural road density; hinterland areas can often be mountainous or arid areas. That is why the study by Deichmann et al. (2011) in Bangladesh is particularly interesting for its crossing of distance to city with agroecological indices (in studying RNFE; this method needs more application to technology diffusion).

**e) Areas that are generating RNFE and migration remittances can also exhibit capital-led intensification.** This is a more complex and sometimes ambiguous relation. On the one hand, nonfarm income can generate cash to invest in farm machines and inputs, and even hired labor, as Takahashi and Otsuka (2009) illustrate; this may be even more marked in areas with credit constraints. On the other hand, in some areas nonfarm activity can be a substitute for intensification, relieving the need for it (including where agroecological conditions make it impractical) by diversifying income.

## **6.2. Farm Size Distribution Change – and its links to factor market and agricultural technology change**

**a) There is evidence of aggregate decline in farm size in Asian countries.** Eastwood et al. (2010) examined aggregate data from Bangladesh and India, China, India, and South Korea over 1950 to 1990, and found a gradual decline in average farm size.

**b) Asian farm sizes average small but nevertheless there is substantial variation over farm sizes.** Using data from the 1990s, Eastwood et al. show that: (1) South Asian farm sizes average 1.4 ha, with a Gini coefficient of 54%. 92% of the farms are under 2 ha, but fully 60% of the area under farming is of farms great than 2 ha; (2) in East Asia, the average is 1 ha, the Gini is 50%, 92% are under 2 ha, and nearly 40% of the land is of farms above 2 ha; (3) in Southeast Asia, the average is 1.8 ha, with a 60% Gini coefficient; while 57% of the farms are under 2 ha, only 77% of the land is of farms over 2 ha.

**In these figures I have deliberately emphasized three things: (1) the average farm size is indeed small; (2) but the Gini coefficients are fairly large; (3) and in South and Southeast Asia, 60% and 77% of the farmland is operated by farms over 2 ha. These broad findings open the door to exceptions that we have observed in recent field surveys in several countries – where the average farm size in the country is small, but in several study zones the average size is larger, and the share to medium and large farms is substantial.** I return to that below.

**c) The literature generally hypothesizes the following reasons for the persistence of small farms,** and even the average decline of farm size, in Asia:

(c.1) families are growing and divide up their land to sons (Eastwood et al.);

(c.2) land reform in India has been somewhat effective in the long term (Eastwood et al. 2010);

(c.3) RNFE (and remittances from migration) allows small farms to persist as they can be part time farmers (HHR 2007);

(c.4) labor-led and then capital-led intensification allows small farms to grow in productivity and compensate for land constraints;

(c.5) irrigation allows multiple cropping;

(c.6) high-value agricultural diversification such as into vegetables allows even small farms to be viable (Joshi et al. 2004);

(c.7) ability to outsource harvest, land preparation, and spraying-trading services by machine service providers allows small farmers to enjoy input side economies of scale (see above).

(c.8) Some countries, such as China, have had strictures on land transactions (Deininger and Jin 2009).

d) Here I illustrate the above trends with the case of India. The text table below shows both the average decline but paradoxically also the persistence (although with some aggregate decline) of the major farming role of medium/large farmers.

Text Table: Changes in the size and distribution of landholdings in India			
Farm category	1980-81	1991-92	2002-03
% share in holdings			
Small (LTE 2 ha)	75.3	80.6	86.0
Medium (2-4 ha)	14.2	12.0	9.0
Large (GT 4 ha)	10.5	7.4	5.0
Total (millions farmers)	71.0	93.5	101.3
NOTE % of medium/ large in farmers	24.7	19.4	14%
% share in area operated			
Small	28.1	34.3	43.5
Medium	23.6	24.1	22.5
Large	48.4	41.6	34.0
Total (millions ha)	118.6	125.1	107.7
NOTE share of medium + large in operated area	72%	65.7%	56.5%
% of rented-in area	7.18	8.52	6.5%
Average size of holding (ha)			
Small	0.62	0.57	0.53
Medium	2.77	2.69	2.66
Large	7.69	7.53	7.23
All holdings	1.67	1.34	1.06
Source: Government of India (2006)			

The table shows that: (a) the average landholding is declining; (b) the share of the medium and large farmers in total area is declining; (c) but the latter still farm the majority of land: 14% of farmers are medium/large, but farm 57% of the operated land.

e) **Is there any reason to believe that while the above picture over 20 years shows a farm size decline, that a 40 year long table might not map to a U curve of farm size? Or if this does not occur for the country or countries as aggregates, it may occur in substantial regions of countries?**

**While this section is speculative, I offer reasons for a hypothesis that average land size may indeed climb in at least some areas of Asia, even South Asia, over the next two decades.**

e.1) Recent survey evidence in “dynamic zones” of intensifying and diversifying farming, near to cities, shows average farm sizes are higher than average, and rental rates are high



and growing fast. An example of this is in Western and Central Uttar Pradesh (even controlling for Punjabi settlement areas in those zones); see Reardon et al. (2012a) and vegetable areas in West Java (Natawidjaja et al. 2007). Small farmers in these areas are selling or renting out part or all of their grain farms to larger grain farmers or large vegetable or fruit farmers, and then relying on RNFE and migration labor markets. I surmise that as urbanization proceeds, and provides more spillover effects of RNFE development, strong product market development, and migration opportunities, this apparent concentration process will continue in these dynamic areas.

e.2) The above could be accelerated as cost side pressures (such as on energy and water) and demand side pressures (for product quality) affect the viability of at least the marginal farms. Reardon et al. (2012a,b) found in India distinct differences between marginal farms, and small and medium farms in these zones.

e.3) Gradually regulations restricting land transactions will ease, for example in China; this is extrapolating from the gradual but steady reductions in limitation to rent land (Deininger and Jin 2009) and recent experiments in land titling for sale in some parts of China.

e.4) Agribusiness investments in tracts of land (such as FDI in farm land in Cambodia or Lao PDR, or purchase or rental of large tracts of land by domestic agribusinesses such as the Reliance mango plantations in India, or the “long lease of township farmland” by agribusinesses in China) could increase and lead to concentration of land in some areas.

e.5) Food industry and agribusiness sectors are consolidating in Asia. I have noted above that, outside of land investments, this upstream and downstream consolidation does not necessarily imply pressure for consolidation in the farm sector. Agricultural services like mechanization services can lower costs to small farms; processors and supermarkets can implement hub and spoke models to source from small farms via collection centers and specialized wholesalers, or they can rely for some time on the wholesale markets. The way that consolidation downstream can eventually put pressure on farm sector consolidation may be through a combination of forces that led to farm concentration in traditionally small-scale farm sectors like poultry or pig or fish operations in developed countries. The pressures can be to cut costs in ways that eventually just using own labor cannot support, and farm equipment investments are needed, and even more plausibly, that pressure to augment product safety and quality may come from the consolidated downstream firms. One can see this pressure already in the dairy and pig sectors in China, and the fish sector in Bangladesh.

e.6) The mechanization trends displacing farm labor, and the convergence of use rates of chemicals and improved seed, may reduce yield advantages that smaller farmers have in some places. Already, in the intensified agriculture zones we have studied in India, China, and Bangladesh, there is little yield difference over farm size strata.

e.7) There is some evidence of concentration of RNFE, as capital requirements for viable businesses increase under competition from urban areas. This concentration in the labor market may translate into concentration forces in the land market. (This point was argued in Africa by Reardon et al. 2000.)

f) However, that there does indeed appear to be evidence of a “poverty trap” below a certain land threshold, such as we see in our India field surveys, below 1 ha, and in certain poor agroecological and hinterland areas. These traps may not be amenable in the longer run to any of the possible land concentration forces noted and may fragment further.

## **7. Implications for Asian Agricultural Research and Development Strategies of the above 5 inter-linked transformations**

The paper has emphasized that the agrifood sector of Asia is undergoing rapid transformation. The change is so rapid because there are five mutually reinforcing and encouraging transformations occurring at once. I have shown the connections among them in all directions.

Moreover, the paper has emphasized that while a significant part of the transformation is driven by the “private sector”, popularly thought to mean the large and multinational players in the food business, in fact a very large part of the transformation has been due to private domestic investments by small and medium firms and farms in the traditional systems. The state has played a role at the margin in the recent decades, having played an initiating and formative role in the transformation before that.

Finally, the paper has emphasized the extreme differentiation over countries and over zones within countries, pointing to the existence of 3 rural Asia's. (1) The rural Asia zones that are transforming fastest and with the least external needs and help are the dynamic zones around the cities and towns, a substantial part of rural Asia. Capital-led intensification and RNFE development often develop in these zones and complement each other to spur growth. (2) On the other extreme is the most hinterland zone, where agriculture is poor, infrastructure is poor, and aggregate demand is low, leading to RNFE being mainly low return and subsistence. This is the zone with the most need, but also unfortunately appears to be in line for a long period of lagging, and export of labor and perhaps acquisition by large firms for land extensive operations. (3) In between is a substantial area in Asia that has “high potential but low performance”. This area was perfectly identified in the Deichmann et al. study in Bangladesh as having strong agricultural potential but being relatively far from cities.

I have called these latter, “intermediate zones” “the missing middle” in my prior work in Africa. It appears that these zones have the highest promise for return to research and development efforts to promote sustainable capital-led intensification, RNFE, and at the same time to build the infrastructural base to connect to sources of demand, mainly in the growing cities and towns, even rur-urban areas.

I have also emphasized that while there is a small farm domination in numbers, this disguises two trends of strategic importance. The first is that there is substantial heterogeneity in the farm population, with marginal farmers, and asset poor small farmers (as compared with small farmers) least sharing in the benefits of the transformation. The second is that small-medium and medium farmers dominate output supply, and may in the longer run set the cost and quality competition bar for the smaller and poorer farmers to meet, and be challenged by. The above points imply the need for differentiated strategies for the geographic and socioeconomic strata.

A final set of points focus on the need for research and development strategies to help the farm areas of Asia to meet demand trends. The overwhelming fact is that the urban food economy is already the majority of food demand in Asia, and in several decades, will be the vast majority of demand. That means that meeting urban demand, and developing the rural-urban supply chains to do so, will be of major importance. This will mean more research and development on post-farmgate segments of the supply chain – processing, logistics/distribution, and retail.

Moreover, the nature of that demand is shifting gradually and steadily toward non-grains for the majority of food needs. Much more focus will need to be made on horticulture, aquaculture, meat, oilseeds, dairy, and feedgrains. There will also need to be more focus on attributes beyond yields (even as yields continue to be important for overall food costs): quality attributes for modern markets, food safety, and ability to withstand climate shocks.

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# Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies

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A Foresight Study of the Independent  
Science and Partnership Council

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Thomas Reardon

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# **Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies**

**Thomas Reardon**

**March 2013<sup>1</sup>**

## **1. Introduction**

“Five interlinked transformations” of the agrifood system are occurring rapidly in Asia: (1) urbanization; (2) diet change; (3) food market transformation, (4) rural factor market transformation, (5) agricultural technology and farm scale (land size) change. The changes are linked in mutually causal ways in all directions – so that we are witnessing the transformation of an integrated system rather than piecemeal, independent changes. This makes the transformation more powerful, more rapid, and more complicated in its impacts and implications for agricultural research strategies.

The transformations are occurring in waves over developing regions and countries within the regions over the past decades, and between types of zones inside the countries. Hence, East Asia (outside Japan) started these transformations earliest, with some of the parts of the set of five transformations starting earlier than other parts there. The second in line was much of Southeast Asia. The third in line were the transition countries, in particular China and Vietnam. The fourth in line were the South Asian countries and recently the Southeast Asian countries that had not been in the second wave. Within each of these regions, there are further waves by countries, such as India initiating the integrated set of transformations earlier than Nepal.

Finally, and a major focus in this paper, is that the transformations are highly correlated with the type of zone – whether: (1) “dynamic, commercial zones” in the 8-10 hour market catchment areas of large and medium cities (and within zones, around towns); (2) “intermediate zones” that are in the pathway, over time, of urban centers’ economic “pull” of supply from rural areas, and that are relatively medium-high potential in agroclimatic terms, but in a situation of medium to under-realization of potential in terms of current performance; and (3) hinterland, traditional,

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semi-subsistence zones” further from cities and in more remote and agroclimatically unfavored areas.

This paper focuses on emerging evidence from surveys and broad trend information of the inter-related five transformations, examined in turn. South Asia is the focus of the paper per the terms of reference for this conference contribution, but to a minimum extent the paper is set in a comparative context with the rest of Asia. Indeed, the underlying trend appears to be that there is a “moving average” where like types of zones are transforming, at various paces, in ways that move them toward convergence with “lead geese” that earlier flew that path. The paper ends with an initial assessment of implications for agricultural development strategies for the different types of zones and farmer strata, countries, and regions.

## **2. First transformation: Urbanization and Rur-urbanization: Patterns, Determinants, Effects**

a) **There is rapid aggregate urbanization occurring in Asia.** Estimates of the urban share by Asian Development Bank show a 60% urban share in population by 2025, from only 20% in 1960 (James et al. 2008); estimates by the United Nations (2011) show Asia is at an urban share of 45% by 2011, and estimate that that share will rise to 56% by 2030 and 64% by 2050; they also estimate that the Asian rural population rose from 1.63 billion in 1970 to 2.31 in 2011, but then will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050.

### **b) Fast Urbanization countries in East and Southeast Asia, but Constrained urbanization countries in South Asia**

In 1960, 1990, and 2005, India had an urban population share of 18%, 26%, and 29%; in China those figures were 16%, 27, and 40%; in Indonesia, 15%, 31, and 48%.<sup>2</sup> Both China and Indonesia look to be on the “urbanization take-off” path of earlier fast-developers, for example South Korea; South Korea in 1960 had (at 28%) an urban share like India today or India in 1990, or China in 1990; by 1970 South Korea had 41% (like China today), and then South Korea rose quickly to 74% in 1990 and 81% by 2005. South Korea achieved a shift in urban share in 20 years that it took 90 years for the US to achieve.

The figures above show India as on a “slow urbanization path,” compared to other large and medium countries in East and Southeast Asia. McKinsey (Ablett et al. 2007) has made the assumption that the slow urbanization will continue in India, as it projects that India will still only have a 37% urbanization rate by 2025 – not even to China’s rate today. This rate of growth in the urban share has been modest. Of course, the absolute increase and current urban population are large: India’s urban population grew six-fold from 1948 to 2001 (Mathur 2005); the urban population in 2006 was 318 million, the size of the US, and by 2025, is projected to be 523 million, larger than the 2008 EU population.

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<sup>2</sup> For urbanization rates, see [www.nationmaster.com](http://www.nationmaster.com).

The question of “why has India’s urbanization been so slow” has been a keen point of debate among demographers and urban sociologists and economists for the past half century. While there is some consensus around why urbanization was slow from 1900 to 1950 (slow economic growth and disruptions), the juxtaposition of rapid industrialization and slow urbanization in the decade of the 1950s and 1960s and again in the 1990s and 2000s has puzzled urban experts in those decades. Several points have dominated the debate, leading us to believe that India’s urbanization process is already faster than is officially stated, and will be faster in the future than in the past.

First, there has been criticism of the criteria used in the censuses to classify areas as urban or rural and thus create an under-estimate of the urban share (Bose 1974). Moreover, in 2001 the number of “villages” (ranked as rural) with more than 10,000 inhabitants surpassed in 2001 for the first time (in the census) the number of official “towns” and “urban areas” having greater than 10,000 population. It is posited that if these large villages that are the size of (officially urban) towns were reclassified (as many do not want to do because of tax advantages of continuing as “rural”), there would be a significant jump in the statistical share of urban in India population (Marius-Gnanou and F. Moriconi-Ebrard, 2007).

Second, the debate has noted that urbanization in India was, in the 1960s-1980s, highly “large city” centric, and that the high rates of unemployment in those cities discouraged rural urban migration, but that towns and medium cities did not have the economic base to grow quickly in the 1960s/1970s (Bose 1974). This point was revived in the 2000s, linked to persistent poor infrastructure, poverty, and absorptive capacity of large cities in India (Mathur 2005).

However, starting in the 1980s and into the 1990s and 2000s the secondary and tertiary cities have “taken off” (especially in the economically dynamic states, see the next point) and led to an increase in urbanization. There are 5,161 cities and towns in India as of the 2001 census. There is no standard categorization of these, but typically used is a four-way taxonomy, of Tier 1, 2, 3, and 4 cities. McKinsey uses a classification with a cutoff of 4 million or more population for Tier 1 cities (e.g., Mumbai, Delhi), Tier 2 cities (26 cities with greater than 1 million and less than 4 million, such as Surat or Indore), Tier 3 cities with more than 500,000 population and less than 1 million (such as Amritsar or Goa), and Tier 4, or small towns. In this set, there is relative concentration: Tiers 1 and 2 have 44% of the urban population. But the trend now is toward relative rapid development of the Tier 2 and 3 cities. Moreover, the middle class is spread over the city categories: two-thirds of the middle class is outside of tier 1 cities, and tier 3 cities have as many middle class as tier 2, and a number of tier 3 cities have higher average incomes than tier 2 cities and even some tier 1 cities. There is, however, a greater average household income comparing the first three tiers and the fourth tier (Weinstein, 1991, Bhalla, 1997, New York Times, 2007, and Ablett et al. 2007).

Third, as there is extreme heterogeneity of economic performance and growth rates over India’s states, there is in turn great heterogeneity over states of urbanization rates; thus, the major Indian states that have grown rapidly have urbanization rates in excess of 40% (like China), and those with lagging growth rates have far lower urbanization rates (Mathur, 2005). In turn, urban

growth is in part conditioned by rural growth; hence, for example, in one of the states with the most dynamic agriculture (Punjab), one also finds among the fastest urbanization with growth of Tier 2 and Tier 3 cities, noted above.

c) **Measuring urban population growth alone understates urbanization's importance to the overall food economy from the demand side - because the urban areas share in the total food economy exceeds its share in population.** I have roughly estimated (using figures for urban share, propensity to consume food from income, and income disparities between rural and urban areas) that already half to two-thirds of the food economy in Asia is urban, in the sense of the share of the value of total food consumed in the countries. Typically, the total food expenditure per person in urban areas is greater than that of rural areas (for example in India in 1999 it was 42% higher, Dev et al. 2004), and thus the population share of urban areas understates the share of urban areas in the total value of food consumed in the country. An example of that kind of reasoning has been done for India for all consumption: Ablett et al. (2007) note that by 2006, while 29% of population is in cities, 43% of overall consumption is in cities (given higher average incomes than in rural areas). They project this share to be 62% by 2025.

d) **Urbanization of population per se understates the role of urban areas in the overall food economy from the supply side - as half to two-thirds of the food supply chain "value added" is off-farm (in wholesale and retail, in mills, in cold storage), much of it clusters in towns and cities in Asia especially in the dynamic zones. There appears to be "rur-urbanization" of the food supply chains in Asia.** Moreover, towns, as nodal points of rural road networks, inter-urban highway and rail interfaces, and electricity-endowed platforms, serve as the staging grounds for clusters of services that are crucial to agricultural development in surrounding rural areas. For example, Rashid et al. (2012) analyze clusters of fish/shrimp related enterprises in towns and secondary cities in Bangladesh, involving nodes of numerous feed mills, hatcheries, nurseries, traders, processors, ice makers, repair shops, and so on.

e) An extension of the above is that **urban population growth as an aggregate concept underplays the effect of urban areas on rural areas depending on the proximity or density of urban areas** (proximity of one city to another, even with rural areas intervening between them) **and the development of rural infrastructure, particularly roads and rails, connecting the cities.** South Asia and China, much of Southeast Asia both on the mainland and on the main islands of archipelagic countries, is peppered densely with cities so that rural areas are constantly close to cities in most zones where most of the rural population resides.

The latter effect is presumably magnified by the **huge investments in rural infrastructure and rural-urban links**, particularly roads and rail made by Asian governments in the past 1-2 decades. For example, over 1991 to 2005, road density increased rapidly in South Asia, per the following annual growth rates: Bangladesh, 4.4%; India, 4.6%; Nepal, 12.6%, and Pakistan, 3.8% (ADB, 2012). In the next section we also examine the massive investments in wholesale market infrastructure that Asian governments have made.

An important variation on the above theme is the development of **highway corridors between cities**. Bhalla (1981; 1997) analyzed the development of rural nonfarm enterprises and employment along major highways connecting large cities in India, sources of derived demand for services and products; she found what we can call “internal coastlines” to be very intense areas of nonfarm development, often involving attracting enterprises from villages well away from the highway.

f) **Urbanization per se abstracts from the “type of city” – that is whether its growth is linked or not to the surrounding rural area.** This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007, who makes this link). On the one hand, the urban area may have developed either as an emanation from those linkages, such as in the case of the growth of towns and cities in Shandong or West Java, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as a relative enclave *vis* the surrounding rural area (like resort based towns on the coast of Cambodia, or mining towns in hinterland agricultural areas. In the latter case, urbanization per se may have little effect for the local agricultural area.

g) **Hypotheses concerning general impacts of urbanization on rural areas include:**

g.1.) De facto “de-protection” of rural areas as part of general transaction cost reduction; thus also creating dynamic areas linked to the cities;

g.2.) Facilitation in towns and secondary cities of various clusters and agglomeration of services crucial to capital-led intensification of agriculture, which can also help the survival of small farms.

g.3) Facilitation of development of rural nonfarm activity (and short-distance commuting migration) which in turn affects technology and farm size as discussed below.

g.4) Facilitation of the transformation of food supply chains and agricultural diversification, discussed below.

### **3. Second transformation: Diet Change in Asia**

a) **Income increases (via “Bennett’s Law, Bennett, 1954) and lifestyle changes accompanying urbanization that increase the opportunity cost of women’s time, lead to changes in product composition of demand.**

**These include an increase in the level and shares of: (1) non-grains (meat, fish, dairy, edible oils, fruit, vegetables), with derived demand for feed-grain for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home.** There is abundant evidence that these shifts are occurring in Asia (Pingali 2007; Timmer 2013).

**The corollary is that the share and in some cases the level of cereals consumption is declining.** For the India case, the Government of India (2010) shows that the share of cereal consumption in the urban food basket has declined from 36% in 1972 to 23% in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32%. Weighting by urban and rural population (thus abstracting from income differences), Reardon and Minten (2012) find that roughly 29% of India's food economy was in cereals in 2006, versus roughly 52% in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins.

India appears to be going along a diet change continuum that has further expression in the Southeast Asia case, such as in Indonesia, for which Timmer (2013) shows that by 2011 only 10 percent of the food budget goes to rice (on average—it is higher for the poor), so 90 percent of the food budget is spent on other commodities and value added from processing and convenience.

**The same changes take place in rural areas of Asia, but typically just less fast and far.** This manifests itself in cross section: Ahmed (2013) shows a decline in the share of rice as a share of total energy intake as a function of income strata in the poorest zones of rural Bangladesh. It also manifests itself over time: This was noted above for the case of cereals in rural India; moreover, Timmer (2013) shows a decline in rice consumption per capita in all but the lowest quintile in rural areas of Indonesia over the past two decades. The decline is slower than in urban areas, but still significant.

**The converse of the above point is that the consumption of non-grains is growing faster and/or further in urban areas than in rural areas.** In India for instance, Dev et al. (2004) show, in constant 1999/2000 rupees, in rupees per capita per month, that: (1) cereals in rural areas dropped from 137 to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; (5) Overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410.

b) **Rice is still important in Asia.** Rice is currently and traditionally important in the food consumption basket of Asian countries. For example, nearly all the food grain consumed in Bangladesh was rice, and rice comprised about half the food grain consumed in China and India. However, there are differences between rural and urban areas. For example, in China, in 2004, urban residents consumed 51 kilograms (kg) of rice per capita, while rural residents consumed 93 kg.

c) **However... rice consumption is in a gradual, absolute decline in Asia.** The importance of rice as a share in the diet of most Asian consumers has been declining during the past several decades, as analyzed by Timmer and Dawe (2010). The share of rice in calories for all Asian

countries in the FAO's food balance data sheets was at its highest in 1970 in the midst of the Green Revolution, at 38.2%, and then trended down to 29.3% by 2007 (FAOSTAT 2012). The shift has been marked in China, for example, from rice being 38.7% of calories in 1970 to 26.8% in 2007) and Bangladesh (from 75.1% in 1970 to 69.8% in 2007), Indonesia, from 58% in 1961 to 47% in 2009, and India, from 32.4% in 1970 to 29.9% in 2007. The downward drift was very slow until 1990 and then much faster (as Asian incomes increased) (Timmer and Dawe 2010, and Timmer 2013).

**By 2007, only 30% of calories in Asian consumers' diets came from rice (comprising 5% of their food budget in money terms).** The calories from rice changed in the PRC (from a low of 444 in 1961 to a high of 872 in 1990, then dropped to 799 by 2007) and India (from a low in the 600s in the 1960s–1970s to a high of 781 in 1990, then dropped to 703 in 2007). The calories from rice rose slightly in Bangladesh in absolute terms (from a high in the 1,500s in the 1960s–1970s, down to 1,311 in 1980 and 1,473 in 1990, and up to 1,591 in 2007), as Bangladesh rode through the Green Revolution, a prolonged crisis, and a long recovery.

Timmer and Dawe (2010) noted that the decline had accelerated in the last decade, and should be expected to continue for some time because (1) the income elasticity of rice demand is falling over time; (2) as rural-to-urban migration occurs and incomes rise, the elasticity trends downward; and (3) the income elasticity is lower in urban than in rural areas and among richer than poorer consumers. This general decline of course disguises heterogeneity among age groups, regions within countries, and across the economies themselves, but the overall trend is clear.

**d) But there has been a rise in wheat consumption – and wheat imports.** Wheat is still minor in most Asian countries compared with rice (except in India and China). But the rise of wheat from a low base to a significant presence in consumption is especially marked in Southeast Asia, as Timmer (2013) shows: from 1 million metric tons of imports of wheat in 1961 to 13 million tons by 2010; wheat was 2.8% of the level of rice consumption in 1961, and by 2009 was up to 11.5%. Senauer et al. (1986) documented the early stages of this rise of wheat in Sri Lanka in the 1980s. In both cases, the rise of wheat brought increases in imports as Sri Lanka and Southeast Asian countries do not produce them significantly. By contrast, wheat consumption in China and India are important but they are also major producers of wheat and imports are minor. Of course, some countries like Bangladesh are still focused on rice and the imports of wheat are minor.

**e) Note that the current changes in cereal consumption (secular decline of rice, rise of wheat) and tuber consumption (rapid decline of sweet potatoes, rise of white potatoes) are not the first time consumption composition changes have taken place. In the 1960's through 1980s, as a rough approximation, there was a decline in coarse grains, especially millet and sorghum, in India (ICRISAT 1982) – displaced by the rise of rice and wheat and somewhat maize (as it was doing in Africa at the same time, see Reardon 1993).**

**f) Diet patterns are malleable in Asia, with “traditional food culture” appearing to be only moderately constraining of shifts.** Several points stand out.



**f.1) Many non-traditional food products have quickly become “traditional” and widely diffused in Asia.** (1) Central/South America’s products (potatoes, tomatoes, chili peppers, sweet corn, pineapple, papaya) have become leading produce items in Asia (potatoes are the leading vegetable in India, Bangladesh, China, Indonesia - all places they are utterly non-traditional and recent). (2) Shifts from Africa to Asia also are common: sorghum and millet (ICRISAT 1982) were introduced into India from Africa and highly diffused into large tracts of India where only recently (mainly in the past half century) did rice and wheat (and pulses) enter and displace those “traditional” crops. Oil-palms were brought to Southeast Asia from Nigeria in 1961, to become major crop in Southeast Asia and major edible oil in much of Asia. (3) Dairy, non-traditional in the great majority of East/Southeast Asia (except in the far north in the grasslands such as in Inner Mongolia or Mongolia), emerged as a significant sector in many countries of the region in only the past few decades.

**f.2) Traditionally “vegetarian” areas, such as the (mainly-Hindu) India and (mainly Buddhist) Southeast Asia have rapidly growing fish, poultry, and even red meat consumption.** For example, 31% of Indians are strict vegetarians, and thus in a sense may be “structurally constrained” in diet habits, but the working hypothesis is that many of the rest will increase at least fish and poultry consumption as incomes grow.

**f.3) New forms of consumption and buying** (in processed form, from away-from-home sources, and from modern retail or fast food chains, as discussed further below) **also have spread very quickly**, even though these are highly non-traditional (just as they were in the “West” only 50-80 years before);

**f.4) There has been a proliferation of grain and potato varieties amenable to longer storage, easier processing, and long-distance shipment**, such as in the case of potatoes in India (Reardon et al. 2012a).

**g) Shift toward more consumption of non-grain foods and more processed foods is conditioned by supply side factors that vary a lot over time, over countries, and over product types – but factors that in Asia in the past 20 years have been very amenable to the shift, as follows.**

**g.1) One such supply side factor is in general NOT imports – imports are not driving diet change. Imports as a source of food are minor as a share of total food consumed. Exceptions are the rise of wheat imports, although even that is a tiny share of total food, and of soy imports for livestock production.** Asia’s situation of near full self-sufficiency in food (measured merely as the share of domestic production in total food consumption) is in contrast to a greater dependence on imports that has been more important in for example Africa (for West Africa for the issue of growing cereal imports especially of cereals not produced in the region, see Reardon 1993). For more on this subject for Southeast Asia, see Timmer (2013).

g.2) **Domestic farm side supply of nongrains is rapidly increasing: farmers are undertaking agricultural diversification** toward fruits, vegetables, fish, meat, and dairy has been proceeding apace in Asian countries, such as noted in Pingali (2006) for a number of Asian countries, Joshi et al. (2004) for all South Asian countries, and Birthal et al. (2012) for India.

Rao et al. (2006) note for India that there is a **strong correlation between agricultural diversification on the one hand, and the urban share and road and population density of the district in India**; urbanization and infrastructure development have thus encouraged that diversification over the past several decades. There have been large investments in irrigation in horticultural areas such as in Gujarat in India and Comilla in Bangladesh, and in fish and shrimp ponds in Bangladesh (Rashid et al. 2012), Indonesia (Yi et al. 2012), India, and China. There have been massive investments by farmers in inexpensive clay greenhouses in Shandong (Wang et al. 2012).

g.3) **Domestic supply chain development after the farm-gate is facilitating the supply of non-grain products to Asian cities. Supply chain actors (off-farm) have invested enormous sums in the aggregate in rural-urban supply chains for non-grain products: storage, packing, logistics/shipping, and commercial services.** The emerging evidence is abundant concerning the rapid development of these services in Asia, both in the modern large-scale sector and in the informal, small-scale sector. Examples include the very rapid emergence especially in the 2000s of potato cold storage facilities in western Uttar Pradesh (to serve the Delhi market, where fully two-thirds of potato consumption is now from cold storages in nearby production areas) (Reardon et al. 2012a) and even in poor areas of Bihar (Minten et al. 2011). There has also been a rapid emergence of cold storage and logistics companies that operate increasingly pan-India; part of this has been from FDI from Japan and the US and others (Reardon and Minten 2012). Domestic and multinational packaging companies are also important to this trend. For example, the Swedish multinational Tetrapak, so important in dairy packaging that spurred dairy sector development in Latin America in the 1980s/1990s (see Farina et al. 2005) is making large investments in a number of Asian countries for milk and juice packaging in the 2000s.

g.4) **The growth of non-grain supply chains (as well as grain supply chains) has hastened and been facilitated by intra-country (inter-region) market integration as cities across a given country demand similar products** (northern India, before a wheat consumer (and before that a sorghum and millet consumer) starts demanding more rice, southern India and southern China demand more potatoes (produced in the mountain/hills and northern areas of the countries); fish is marketed over regions in Bangladesh, from the pond-strewn and river-laced south to the drier north; japonica rice is shipped increasingly from northern China into southern China even as the consumption of indica rice wanes).

**Probably over time food market integration and development of pan-region supply chains will be and is being hastened and facilitated by the spread of fast food chains in urban areas:** Northern India cuisine has spread by this vector to Southern India, and vice versa; as has the consumption of French fries (see Scott and Suarez (2012) for latter in China). This is similar to what happened in the US.

**h) Quality demanded of farmers and by consumers increases also with urbanization, in several ways:**

**h.1) Demand does not only differentiate over broad categories – but within categories over niches, commodities, and differentiated products which create new series of niches which are then commoditized, as in the “product cycle”.** This is a cycle of cost then quality competition, cost then quality competition, and so on. A good example of this is the kiwi fruit: it started as a wild/local niche fruit in China, then moved to commoditized phase after introduction into New Zealand (and Italy and California and others) to then commoditize in China too; the kiwi was then differentiated into various varieties (such as golden kiwi) as part of the third phase of the cycle, product differentiation, “climbing the value ladder.” This same process can be seen in the fish sector in Bangladesh (Rashid et al. 2012).

**The product cycle often manifests itself in geographical differentiation over the phases.** For example, land shifts from rice into commodity vegetables near Jakarta in the early 1990s; by the late 1990s, the commodity vegetable production had shifted to cheaper land and labor areas in West Java (and shipped back to Jakarta), while the vegetable areas near Jakarta had started to enter the product differentiation phase, for the local market and for emerging supermarkets. By the mid/late 2000s, the areas near Jakarta (with much higher land and labor costs by then) started to shift to export vegetables and high end products such as hydroponic vegetables, and “supermarket” quality vegetables had shifted to West Java, and commodity vegetables such as bulk potatoes and cabbage started to shift to cheap land areas in Sumatra. There are many similar cases in various parts of Asia (and elsewhere).

**h.2) Food safety is gradually introduced as a requirement, especially for fresh produce and dairy and meat products.** This tends to be first introduced for export markets, for situations where public and private standards are introduced, and for high-end supermarket chains, and in the wake of crises such as the melamine crisis in China or the bird flu crisis in various countries of Asia. An example of a regulatory initiative is China’s first comprehensive Food Safety Law of 2009.

**h.3) Branding cum quality differentiation of products is also gradually being introduced.** In our study of rice in China, India, and Bangladesh, it was particularly in China where mill branding and packaging has developed rapidly recently (Reardon et al. 2012a). In Bangladesh, there has been a differentiation of rice quality over the past decade (with the price premiums mainly captured by millers and traders), see Minten et al.

2013a, and incipient branding in fruit value chains in India, even originating in poor zones like Bihar (Minten et al. 2013b). **I surmise that in Asia over the next decade, the rise of branding (especially by large and medium food companies) will go hand in hand with the rise of consciousness of and public concern about food safety – as it did in the first half of the 1900s in the US** (see Levenstein 2013).

h.4) **There has also been a shift in some cases toward varieties that can ship further or have longer shelf life (such as potato varieties in India, see Reardon et al. 2012a), that are easier to mill, and so on.** That is, varietal development and transformation of the food system are sometimes linked.

i) **Hypotheses concerning general implications for rural areas of urbanization *cum* diet change:**

i.1) **inducement for diversification of agriculture from grains to non-grains, and from commodity grain to differentiated quality grains.**

i.2) **inducement to shift the product and variety mix in agricultural zones as part of product differentiation and the product cycle** (for example, the rise of horticulture in the market-catchment areas of large cities in India and Bangladesh, such as found by Rao et al. 2006).

#### **4. Third Transformation: Food System Transformation in Asia**

The food system (a general term for food supply chains and markets) transformation is taking place along several lines in Asia. Here we will focus on the transformation of the “post-farmgate” segments of the supply chain: wholesale/brokerage/logistics/cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are formed in these segments).

The transformation of the post farmgate segments is intimately connected with urbanization both in terms of the drivers being especially in urban areas, because the majority of the food supply chain in Asia is from rural to urban, and because many of the post-farmgate activities are in towns and secondary cities and primary cities.

In this section I briefly review key evidence on the food system transformation in Asia, drawing from Reardon and Timmer (2012), Reardon et al. (2012abc), and Reardon et al. (2009) which in turn contain reviews of the detailed evidence and literature, much of which was formed in the 2000s.

**A first important qualifier** to the discussion is that the **transformation of food systems in the Asia mega-region took and takes place unevenly – a) in spatial terms**, spreading in waves over regions, sub-regions, countries, and within countries, over tiers of urban areas, and over dynamic versus hinterland rural zones, **and b) in product terms**, happening earliest and fastest

in processed, then semi-processed, then fresh/raw products. Thus, countries like India, and a few years ago, China, are in the earlier phases of transformation, doing them very fast, but doing them with a lag after earlier sets of transformations took place in parts of Southeast Asia like Thailand or Northeast Asia like South Korea, and of course all lagged compared to the “lead goose” both in early industrialization and in food system transformation, developed Japan. The food system transformation is thus broadly correlated with the path of overall economic development, but mediated and conditioned by policy processes that delay or constrain various processes, such as for example retail FDI liberalization that occurred early in Southeast Asia, recently in China, and only a few months ago in India.

**Despite the heterogeneity** of distribution of these conditioners of transformation – over products, over firms, over countries, over regions, over time – and the consequent unevenness in the diffusion of transformation - **there is still surprising regularity and timing of “waves” of diffusion**, which occurred geographically (over countries and within countries, over income classes, and over products), for all the three agrifood industry segments.

**A second important qualifier is that there has been a dual-revolution in food, comprising –**

a) a **“modern revolution” - large scale, largely retail and second-stage processing sector focused transformation, with an important component of FDI** (Reardon and Timmer 2007);

b) a **“Quiet Revolution” – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services – in its great majority domestic capital based** (Reardon et al. 2012a).

Throughout the discussion below of the food system transformation, I have as under-pinning points the above qualifiers concerning the above heterogeneity and duality of the transformation. The key findings concerning the transformation are as follows.

a) **Reardon and Timmer (2007) emphasize that there have been two “broad phases” of agrifood industry transformation over the past 50 years: “pre-liberalization/pre-globalization” (mainly 1960s- mid 1980s) and “liberalization/ globalization” (mainly mid-1980s to now).** Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or later in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

b) **Overlaying the above two broad phases are a series of waves of transformation of food systems. The waves are as follows.**

b.1) **The first wave** tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, **East Asia outside China** (and Japan, which I exclude from this discussion as being already developed). The start of wholesale sector transformation (with major investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation “took off” from the early 1990s.

b.2) **The second wave** tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in **much of Southeast Asia (outside Vietnam, Cambodia, and Laos)**, wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

b.3) **The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others.** Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam. As we show below, the retail revolution only took off in earnest mid 2000s in India and Vietnam, and then grew rapidly. In India, although FDI liberalization in retail occurred only at the end of 2012, the sales of modern retail’s leading food-selling chains leapt from 200 million USD in 2001 to 5 billion in 2010, with a 49% annual sales growth for modern food retail (Reardon and Minten 2011) – mainly driven by domestic conglomerates, themselves creatures of the economic boom. This latter also happened in South Korea.

b.4) One can say that there is a fourth wave that includes **other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are on the initial phases of processing and retail transformation.** There were some striking anomalies in the third wave. For example, India had as early a public-sector transformation of the three segments as any first wave country, and kept this public-sector apparatus to the present, not only intact but enlarged – while transition countries like China, Russia, Vietnam had already moved to privatizing the state processing, wholesale, and retailing in the 1990s and 2000s.

b.5) **Diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi-processed, then fresh products.**

c) **There are several key findings in empirical studies concerning the two-stage transformation of the wholesale/logistics segment.**

c.1) **There has been a trend of rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector.** State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then “feeder” or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India. The growth of public markets was spectacular. For example, China’s wholesale market volume increased 11,000 percent from 1990 to 2000 (Huang et al. 2007; Ahmadi-Esfahani and Locke, 1998), and India’s regulated wholesale markets went from 450 in 1948 to 5500 in 2008. A similar rapid growth had occurred in the first- and second-wave countries in the 1960s-1970s.

c.2) **The large investments in public wholesale markets partially transformed this segment - substantially “de-fragmenting” and integrating markets, by providing “economies of agglomeration”** and channeling wholesale from field brokers into a network of covered markets with in situ wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets. In some countries, domestic regulations have held back the transformation of the wholesale market sector. For example, in parts of India, Minten et al. 2010 note that there has been a limitation (through licensing) of the number of wholesalers in markets.

c.3) **The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries opened the door to progressive “dis-intermediation”** in the rural areas and in supply chains.

This has involved two important trends.

**First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers** – such as development (at least in its incipience) or further development of contract farming by processors and collection centers by supermarket chains.

**Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, has spurred “disintermediation”, of the decline of village traders in diverse settings** (with evidence in horticulture and cereals and fish in various Asian countries), and development of direct purchase from farmers by wholesale market traders who often formerly had to procure via village trader networks (see Reardon et al. (2012a) for cases of rice and potatoes in India, China, and Bangladesh, and Dao (2013) for the case of southern Vietnam for rice, Huang et al. (2007) for vegetables in Shandong, and Natawidjaja et al. (2007) for tomatoes on Java in Indonesia).

Rather, wholesale market traders based in towns and cities now dominate wholesale with the farmers, buying directly and “dis-intermediating” the supply chain by displacing the traditional

village trader. For rice, these same works show the rapid decline especially in the past decade of village mills, which if persisting are relegated to custom milling for local farmers for home consumption, a minority share of their output disposal in the dynamic zones. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns and cities in the province or even in the receiving consumption-cities. And as the urban areas assume the majority of the value of consumption, the urban retailer takes on more importance in the total food supply chain than does the rural retailer, such as the haat in the dynamic zones of India, as shown in the recent surveys.

By contrast, we have found that while less-dynamic areas are starting to follow the above trends, they are doing it with a strong lag and much more slowly than the dynamic areas; see for example field survey analyses of Reardon et al. (2012b) for eastern versus dynamic western Uttar Pradesh and Madhya Pradesh and dynamic eastern Andhra Pradesh versus western Andhra Pradesh.

**Moreover, as in the case of modern cold storages in India, these firms act as de facto wholesale market venues, displacing the “mandis” (regulated wholesale markets).** This change appears to be good for Asian farmers as it allows greater choice of buyer. We have also observed (in the study countries of India, China, and Bangladesh, in rice and potato) a great reduction, even in most places a near disappearance, of “tied output-credit markets” where traders pay advances to farmers and expect their output to be sold to that trader. Interestingly, the main and only places we observed a continuation of this traditional “tied” system was in the hinterland zones (that resemble the “traditional image”). (See Reardon et al. 2012b,c).

**c.4) There has even been an incipient emergence of various “off-market” actors specialized in meeting the sourcing requirements of modern processors and supermarkets.**

**The first of the modern wholesale actors are the “dedicated wholesalers” (such as Bimandiri in Indonesia).** These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers. They add value (relative to the simple spot market of the traditional wholesale segment) by managing the relation, collecting, sorting, grading, packing or processing, and delivering.

**The second of the modern wholesale actors are modern logistics companies.** Commonly they undertake a variety of logistics 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 Indian supermarket chains, Reardon and Minten 2011). FDI has been an important driver of the rise of these second type of firms; **this was spurred with the liberalization of FDI in “distribution” (logistics and wholesale)** as part of general liberalization in the 1990s and 2000s. In China and India, for example, this occurred in the 2000s, and was immediately followed by a rush of foreign companies investing.



**A third element of the modernizing wholesale sector is the “cash & carry” chain.** This is in direct competition with the traditional wholesalers and “stockist” networks, supplying traditional retail and traditional HORECA. Global chains operating in this segment include Metro, Walmart (Sam’s Club), Makro, and others.

**d) There are several key findings in the recent empirical literature on the two-stage transformation of agrifood processing in Asia.**

**d.1) The general debate about food systems appears to me to little realize how high a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 16.8% of food undergoes no processing (like fresh whole fruit); that share is 15.3% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as “first processing” with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

**d.2) The processed food<sup>3</sup> sector has grown quickly in the past several decades; this growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments.** These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

**d.3) The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today, very small.** Although the parastatal grain processing sector has been important in urban food security debates for decades, the government’s direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was often larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

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<sup>3</sup> Processed foods are from cereals and pulses, tubers, fish, meat, dairy/eggs, edible oils, and condiments. These are either minimally (semi-) processed or fully processed. They are sold both packaged (bagged, boxed, wrapped, bottled) and non-packaged (like loose flour).

Only a few countries' governments still have substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al. 2007), and far lower yet in other regions.

**d.4) Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multinationalization, and technological, institutional, and organizational change.**

**In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.**

**On the one hand, there was a proliferation of small and medium scale enterprise (SME)** grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. An example of such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

**On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of processing FDI, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants.** The FDI came first mainly from Western Europe and the US (with global firms like Nestle, Kraft, Danone, seeking less saturated markets with higher profit rates, Gehlhar and Regmi 2005), then Japan, and eventually from regional multinationals such as Thailand's CP or Singapore's Wilmar into China and other Southeast Asian countries and India (last year CP created the largest shrimp processing firm in the world in Indonesia), Philippine's San Miguel into Vietnam and Del Monte Asia (Philippines). Some of this has been in the feed sector; the largest feed company in China (New Hope) is now the lead feed miller in Bangladesh (Rashid et al. 2012).

**The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.**

**d.5) There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. The drivers of this consolidation are as follows.**

**In some cases, such as India, the processing sector was "reserved" to SMEs, 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, regulations affecting the segment appeared to accelerate the pressures on SMEs.** For example, re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food businesses have been important examples imposing special burdens on small firms who lacked the investment surplus and access to bank loans to shift location, register their firm, and adopt all the measures (such as hygiene facilities and cement floors) needed to conform to new laws. This has occurred in poultry and egg companies in Vietnam with avian flu regulations. There is mounting evidence that consumers are drawn to supermarkets as a result of food safety concerns about small processors and traditional markets (for Thailand, see Posri and Chadbunchachai, 2006).

**We expect that the new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector.** There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities just as in the US in the 1910s-1920s (Levenstein, 1988).

**Finally, while the “pie” of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in out-competing many small firms.** The large processing firms have several advantages. Through private standards and “resource provision contracts” with suppliers, they can increase the quality and consistency of their intermediate inputs from farmers, driving down costs, controlling for plant size. Also, large firms can borrow more cheaply than small, and foreign firms more cheaply than domestic. Furthermore, in many categories of processing, larger plants have economies of scale. Moreover, a critical mass of output is needed to defend a brand, and the brand provides a competitive attribute over non-branded product, especially where credence goods like food safety are involved. To these can be added economies of scope, as more lines can be added and thus the company can create a “one stop shop” for retailers to source the diversity they require.

**e) There are several key findings in the empirical literature regarding the two-stage transformation of food retail in developing Asia.**

**e.1) As with processing, many governments had several types of public sector cum cooperative retail mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India and Vietnam and China.** At the end of that period, with structural adjustment or liberalization, most were dismantled or privatized, although some continued into the 1990s/2000s and “morphed” into competitors with modern-private chains.

**e.2) In the 1990’s and 2000s occurred the “take-off” of private-sector modern retail – what has become known as the “supermarket revolution” (Reardon et al. 2003).**

**In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries** (Reardon et al. 2012b): (1) the first wave, with take-off in the early 1990s, was in East Asia (outside Japan and China); the share of modern retail in food retail went from roughly 5-10% in 1990 to some 50-60% by the late 1990s; (2) the second wave, in the mid-late

1990s, was in Southeast Asia (outside transition countries like Vietnam); the share reached some 20-50% by the late 2000s; (3) the third wave, in the late 1990s and 2000s, has been mainly in China, Vietnam, and India. The share climbed to some 5-20% by end 2000s, in a rapid rise.

**There has been a steep crescendo in modern retail growth in the third wave countries in the 2000s.** For example, Reardon et al. 2012b, using raw data from the leading retail data source, Planet Retail, calculated leading modern retail sales (for chains selling food) growth rates in representative Asian countries in the three waves. The rates of growth vary over the “waves” as one would expect: the East Asian “first wave” countries (South Korea and Taiwan) indeed show slower modern-retail sales growth rates (a compound growth rate of 11.2% over the 8 years from 2001 to 2009), the second wave (Indonesia, Malaysia, Philippines, Thailand) in the middle (a compound growth rate of 17.9% annually), and the third wave (China, India, Vietnam) the highest (40.9% compound growth rate), as expected due to the most recent starters advancing fastest and the earliest relatively saturated<sup>4</sup>. These rates can be compared to approximately 5% annual growth in real GDP over 2000-2008 in the first and second wave countries, and 7.5-10% in the third wave countries. Even at these rapid GDP growth rates, modern retail sales grew 2-3 times as fast in the first and second wave, and 4-5 times as fast in the third wave. This implies that modern retail’s share of the retail pie continues to expand.

**e.3) Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce<sup>5</sup>. These paths are essentially the same as occurred “historically” (in the 20<sup>th</sup> century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been used to buying them only in wetmarkets, from hawkers, and from tiny shops.**

**f) The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets’ sales, reflecting, as we noted above, the consumption basket), and recently and incipiently, in fresh produce procurement.** The modernization provides a cost advantage to the large and an acceleration of

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<sup>4</sup> The calculations are based on sales data for leading chains from [www.planetretail.net](http://www.planetretail.net)

<sup>5</sup> For example, in “third wave” China, Goldman and Vanhonacker (2006) found that modern retailers already have a retail market share of 79 percent in packaged and processed goods, 55 percent in baked goods, 46 percent in meat, 37 percent in fruit, 35 percent in poultry, 33 percent in fish, and 22 percent in vegetables in large cities. Compare that to the more advanced (“first wave”) case of Hong Kong, which may represent the average Asian consumer sometime in the medium-term future. Hong Kong supermarkets have a 59 percent share in fruit retail and a 55 percent share in vegetables (thus, a share similar to supermarket penetration of produce retail in Brazil), 52 percent in meat, 39 percent in poultry, and 33 percent in fish (Coca-Cola Retailing Research Council Asia 2005). See Ho (2005) re modern retail penetration of rice retail in Hong Kong.

consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2011). This procurement change is discussed below as part of the treatment of effects on producers.

**g) The general implications for rural areas of urbanization cum food industry/supply chain transformation emerge as follows from the literature.**

**g.1) The foremost impact of the transformation of retail has been on the processing sector, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding of small processors;** as modern retailers take a larger and larger share of processed foods markets, this procurement trend will mean that concentrating retail will spill over to **accelerate and magnify the trend of consolidation in the processing sector; the latter trend is also encouraged and forced by a host of other trends that we have noted, and illustrated in the case of India.**

**g.2) Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries,** except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (discussed above for the Bimandiri case in Indonesia) who in turn tend to buy from sets of preferred suppliers. Occasionally, such as in the case of Reliance in India or Cargill (a domestic chain) in Sri Lanka, the chain buys via collection centers from farmers.

**g.3) There have been several reviews recently of the impacts of processors' contracting and supermarket chains' direct sourcing, on farmers** (See Barrett et al. 2012; Reardon et al. 2009). The key findings are as follows.

**(1) There seems to be a general tendency for modern processors and retailers to source from dynamic, close-by zones, rather than hinterland and (agroclimatically) un-favored zones.** This tendency then merely reinforces the prior and ongoing "exclusion" of hinterland zones from the fruits of the growth of urban markets.

**(2) There is no clear pattern – but rather mixed findings – regarding whether small or very small farmers are excluded** from supermarket sourcing or processor contracting. The small set of studies of this question in Asia, like elsewhere, find that sometimes they are excluded (mainly where the buyers have fitting and easy alternative suppliers among larger farmers or sometimes from imports), and sometimes they are included (especially where small farmers are the main source of the produce).

**(3) There appears some tendency for non-land asset-poor farmers, regardless of their land size, to be excluded.** This finding makes sense in that the non-land assets are typically the key conditioners of quality and consistency by the farmers – such as irrigation. As quality and safety requirements of buyers gradually rise, from private

demand or from food safety regulation or from import competition, this source of exclusion may rise.

(4) **There is some evidence that large processors and retailers “help” small producers who face constraints of information, credit, and inputs. The modern buyers are thus helping to resolve “idiosyncratic market failures” facing small or non-land asset poor farmers.** This is often just a private initiative of companies; sometimes it is helped and encouraged by government programs, such as the Government of China’s program to help supermarket chains buy direct from farmers. Note that this “helping hand” is not confined to large firms; we found for example that modern cold storage firms, medium sized companies, also provide credit and input sales to potato farmers in western Uttar Pradesh.

## **5. Fourth Transformation: The Rise of the Rural Nonfarm Labor Market**

a) **Rural nonfarm employment (RNFE) has grown over the three decades to be an important share of rural employment and incomes in Asia.**

**RNFE income is important to rural Asians.** Hagglade, Hazell, and Reardon, henceforth HHR (2007, 2010) note that, based on the review of a number of surveys in various Asian countries<sup>6</sup>, that the average share of rural nonfarm employment, RNFE (employment in manufactures and services, in rural areas) is **40% of total rural incomes; migration income is an additional 11% of total rural incomes; these two (local versus migratory nonfarm income) sum to 51% of rural incomes.**

**RNFE income shares in total incomes are usually higher than “full time” RNFE shares in total employment.** For example, HHR find in a review of full time employment censuses in Asia that the share of local RNFE in total employment is only 24%, well below the 40% income. On average over countries, employment shares are some 20% below income shares. **This is because of much of the RNFE is part time and diversification of income is preponderant.** For example, Davis et al. (2010) for Bangladesh, Nepal, and Pakistan, that many households (52%, 53%, and 36%) earn diversified sources, where no one source exceeds 75% of their total income.

**RNFE income has grown over the past several decades, illustrated here by India’s experience.** There is little systematic data over countries to show this; but individual country cases show this. I illustrate the point here with data from India. Lanjouw and Murgai (2009) show a shift, using NSSO rural household survey data over 1983 to 2004, in the share of total rural employment that is in nonfarm self-employment, going from 10.9 to 14.5%; for casual - wage RNFE, from 5.2 to 9.6%; for “regular RNFE” (salaried RNFE), from 6.4 to 7.3%. Summing these, they show the RNFE employment share from 22% to 31% over this period; note that this is “as full time;” recall the caveat above that this understates the share of this employment in income due to diversified incomes or non-specialization). By contrast, the share

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<sup>6</sup> Bangladesh, China, India, South Korea, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

of the “cultivator” as full time employment dropped from 38.4 to 31.9%, and farm wage labor earners, from 24.3 to 21.8%.

Kumar et al. (2011) show that from 1983 to 1994, 60% of rural job growth was from the farm sector; but from 1994 to 2005, 60% of rural job growth came from the RNFE sector. From 2004 to 2010, total rural employment dropped 5 million even while 13 million new RNFE jobs were added.

Corroborating RNFE’s growth in India from a macro perspective, Himanshu et al. (2011) show that from 1983 to 2004, the RNFE GDP grew 7.1% per year (with a jump from 6.4% per year in 1983-1993, and then 7.7% a year from 1993 to 2004); compare those rates with the agriculture GDP that grew 2.6% per year over those 20 years.

Himanshu (2011) also goes down to the micro level by showing data from a single village taken in some sense as representative, that of Palanpur, where from 1983 to 2008/9 the share of RNFE in total village income rose from 34% to 67%. These changes are similar to those shown in HHR, who review survey studies in India that average to show a change in the share of income from RNFE rising from 26% in 1968 to 36% in 1980 to 46% in 2000.

**RNFE employment in general is much more important to rural Asians than migration employment and farm wage labor.** In popular and also research discussion of “off-farm income” in Asia the assumption is that most comes from migration income and from farm wage labor income. This was shown for migration above.<sup>7</sup> For the case of farm wage labor, Davis et al. (2010), for Bangladesh, Nepal, and Pakistan, show that the share of rural income from farm wage labor is 20, 13, and 9%, respectively, while that of RNFE (wage and self-employment) income is 36%, 30%, and 40% for the three countries, respectively. The ratios of farm

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<sup>7</sup> There are some exceptions to that general finding that migration is much less important than migration income. On the one hand, there are some countries, or rather areas within some countries, where migration income outside the local area is an important share of income and employment. For example, in western and central China, income outside cropping can be a third to half of income, and of that non-cropping income, an important share can be from migration; but note that the literature shows that much of that is still “local” in the sense that it is within the local area around the village, within the province: roughly 40% of employment in migration is outside the local province, and 60% is local semi-migration, sometimes called commuting. The converse is also the case, illustrated by the situation in India; much (with estimates around 50-60%) of “rural” nonfarm employment is actually not in the rural areas per se but in commuting to local towns. This spatial aspect has been under-researched so these estimates are based on just a few studies. On the other hand, there are some countries where migration is important but is very concentrated in terms of participation (a small share of households migrate, but those that do earn a substantial amount of their income from that); this is the case in Bangladesh for example.

participation rates for RNFE versus farm wage labor employment for the three countries are 53/35, 52/38, and 58/20%.

**Rural income diversification (away from just dependence on grain income) from the rise in RNFE far exceeded such diversification from the shift from grains to horticulture and other non-grain cash crops.** Kumar et al. 2011 show that the shift in the share of (full time) employment in RNFE over 1983 to 2004 (from 19% to 32%) can be compared with the shift from 1.9 to 3.5% of employment in horticulture and 4.3 to 9.8% of employment from cash crops. Of course the same caveat as noted above comes into play, that these shares of full time or majority employment understate the shares of these categories in total income due to activity diversification.

**b) RNFE is bimodal - composed of low return (equivalent of subsistence cropping) and high return (poverty alleviating) activities.**

RNFE activities tend to be mainly services (commerce/transport, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR 2010). The activities are a mix of: (1) **casual wage employment** (for relatively low wage, sometimes often below or at the agricultural wage (as in Bangladesh) or modestly above the farm wage (as in India); (2) **salaried “regular” employment** (like a government employee like a rural teacher); (3) **self-employment** (such as owning/managing a micro/small enterprise making cheese).

**The casual wage jobs, and the self-employment jobs (although these vary markedly in returns) are typically relatively low return jobs, while the salaried employment (and some self-employment) are high return job.** It is important to note that the returns can differ very widely across these activities; for example, for Bangladesh, Hossain (1986) showed a long list of RNFE activities ranging from earnings of 4 taka/day to 27.5 taka/day.

**Low return activities typically have much lower entry requirements (in terms of physical, financial, and human capital) than high return activities. One tends to see a strong correlation between poorer households and diversification into low-return off-farm activities,** such as farm wage labor, low return self-employment, and casual wage RNFE (HHR, 2007). For example, for India, Lanjouw and Shariff (2004), echoed with later data by Lanjouw and Murgai (2009), show that households in the various income quintiles (ranging from 1146 to 11,226 rupees) have very different income diversification profiles: the lowest has 38% cropping, 28% farm wage labor, 16% casual RNFE, 11% self-employment RNFE (of the less remunerative kind), 4% salaried RNFE, for 32% of their income from RNFE (and 2% from remittances). The highest quintile had 65% cropping, a mere 2% from farm wage labor and another mere 2% from casual RNFE, but fully 15% for (fourth quintile and 8% for 5<sup>th</sup> quintile) in self-employment (of the more remunerative kind), and fully 21% in salaried RNFE, for a total share of RNFE of 39% for the fourth quintile and 31% for the richest quintile.

**c) Drivers: Push and Pull Factors (differing by dynamic and hinterland zones) and links to types of RNFE generated**



**An important reason for the discussion of the types of RNFE is that the growth of RNFE can be thought of as a mix of the proliferation of low-return RNFE analog to subsistence farming, more of a “refuge” activity (Elbers and Lanjouw, 2001) and the development of high-return RNFE that can alleviate poverty and also feed into investment funds for agriculture.**

**HHR (2007) note correlations: (1) between low-return RNFE activities and “un-favored” zones with low aggregate demand for goods and services from nonfarm sectors; and (2) between high-return RNFE activities and zones with high aggregate demand.** High demand for nonfarm products tends to be generated, as Engels Law would predict, from higher incomes and purchasing power, and from investable surplus to invest in nonfarm activity.

**There is some controversy over whether it is necessary for aggregate demand to come from agricultural development** (as Hossain 1988 and Hazell and Haggblade 1991 emphasize, in their analysis of consumption and production linkages from agriculture in Bangladesh and India), or income from nonfarm activity that developed based on an earlier round of agricultural development (HHR 2007) **or some other source of income, such as proximity to cities or highways between cities or towns (as we discuss below)** or some enclave such as a rural tourism complex, or even from large inflows of migration income.

**The converse is that zones with low aggregate demand can manifest low-return RNFE diffusion.** That low aggregate demand can be from poor agriculture without other sources of income (HHR), or growing agriculture in a zone with poor links to cities (such as shown for Bangladesh by Deichmann et al. 2009, discussed further below), or export markets so that the farmers cannot “realize” sufficient profit from the agricultural development; the most extreme case is where production causes a glut and a price decline. One can find then a paradox of a combination of growing or high level of RNFE (of the low return variety) and stagnant agricultural zones.

**This paradox can explain some findings in India that seem to contradict the “farm development is needed for RNFE development”:** (1) Foster and Rosenzweig (2003) found RNF growing fastest in zones with lower agricultural wages (presumably from weaker agricultural growth and thus derived demand for labor); Lanjouw and Murgai (2009) found that self-employment is greatest in zones with low agricultural productivity in India. (This is similar to findings in Latin America; see Elbers and Lanjouw 2001 and Reardon et al. 2001.)

Note however that even low return nonfarm wage employment can be higher than the farm wage (as Himanshu et al. 2011) note for India, so that the growth of that RNFE can increase farm wages, as Lanjouw and Murgai (2009) find.

**d) Spatiality: RNFE develops especially in proximity to cities and towns**

**This is a key point that links our discussion of urbanization and that of RNFE in Asia.**

Renkow (2007) analyzed conceptually the links between RNFE development clustering around cities and towns, and the presence of agglomeration economies from urban and rur-urban areas as a centripetal force of RNFE toward proximity to urban areas, and congestion diseconomies in urban areas as centrifugal forces to push NFE from cities into surrounding rural areas.

**There have been so far several empirical studies that have tested this hypothesis and confirmed it, showing RNFE clusters near cities/towns; this suggests that RNFE may grow with towns and thus urbanization in general.**

(1) For Nepal, Fafchamps and Shilpi (2003) found RNFE spatially concentrated around cities and towns – specifically within 4 hours of large towns and cities, and within 1 hour of the village/rural town market. They also found “von Thünen” patterns for crop production – with vegetable production concentrated within 1-3 hours of cities and towns, and commercial paddy within 3-5 hours. Paddy marketing and fertilizer use fell off very sharply or disappeared beyond 5 hours around cities and towns as one entered the deeper hinterland areas.

(2) For Bangladesh, Deichmann et al. (2008) found that in the areas near cities and towns, the RNFE share of rural incomes was 56%, versus only 41% in the hinterlands. The hinterland features RNFE of the low-return type, while RNFE near towns is higher-return wage and self-employment. Moreover, Deichmann et al. cross the analysis of effects of urban proximity and agricultural potential and find that high potential farm areas that are near to cities have a lot of high-return wage and self-employment RNFE – but that if the high potential farm area is far from the city (and thus aggregate demand sources and agglomeration economies), the share of high return RNFE is low and low return RNFE by far predominates, often just focused on local services; they note that 28% of the latter is at a return below even the low farm labor wage.

(3) For India, similar to Deichmann et al., Lanjouw and Murgai (2009) found that the urban share of the zone is correlated with a higher incidence of “regular RNFE” (high return wage employment) and self-employment, but not casual, low wage RNFE.

(4) For India, Hazell, Ramaswami, and Rajagopalan (1991) found that rural road density radiating from cities and towns heightens the production- and consumption-linkage effects (in creating RNFE) of agricultural development from the Green Revolution.

(5) An extension of the Hazell et al. (1991) findings about the effects of roads can be found in Bhalla’s (1997) finding that major highway “corridors” between big cities in India form magnets and nodes for RNFE development along and around them; in fact she showed that over decades, these infrastructural linear nodes draw RNFE such as small manufacturing from more hinterland areas, and increase the average size of the firm and increase thus the overall wage employment share in RNFE.

(6) Kumar et al. (2011) show for some states in India that fully 57% of the RNFE jobs are actually commuting and/or temporary local migration from more rural to rur-urban areas and rural towns to work.

**However, urbanization in/near rural areas can be a two-edged sword for RNFE: urban manufactures, produced for mass markets using large scale plants enjoying economies of scale, may compete with RNFE-supplied manufactures.** The cities and towns in rural areas, and the rural roads and inter-city highways are conduits from urban industry to rural areas of these products. This can challenge small scale rural manufacturing with both cost and quality and variety competition. An example is the large-scale food manufacturer in Indonesia, Indofood, selling basic processed food items through convenience store chains into rural towns into rural areas and crowding out cottage-industry goods (Reardon, Stamoulis, Pingali, 2007).

#### **e) Effects and Correlates of RNFE growth on Agriculture and Farm Labor Markets in South Asia: Hypotheses and Findings**

##### **e.1) RNFE (and other factors) drive up the farm wage (in turn inducing mechanization)**

**Farm wages have risen over the past three decades. With the Green Revolution, there was at first a period (in the 1970s) of farm employment increase but without wage increase as labor-intensive high yielding varieties diffused (Lipton with Longhurst, 1989), and then a period of moderate wage increase (with greatly varying rates over zones), and then evidence of acceleration in the past 5-10 years in various countries of a sharp upswing.** In India, Lanjouw and Murgai (2009) note that, in 1993 terms, farm wages doubled from 1983 to 2004/5. Gupta and Sidhartha (2011) note that farm wages rose quickly in the second half of the 2000s. These two India pieces emphasized that the wage growth rates differed markedly over zones. Zhang et al. (2011) note that farm wage rates grew steeply from 2003 on in China, and Zhang et al. (2013) note the same for Bangladesh in the late 2000s, in what they describe as evidence of a Lewis Turning Point.

**The studies in India, China, and Bangladesh note that farm wage growth was driven by: (1) RNFE and migration tightening the labor market; (2) farm productivity growth in some zones.**

**The rise of the farm wage has in turn spurred the spread of farm mechanization, even on small farms. We discuss this further below.**

**e.2) RNFE and migration remittances in turn appears to facilitate purchase of farm machines (such as Estudillo and Otsuka 1998 and Takahashi and Otsuka 2009 show for Luzon, Philippines in a panel study) and other lumpy investments that permit diversification (such as pumps for fish ponds or irrigation for fruit orchards).**

**e.3) RNFE and migration remittances are one way (beside labor- and capital-led intensification, discussed below) for farm households to continue to farm very small farms – as part time farmers (HHR 2007).**

## **6. Fifth Transformation: Farm Technology and Scale Change and Rise of Intermediate Factor Markets**

### **6.1. Farm Technology Intensification and Rise of Intermediate Factor Markets**

a) **In general** over Asia over the past three decades, there has been “intensification-cum-commercialization/diversification”: (1) farms have commercialized; (2) the agricultural sector has diversified (into non-grains, mirroring the diet diversification) while individual farms have specialized (into cropping, or livestock, poultry, aquaculture); (3) farms have shifted from non-purchased to purchased input use (from human to animal to machine power, from manure, byproducts, and residues to chemical fertilizer, and to use of more pesticides and herbicides) (Pingali and Rosegrant, 1995, as well as in analyses of the Green Revolution stages in Cassman and Pingali, 1995, Estudillo and Otsuka, 1998.) These changes occurred earliest and fastest in the “classical Green Revolution” zones, particularly lowland rice systems and irrigated wheat areas. It should be noted however that in these areas as early as the mid-1990s/early 2000s there were warnings that yield growth had begun to plateau despite this intensification (see Cassman and Pingali as well as Lipton (2000)).

**A second wave of this intensification-cum-commercialization occurred, also mainly still in rice and wheat and horticulture areas, in zones that in the 2000s were “catching up” with the initial Green Revolution zones;** this is depicted for example in recent studies in western and central Uttar Pradesh in India, northern Bangladesh, and northeast China in rice and potato (see Reardon et al. 2012a). There was another source of intensification with the development of horticulture in the 1990s-2000s (see for India, Joshi et al., 2004, and BIRTHAL et al. 2012).

b) **The increase over several decades of the farm wage (discussed above) drove a continuous rise in the use of farm machinery** – first for “power” replacement of human and animal power, for example in land preparation, and then “control” replacement for harvesting and weeding (with the latter also and especially addressed by the **rise of the use of herbicide**) (Pingali and Rosegrant 1995).

**RNFE (and thus urbanization, by extension, given our discuss above) appears to have two way effects with the increase in the use of farm machines.** On the one hand, **RNFE and migration remittances are associated with ownership of machines**, as RNFE provides cash to buy the machines (as credit for machine purchase is usually limited); Takahashi and Otsuka (2009) illustrate this in the case of Central Luzon in the Philippines over 1979 to 2003. On the other hand, **using farm machines also frees labor for both migration to cities and local RNFE**; a similar effect comes from using RNFE cash to replace home labor on farms with hired farm labor, as shown in Takahashi and Otsuka).

**Empirical studies find that RNFE is poorly correlated with use (rather than ownership) of farm machinery – mainly because of the existence of active rental markets for farm machines,** that appear to have grown quickly over time (for discussion of this in rice zones, see for example a study of the Philippines by Takahashi and Otsuka (2009), and for rice and potato in Bangladesh, China, and India, see Reardon et al. (2012a).

**Rental of farm machines has further developed recently with the spread of outsource-services of teams of labor with large harvesting machines in China that go from province to province harvesting rice** (see a study of a cluster of such operations based in Jiangsu, each serving hundreds of farmers spanning many provinces over months per year of harvesting, discussed in Yang et al. 2013). **This allows economies of scale on the machine side to small farmers (analogous to small farmers on the output market side to deal with post-harvest services that are increasing in scale – thus small farms wedged between consolidating and scale-increasing services on each side of them in the supply chain.**

**A similar arrangement in fruit farming in the unique analysis of “sprayer traders”** found by dela Cruz et al. (2010) on Luzon in the Philippines: teams of labor equipped with pruning and spraying and harvesting equipment service numerous small mango farms both in all the steps of production but also in harvesting and marketing the mangoes. Small farmers thus benefit from equipment expensive for them, labor supply concentrated and managed in one site in a timely way, as well as special skills and expertise of these teams.

**c) Beside the rise of the machinery purchase, rental, and outsourced services markets, there has been a rapid development of “intermediate factor markets” (Johnson et al. 2003) in Asia, such as those of chemical fertilizer and improved seeds, and in some cases private water markets.**

**The development of the supply side of these intermediate factor markets appears to have mirrored the development of output markets discussed in Reardon and Timmer (2012), with a first phase of “modernization” developed as a public sector action (such as the widespread construction of wholesale markets and public grain depots) and then a second phase of private sector (traditional and modern) development of output market facilities and services. In the input supply sector there is a parallelism:** in the 1960s-1980s Asian governments developed fertilizer and seed depots for subsidized input sales to Asian farmers; in the 1990s and 2000s these diminished in importance with a second phase of development of private sector (traditional and modern) input sales outlets. Our surveys showed that farmers in India, Bangladesh, and China source from very little to a minority of their external inputs from state outlets (see Reardon et al. 2012a). An exception is that pesticides/herbicides markets have traditionally mainly been private sector (traditional or modern) rather than state distribution systems.

**d) A very important point for this paper is that both the “capital-led intensification” (to use Lele and Stone’s 1989 phrase) noted above, and commercialization and diversification, have diffused very unevenly over Asian rural areas, as we emphasized for all the**

**transformations in the introduction to this paper.** The reasons for this unevenness meld with a discussion of drivers of the intensification cum mechanization, and we discuss them both in turn here.

**d.1) The most obvious unevenness comes from agroecological differentiation over zones, unmitigated by infrastructure** – for example, zones with low rainfall that have little irrigation (Rajasthan), or zones with high rainfall that have little drainage tiling (eastern Uttar Pradesh) are disadvantaged.

**Geography, performance, and potential are, however, not static, but rather are malleable:** in the past decade, the western area of Gujarat has shifted toward an intensive, multiple cropping grain area, and the eastern area, to a horticulture area, with the installation of large power grids that allowed a shift to extensive use of irrigation. Another example we can derive is comparing Lipton with Longhurst (1989) characterization of Madhya Pradesh as lagging the Punjab in the 1980s, with Reardon et al. (2012a,b) findings of rapid intensification in the western and central areas of MP in the 2000s.

**d.2) Areas well served by rural roads, and those closer to urban areas, have lower transaction costs of getting inputs, and higher use rates, as discussed above.** Striking findings of differences in external input use between hinterland and non-hinterland areas are found in the Fafchamps/Shilpi (2007) study on Nepal, and Reardon et al. (2012b) study in three states in India, comparing dynamic/connected and hinterland areas. There is however the methodological issue of controlling for agroecology when examining the impact of urban distance and rural road density; hinterland areas can often be mountainous or arid areas. That is why the study by Deichmann et al. (2011) in Bangladesh is particularly interesting for its crossing of distance to city with agroecological indices (in studying RNFE; this method needs more application to technology diffusion).

**e) Areas that are generating RNFE and migration remittances can also exhibit capital-led intensification.** This is a more complex and sometimes ambiguous relation. On the one hand, nonfarm income can generate cash to invest in farm machines and inputs, and even hired labor, as Takahashi and Otsuka (2009) illustrate; this may be even more marked in areas with credit constraints. On the other hand, in some areas nonfarm activity can be a substitute for intensification, relieving the need for it (including where agroecological conditions make it impractical) by diversifying income.

## **6.2. Farm Size Distribution Change – and its links to factor market and agricultural technology change**

**a) There is evidence of aggregate decline in farm size in Asian countries.** Eastwood et al. (2010) examined aggregate data from Bangladesh and India, China, India, and South Korea over 1950 to 1990, and found a gradual decline in average farm size.

**b) Asian farm sizes average small but nevertheless there is substantial variation over farm sizes.** Using data from the 1990s, Eastwood et al. show that: (1) South Asian farm sizes average 1.4 ha, with a Gini coefficient of 54%. 92% of the farms are under 2 ha, but fully 60% of the area under farming is of farms great than 2 ha; (2) in East Asia, the average is 1 ha, the Gini is 50%, 92% are under 2 ha, and nearly 40% of the land is of farms above 2 ha; (3) in Southeast Asia, the average is 1.8 ha, with a 60% Gini coefficient; while 57% of the farms are under 2 ha, only 77% of the land is of farms over 2 ha.

**In these figures I have deliberately emphasized three things: (1) the average farm size is indeed small; (2) but the Gini coefficients are fairly large; (3) and in South and Southeast Asia, 60% and 77% of the farmland is operated by farms over 2 ha. These broad findings open the door to exceptions that we have observed in recent field surveys in several countries – where the average farm size in the country is small, but in several study zones the average size is larger, and the share to medium and large farms is substantial.** I return to that below.

**c) The literature generally hypothesizes the following reasons for the persistence of small farms,** and even the average decline of farm size, in Asia:

(c.1) families are growing and divide up their land to sons (Eastwood et al.);

(c.2) land reform in India has been somewhat effective in the long term (Eastwood et al. 2010);

(c.3) RNFE (and remittances from migration) allows small farms to persist as they can be part time farmers (HHR 2007);

(c.4) labor-led and then capital-led intensification allows small farms to grow in productivity and compensate for land constraints;

(c.5) irrigation allows multiple cropping;

(c.6) high-value agricultural diversification such as into vegetables allows even small farms to be viable (Joshi et al. 2004);

(c.7) ability to outsource harvest, land preparation, and spraying-trading services by machine service providers allows small farmers to enjoy input side economies of scale (see above).

(c.8) Some countries, such as China, have had strictures on land transactions (Deininger and Jin 2009).

d) Here I illustrate the above trends with the case of India. The text table below shows both the average decline but paradoxically also the persistence (although with some aggregate decline) of the major farming role of medium/large farmers.

Text Table: Changes in the size and distribution of landholdings in India			
Farm category	1980-81	1991-92	2002-03
% share in holdings			
Small (LTE 2 ha)	75.3	80.6	86.0
Medium (2-4 ha)	14.2	12.0	9.0
Large (GT 4 ha)	10.5	7.4	5.0
Total (millions farmers)	71.0	93.5	101.3
NOTE % of medium/ large in farmers	24.7	19.4	14%
% share in area operated			
Small	28.1	34.3	43.5
Medium	23.6	24.1	22.5
Large	48.4	41.6	34.0
Total (millions ha)	118.6	125.1	107.7
NOTE share of medium + large in operated area	72%	65.7%	56.5%
% of rented-in area	7.18	8.52	6.5%
Average size of holding (ha)			
Small	0.62	0.57	0.53
Medium	2.77	2.69	2.66
Large	7.69	7.53	7.23
All holdings	1.67	1.34	1.06
Source: Government of India (2006)			

The table shows that: (a) the average landholding is declining; (b) the share of the medium and large farmers in total area is declining; (c) but the latter still farm the majority of land: 14% of farmers are medium/large, but farm 57% of the operated land.

e) **Is there any reason to believe that while the above picture over 20 years shows a farm size decline, that a 40 year long table might not map to a U curve of farm size? Or if this does not occur for the country or countries as aggregates, it may occur in substantial regions of countries?**

**While this section is speculative, I offer reasons for a hypothesis that average land size may indeed climb in at least some areas of Asia, even South Asia, over the next two decades.**

e.1) Recent survey evidence in “dynamic zones” of intensifying and diversifying farming, near to cities, shows average farm sizes are higher than average, and rental rates are high



and growing fast. An example of this is in Western and Central Uttar Pradesh (even controlling for Punjabi settlement areas in those zones); see Reardon et al. (2012a) and vegetable areas in West Java (Natawidjaja et al. 2007). Small farmers in these areas are selling or renting out part or all of their grain farms to larger grain farmers or large vegetable or fruit farmers, and then relying on RNFE and migration labor markets. I surmise that as urbanization proceeds, and provides more spillover effects of RNFE development, strong product market development, and migration opportunities, this apparent concentration process will continue in these dynamic areas.

e.2) The above could be accelerated as cost side pressures (such as on energy and water) and demand side pressures (for product quality) affect the viability of at least the marginal farms. Reardon et al. (2012a,b) found in India distinct differences between marginal farms, and small and medium farms in these zones.

e.3) Gradually regulations restricting land transactions will ease, for example in China; this is extrapolating from the gradual but steady reductions in limitation to rent land (Deininger and Jin 2009) and recent experiments in land titling for sale in some parts of China.

e.4) Agribusiness investments in tracts of land (such as FDI in farm land in Cambodia or Lao PDR, or purchase or rental of large tracts of land by domestic agribusinesses such as the Reliance mango plantations in India, or the “long lease of township farmland” by agribusinesses in China) could increase and lead to concentration of land in some areas.

e.5) Food industry and agribusiness sectors are consolidating in Asia. I have noted above that, outside of land investments, this upstream and downstream consolidation does not necessarily imply pressure for consolidation in the farm sector. Agricultural services like mechanization services can lower costs to small farms; processors and supermarkets can implement hub and spoke models to source from small farms via collection centers and specialized wholesalers, or they can rely for some time on the wholesale markets. The way that consolidation downstream can eventually put pressure on farm sector consolidation may be through a combination of forces that led to farm concentration in traditionally small-scale farm sectors like poultry or pig or fish operations in developed countries. The pressures can be to cut costs in ways that eventually just using own labor cannot support, and farm equipment investments are needed, and even more plausibly, that pressure to augment product safety and quality may come from the consolidated downstream firms. One can see this pressure already in the dairy and pig sectors in China, and the fish sector in Bangladesh.

e.6) The mechanization trends displacing farm labor, and the convergence of use rates of chemicals and improved seed, may reduce yield advantages that smaller farmers have in some places. Already, in the intensified agriculture zones we have studied in India, China, and Bangladesh, there is little yield difference over farm size strata.

e.7) There is some evidence of concentration of RNFE, as capital requirements for viable businesses increase under competition from urban areas. This concentration in the labor market may translate into concentration forces in the land market. (This point was argued in Africa by Reardon et al. 2000.)

f) However, that there does indeed appear to be evidence of a “poverty trap” below a certain land threshold, such as we see in our India field surveys, below 1 ha, and in certain poor agroecological and hinterland areas. These traps may not be amenable in the longer run to any of the possible land concentration forces noted and may fragment further.

## **7. Implications for Asian Agricultural Research and Development Strategies of the above 5 inter-linked transformations**

The paper has emphasized that the agrifood sector of Asia is undergoing rapid transformation. The change is so rapid because there are five mutually reinforcing and encouraging transformations occurring at once. I have shown the connections among them in all directions.

Moreover, the paper has emphasized that while a significant part of the transformation is driven by the “private sector”, popularly thought to mean the large and multinational players in the food business, in fact a very large part of the transformation has been due to private domestic investments by small and medium firms and farms in the traditional systems. The state has played a role at the margin in the recent decades, having played an initiating and formative role in the transformation before that.

Finally, the paper has emphasized the extreme differentiation over countries and over zones within countries, pointing to the existence of 3 rural Asia's. (1) The rural Asia zones that are transforming fastest and with the least external needs and help are the dynamic zones around the cities and towns, a substantial part of rural Asia. Capital-led intensification and RNFE development often develop in these zones and complement each other to spur growth. (2) On the other extreme is the most hinterland zone, where agriculture is poor, infrastructure is poor, and aggregate demand is low, leading to RNFE being mainly low return and subsistence. This is the zone with the most need, but also unfortunately appears to be in line for a long period of lagging, and export of labor and perhaps acquisition by large firms for land extensive operations. (3) In between is a substantial area in Asia that has “high potential but low performance”. This area was perfectly identified in the Deichmann et al. study in Bangladesh as having strong agricultural potential but being relatively far from cities.

I have called these latter, “intermediate zones” “the missing middle” in my prior work in Africa. It appears that these zones have the highest promise for return to research and development efforts to promote sustainable capital-led intensification, RNFE, and at the same time to build the infrastructural base to connect to sources of demand, mainly in the growing cities and towns, even rur-urban areas.

I have also emphasized that while there is a small farm domination in numbers, this disguises two trends of strategic importance. The first is that there is substantial heterogeneity in the farm population, with marginal farmers, and asset poor small farmers (as compared with small farmers) least sharing in the benefits of the transformation. The second is that small-medium and medium farmers dominate output supply, and may in the longer run set the cost and quality competition bar for the smaller and poorer farmers to meet, and be challenged by.

The above points imply the need for differentiated strategies for the geographic and socioeconomic strata.

A final set of points focus on the need for research and development strategies to help the farm areas of Asia to meet demand trends. The overwhelming fact is that the urban food economy is already the majority of food demand in Asia, and in several decades, will be the vast majority of demand. That means that meeting urban demand, and developing the rural-urban supply chains to do so, will be of major importance. This will mean more research and development on post-farmgate segments of the supply chain – processing, logistics/distribution, and retail.

Moreover, the nature of that demand is shifting gradually and steadily toward non-grains for the majority of food needs. Much more focus will need to be made on horticulture, aquaculture, meat, oilseeds, dairy, and feedgrains. There will also need to be more focus on attributes beyond yields (even as yields continue to be important for overall food costs): quality attributes for modern markets, food safety, and ability to withstand climate shocks.

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# Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies

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A Foresight Study of the Independent  
Science and Partnership Council

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Thomas Reardon

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# **Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies**

**Thomas Reardon**

**March 2013<sup>1</sup>**

## **1. Introduction**

“Five interlinked transformations” of the agrifood system are occurring rapidly in Asia: (1) urbanization; (2) diet change; (3) food market transformation, (4) rural factor market transformation, (5) agricultural technology and farm scale (land size) change. The changes are linked in mutually causal ways in all directions – so that we are witnessing the transformation of an integrated system rather than piecemeal, independent changes. This makes the transformation more powerful, more rapid, and more complicated in its impacts and implications for agricultural research strategies.

The transformations are occurring in waves over developing regions and countries within the regions over the past decades, and between types of zones inside the countries. Hence, East Asia (outside Japan) started these transformations earliest, with some of the parts of the set of five transformations starting earlier than other parts there. The second in line was much of Southeast Asia. The third in line were the transition countries, in particular China and Vietnam. The fourth in line were the South Asian countries and recently the Southeast Asian countries that had not been in the second wave. Within each of these regions, there are further waves by countries, such as India initiating the integrated set of transformations earlier than Nepal.

Finally, and a major focus in this paper, is that the transformations are highly correlated with the type of zone – whether: (1) “dynamic, commercial zones” in the 8-10 hour market catchment areas of large and medium cities (and within zones, around towns); (2) “intermediate zones” that are in the pathway, over time, of urban centers’ economic “pull” of supply from rural areas, and that are relatively medium-high potential in agroclimatic terms, but in a situation of medium to under-realization of potential in terms of current performance; and (3) hinterland, traditional,

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semi-subsistence zones” further from cities and in more remote and agroclimatically unfavored areas.

This paper focuses on emerging evidence from surveys and broad trend information of the inter-related five transformations, examined in turn. South Asia is the focus of the paper per the terms of reference for this conference contribution, but to a minimum extent the paper is set in a comparative context with the rest of Asia. Indeed, the underlying trend appears to be that there is a “moving average” where like types of zones are transforming, at various paces, in ways that move them toward convergence with “lead geese” that earlier flew that path. The paper ends with an initial assessment of implications for agricultural development strategies for the different types of zones and farmer strata, countries, and regions.

## **2. First transformation: Urbanization and Rur-urbanization: Patterns, Determinants, Effects**

a) **There is rapid aggregate urbanization occurring in Asia.** Estimates of the urban share by Asian Development Bank show a 60% urban share in population by 2025, from only 20% in 1960 (James et al. 2008); estimates by the United Nations (2011) show Asia is at an urban share of 45% by 2011, and estimate that that share will rise to 56% by 2030 and 64% by 2050; they also estimate that the Asian rural population rose from 1.63 billion in 1970 to 2.31 in 2011, but then will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050.

### **b) Fast Urbanization countries in East and Southeast Asia, but Constrained urbanization countries in South Asia**

In 1960, 1990, and 2005, India had an urban population share of 18%, 26%, and 29%; in China those figures were 16%, 27, and 40%; in Indonesia, 15%, 31, and 48%.<sup>2</sup> Both China and Indonesia look to be on the “urbanization take-off” path of earlier fast-developers, for example South Korea; South Korea in 1960 had (at 28%) an urban share like India today or India in 1990, or China in 1990; by 1970 South Korea had 41% (like China today), and then South Korea rose quickly to 74% in 1990 and 81% by 2005. South Korea achieved a shift in urban share in 20 years that it took 90 years for the US to achieve.

The figures above show India as on a “slow urbanization path,” compared to other large and medium countries in East and Southeast Asia. McKinsey (Ablett et al. 2007) has made the assumption that the slow urbanization will continue in India, as it projects that India will still only have a 37% urbanization rate by 2025 – not even to China’s rate today. This rate of growth in the urban share has been modest. Of course, the absolute increase and current urban population are large: India’s urban population grew six-fold from 1948 to 2001 (Mathur 2005); the urban population in 2006 was 318 million, the size of the US, and by 2025, is projected to be 523 million, larger than the 2008 EU population.

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<sup>2</sup> For urbanization rates, see [www.nationmaster.com](http://www.nationmaster.com).

The question of “why has India’s urbanization been so slow” has been a keen point of debate among demographers and urban sociologists and economists for the past half century. While there is some consensus around why urbanization was slow from 1900 to 1950 (slow economic growth and disruptions), the juxtaposition of rapid industrialization and slow urbanization in the decade of the 1950s and 1960s and again in the 1990s and 2000s has puzzled urban experts in those decades. Several points have dominated the debate, leading us to believe that India’s urbanization process is already faster than is officially stated, and will be faster in the future than in the past.

First, there has been criticism of the criteria used in the censuses to classify areas as urban or rural and thus create an under-estimate of the urban share (Bose 1974). Moreover, in 2001 the number of “villages” (ranked as rural) with more than 10,000 inhabitants surpassed in 2001 for the first time (in the census) the number of official “towns” and “urban areas” having greater than 10,000 population. It is posited that if these large villages that are the size of (officially urban) towns were reclassified (as many do not want to do because of tax advantages of continuing as “rural”), there would be a significant jump in the statistical share of urban in India population (Marius-Gnanou and F. Moriconi-Ebrard, 2007).

Second, the debate has noted that urbanization in India was, in the 1960s-1980s, highly “large city” centric, and that the high rates of unemployment in those cities discouraged rural urban migration, but that towns and medium cities did not have the economic base to grow quickly in the 1960s/1970s (Bose 1974). This point was revived in the 2000s, linked to persistent poor infrastructure, poverty, and absorptive capacity of large cities in India (Mathur 2005).

However, starting in the 1980s and into the 1990s and 2000s the secondary and tertiary cities have “taken off” (especially in the economically dynamic states, see the next point) and led to an increase in urbanization. There are 5,161 cities and towns in India as of the 2001 census. There is no standard categorization of these, but typically used is a four-way taxonomy, of Tier 1, 2, 3, and 4 cities. McKinsey uses a classification with a cutoff of 4 million or more population for Tier 1 cities (e.g., Mumbai, Delhi), Tier 2 cities (26 cities with greater than 1 million and less than 4 million, such as Surat or Indore), Tier 3 cities with more than 500,000 population and less than 1 million (such as Amritsar or Goa), and Tier 4, or small towns. In this set, there is relative concentration: Tiers 1 and 2 have 44% of the urban population. But the trend now is toward relative rapid development of the Tier 2 and 3 cities. Moreover, the middle class is spread over the city categories: two-thirds of the middle class is outside of tier 1 cities, and tier 3 cities have as many middle class as tier 2, and a number of tier 3 cities have higher average incomes than tier 2 cities and even some tier 1 cities. There is, however, a greater average household income comparing the first three tiers and the fourth tier (Weinstein, 1991, Bhalla, 1997, New York Times, 2007, and Ablett et al. 2007).

Third, as there is extreme heterogeneity of economic performance and growth rates over India’s states, there is in turn great heterogeneity over states of urbanization rates; thus, the major Indian states that have grown rapidly have urbanization rates in excess of 40% (like China), and those with lagging growth rates have far lower urbanization rates (Mathur, 2005). In turn, urban

growth is in part conditioned by rural growth; hence, for example, in one of the states with the most dynamic agriculture (Punjab), one also finds among the fastest urbanization with growth of Tier 2 and Tier 3 cities, noted above.

c) **Measuring urban population growth alone understates urbanization's importance to the overall food economy from the demand side - because the urban areas share in the total food economy exceeds its share in population.** I have roughly estimated (using figures for urban share, propensity to consume food from income, and income disparities between rural and urban areas) that already half to two-thirds of the food economy in Asia is urban, in the sense of the share of the value of total food consumed in the countries. Typically, the total food expenditure per person in urban areas is greater than that of rural areas (for example in India in 1999 it was 42% higher, Dev et al. 2004), and thus the population share of urban areas understates the share of urban areas in the total value of food consumed in the country. An example of that kind of reasoning has been done for India for all consumption: Ablett et al. (2007) note that by 2006, while 29% of population is in cities, 43% of overall consumption is in cities (given higher average incomes than in rural areas). They project this share to be 62% by 2025.

d) **Urbanization of population per se understates the role of urban areas in the overall food economy from the supply side - as half to two-thirds of the food supply chain "value added" is off-farm (in wholesale and retail, in mills, in cold storage), much of it clusters in towns and cities in Asia especially in the dynamic zones. There appears to be "rur-urbanization" of the food supply chains in Asia.** Moreover, towns, as nodal points of rural road networks, inter-urban highway and rail interfaces, and electricity-endowed platforms, serve as the staging grounds for clusters of services that are crucial to agricultural development in surrounding rural areas. For example, Rashid et al. (2012) analyze clusters of fish/shrimp related enterprises in towns and secondary cities in Bangladesh, involving nodes of numerous feed mills, hatcheries, nurseries, traders, processors, ice makers, repair shops, and so on.

e) An extension of the above is that **urban population growth as an aggregate concept underplays the effect of urban areas on rural areas depending on the proximity or density of urban areas** (proximity of one city to another, even with rural areas intervening between them) **and the development of rural infrastructure, particularly roads and rails, connecting the cities.** South Asia and China, much of Southeast Asia both on the mainland and on the main islands of archipelagic countries, is peppered densely with cities so that rural areas are constantly close to cities in most zones where most of the rural population resides.

The latter effect is presumably magnified by the **huge investments in rural infrastructure and rural-urban links**, particularly roads and rail made by Asian governments in the past 1-2 decades. For example, over 1991 to 2005, road density increased rapidly in South Asia, per the following annual growth rates: Bangladesh, 4.4%; India, 4.6%; Nepal, 12.6%, and Pakistan, 3.8% (ADB, 2012). In the next section we also examine the massive investments in wholesale market infrastructure that Asian governments have made.

An important variation on the above theme is the development of **highway corridors between cities**. Bhalla (1981; 1997) analyzed the development of rural nonfarm enterprises and employment along major highways connecting large cities in India, sources of derived demand for services and products; she found what we can call “internal coastlines” to be very intense areas of nonfarm development, often involving attracting enterprises from villages well away from the highway.

f) **Urbanization per se abstracts from the “type of city” – that is whether its growth is linked or not to the surrounding rural area.** This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007, who makes this link). On the one hand, the urban area may have developed either as an emanation from those linkages, such as in the case of the growth of towns and cities in Shandong or West Java, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as a relative enclave *vis* the surrounding rural area (like resort based towns on the coast of Cambodia, or mining towns in hinterland agricultural areas. In the latter case, urbanization per se may have little effect for the local agricultural area.

g) **Hypotheses concerning general impacts of urbanization on rural areas include:**

g.1.) De facto “de-protection” of rural areas as part of general transaction cost reduction; thus also creating dynamic areas linked to the cities;

g.2.) Facilitation in towns and secondary cities of various clusters and agglomeration of services crucial to capital-led intensification of agriculture, which can also help the survival of small farms.

g.3) Facilitation of development of rural nonfarm activity (and short-distance commuting migration) which in turn affects technology and farm size as discussed below.

g.4) Facilitation of the transformation of food supply chains and agricultural diversification, discussed below.

### **3. Second transformation: Diet Change in Asia**

a) **Income increases (via “Bennett’s Law, Bennett, 1954) and lifestyle changes accompanying urbanization that increase the opportunity cost of women’s time, lead to changes in product composition of demand.**

**These include an increase in the level and shares of: (1) non-grains (meat, fish, dairy, edible oils, fruit, vegetables), with derived demand for feed-grain for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home.** There is abundant evidence that these shifts are occurring in Asia (Pingali 2007; Timmer 2013).

**The corollary is that the share and in some cases the level of cereals consumption is declining.** For the India case, the Government of India (2010) shows that the share of cereal consumption in the urban food basket has declined from 36% in 1972 to 23% in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32%. Weighting by urban and rural population (thus abstracting from income differences), Reardon and Minten (2012) find that roughly 29% of India's food economy was in cereals in 2006, versus roughly 52% in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins.

India appears to be going along a diet change continuum that has further expression in the Southeast Asia case, such as in Indonesia, for which Timmer (2013) shows that by 2011 only 10 percent of the food budget goes to rice (on average—it is higher for the poor), so 90 percent of the food budget is spent on other commodities and value added from processing and convenience.

**The same changes take place in rural areas of Asia, but typically just less fast and far.** This manifests itself in cross section: Ahmed (2013) shows a decline in the share of rice as a share of total energy intake as a function of income strata in the poorest zones of rural Bangladesh. It also manifests itself over time: This was noted above for the case of cereals in rural India; moreover, Timmer (2013) shows a decline in rice consumption per capita in all but the lowest quintile in rural areas of Indonesia over the past two decades. The decline is slower than in urban areas, but still significant.

**The converse of the above point is that the consumption of non-grains is growing faster and/or further in urban areas than in rural areas.** In India for instance, Dev et al. (2004) show, in constant 1999/2000 rupees, in rupees per capita per month, that: (1) cereals in rural areas dropped from 137 to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; (5) Overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410.

b) **Rice is still important in Asia.** Rice is currently and traditionally important in the food consumption basket of Asian countries. For example, nearly all the food grain consumed in Bangladesh was rice, and rice comprised about half the food grain consumed in China and India. However, there are differences between rural and urban areas. For example, in China, in 2004, urban residents consumed 51 kilograms (kg) of rice per capita, while rural residents consumed 93 kg.

c) **However... rice consumption is in a gradual, absolute decline in Asia.** The importance of rice as a share in the diet of most Asian consumers has been declining during the past several decades, as analyzed by Timmer and Dawe (2010). The share of rice in calories for all Asian

countries in the FAO's food balance data sheets was at its highest in 1970 in the midst of the Green Revolution, at 38.2%, and then trended down to 29.3% by 2007 (FAOSTAT 2012). The shift has been marked in China, for example, from rice being 38.7% of calories in 1970 to 26.8% in 2007) and Bangladesh (from 75.1% in 1970 to 69.8% in 2007), Indonesia, from 58% in 1961 to 47% in 2009, and India, from 32.4% in 1970 to 29.9% in 2007. The downward drift was very slow until 1990 and then much faster (as Asian incomes increased) (Timmer and Dawe 2010, and Timmer 2013).

**By 2007, only 30% of calories in Asian consumers' diets came from rice (comprising 5% of their food budget in money terms).** The calories from rice changed in the PRC (from a low of 444 in 1961 to a high of 872 in 1990, then dropped to 799 by 2007) and India (from a low in the 600s in the 1960s–1970s to a high of 781 in 1990, then dropped to 703 in 2007). The calories from rice rose slightly in Bangladesh in absolute terms (from a high in the 1,500s in the 1960s–1970s, down to 1,311 in 1980 and 1,473 in 1990, and up to 1,591 in 2007), as Bangladesh rode through the Green Revolution, a prolonged crisis, and a long recovery.

Timmer and Dawe (2010) noted that the decline had accelerated in the last decade, and should be expected to continue for some time because (1) the income elasticity of rice demand is falling over time; (2) as rural-to-urban migration occurs and incomes rise, the elasticity trends downward; and (3) the income elasticity is lower in urban than in rural areas and among richer than poorer consumers. This general decline of course disguises heterogeneity among age groups, regions within countries, and across the economies themselves, but the overall trend is clear.

**d) But there has been a rise in wheat consumption – and wheat imports.** Wheat is still minor in most Asian countries compared with rice (except in India and China). But the rise of wheat from a low base to a significant presence in consumption is especially marked in Southeast Asia, as Timmer (2013) shows: from 1 million metric tons of imports of wheat in 1961 to 13 million tons by 2010; wheat was 2.8% of the level of rice consumption in 1961, and by 2009 was up to 11.5%. Senauer et al. (1986) documented the early stages of this rise of wheat in Sri Lanka in the 1980s. In both cases, the rise of wheat brought increases in imports as Sri Lanka and Southeast Asian countries do not produce them significantly. By contrast, wheat consumption in China and India are important but they are also major producers of wheat and imports are minor. Of course, some countries like Bangladesh are still focused on rice and the imports of wheat are minor.

**e) Note that the current changes in cereal consumption (secular decline of rice, rise of wheat) and tuber consumption (rapid decline of sweet potatoes, rise of white potatoes) are not the first time consumption composition changes have taken place. In the 1960's through 1980s, as a rough approximation, there was a decline in coarse grains, especially millet and sorghum, in India (ICRISAT 1982) – displaced by the rise of rice and wheat and somewhat maize (as it was doing in Africa at the same time, see Reardon 1993).**

**f) Diet patterns are malleable in Asia, with “traditional food culture” appearing to be only moderately constraining of shifts.** Several points stand out.



**f.1) Many non-traditional food products have quickly become “traditional” and widely diffused in Asia.** (1) Central/South America’s products (potatoes, tomatoes, chili peppers, sweet corn, pineapple, papaya) have become leading produce items in Asia (potatoes are the leading vegetable in India, Bangladesh, China, Indonesia - all places they are utterly non-traditional and recent). (2) Shifts from Africa to Asia also are common: sorghum and millet (ICRISAT 1982) were introduced into India from Africa and highly diffused into large tracts of India where only recently (mainly in the past half century) did rice and wheat (and pulses) enter and displace those “traditional” crops. Oil-palms were brought to Southeast Asia from Nigeria in 1961, to become major crop in Southeast Asia and major edible oil in much of Asia. (3) Dairy, non-traditional in the great majority of East/Southeast Asia (except in the far north in the grasslands such as in Inner Mongolia or Mongolia), emerged as a significant sector in many countries of the region in only the past few decades.

**f.2) Traditionally “vegetarian” areas, such as the (mainly-Hindu) India and (mainly Buddhist) Southeast Asia have rapidly growing fish, poultry, and even red meat consumption.** For example, 31% of Indians are strict vegetarians, and thus in a sense may be “structurally constrained” in diet habits, but the working hypothesis is that many of the rest will increase at least fish and poultry consumption as incomes grow.

**f.3) New forms of consumption and buying** (in processed form, from away-from-home sources, and from modern retail or fast food chains, as discussed further below) **also have spread very quickly**, even though these are highly non-traditional (just as they were in the “West” only 50-80 years before);

**f.4) There has been a proliferation of grain and potato varieties amenable to longer storage, easier processing, and long-distance shipment**, such as in the case of potatoes in India (Reardon et al. 2012a).

**g) Shift toward more consumption of non-grain foods and more processed foods is conditioned by supply side factors that vary a lot over time, over countries, and over product types – but factors that in Asia in the past 20 years have been very amenable to the shift, as follows.**

**g.1) One such supply side factor is in general NOT imports – imports are not driving diet change. Imports as a source of food are minor as a share of total food consumed. Exceptions are the rise of wheat imports, although even that is a tiny share of total food, and of soy imports for livestock production.** Asia’s situation of near full self-sufficiency in food (measured merely as the share of domestic production in total food consumption) is in contrast to a greater dependence on imports that has been more important in for example Africa (for West Africa for the issue of growing cereal imports especially of cereals not produced in the region, see Reardon 1993). For more on this subject for Southeast Asia, see Timmer (2013).

g.2) **Domestic farm side supply of nongrains is rapidly increasing: farmers are undertaking agricultural diversification** toward fruits, vegetables, fish, meat, and dairy has been proceeding apace in Asian countries, such as noted in Pingali (2006) for a number of Asian countries, Joshi et al. (2004) for all South Asian countries, and Birthal et al. (2012) for India.

Rao et al. (2006) note for India that there is a **strong correlation between agricultural diversification on the one hand, and the urban share and road and population density of the district in India**; urbanization and infrastructure development have thus encouraged that diversification over the past several decades. There have been large investments in irrigation in horticultural areas such as in Gujarat in India and Comilla in Bangladesh, and in fish and shrimp ponds in Bangladesh (Rashid et al. 2012), Indonesia (Yi et al. 2012), India, and China. There have been massive investments by farmers in inexpensive clay greenhouses in Shandong (Wang et al. 2012).

g.3) **Domestic supply chain development after the farm-gate is facilitating the supply of non-grain products to Asian cities. Supply chain actors (off-farm) have invested enormous sums in the aggregate in rural-urban supply chains for non-grain products: storage, packing, logistics/shipping, and commercial services.** The emerging evidence is abundant concerning the rapid development of these services in Asia, both in the modern large-scale sector and in the informal, small-scale sector. Examples include the very rapid emergence especially in the 2000s of potato cold storage facilities in western Uttar Pradesh (to serve the Delhi market, where fully two-thirds of potato consumption is now from cold storages in nearby production areas) (Reardon et al. 2012a) and even in poor areas of Bihar (Minten et al. 2011). There has also been a rapid emergence of cold storage and logistics companies that operate increasingly pan-India; part of this has been from FDI from Japan and the US and others (Reardon and Minten 2012). Domestic and multinational packaging companies are also important to this trend. For example, the Swedish multinational Tetrapak, so important in dairy packaging that spurred dairy sector development in Latin America in the 1980s/1990s (see Farina et al. 2005) is making large investments in a number of Asian countries for milk and juice packaging in the 2000s.

g.4) **The growth of non-grain supply chains (as well as grain supply chains) has hastened and been facilitated by intra-country (inter-region) market integration as cities across a given country demand similar products** (northern India, before a wheat consumer (and before that a sorghum and millet consumer) starts demanding more rice, southern India and southern China demand more potatoes (produced in the mountain/hills and northern areas of the countries); fish is marketed over regions in Bangladesh, from the pond-strewn and river-laced south to the drier north; japonica rice is shipped increasingly from northern China into southern China even as the consumption of indica rice wanes).

**Probably over time food market integration and development of pan-region supply chains will be and is being hastened and facilitated by the spread of fast food chains in urban areas:** Northern India cuisine has spread by this vector to Southern India, and vice versa; as has the consumption of French fries (see Scott and Suarez (2012) for latter in China). This is similar to what happened in the US.

**h) Quality demanded of farmers and by consumers increases also with urbanization, in several ways:**

**h.1) Demand does not only differentiate over broad categories – but within categories over niches, commodities, and differentiated products which create new series of niches which are then commoditized, as in the “product cycle”.** This is a cycle of cost then quality competition, cost then quality competition, and so on. A good example of this is the kiwi fruit: it started as a wild/local niche fruit in China, then moved to commoditized phase after introduction into New Zealand (and Italy and California and others) to then commoditize in China too; the kiwi was then differentiated into various varieties (such as golden kiwi) as part of the third phase of the cycle, product differentiation, “climbing the value ladder.” This same process can be seen in the fish sector in Bangladesh (Rashid et al. 2012).

**The product cycle often manifests itself in geographical differentiation over the phases.** For example, land shifts from rice into commodity vegetables near Jakarta in the early 1990s; by the late 1990s, the commodity vegetable production had shifted to cheaper land and labor areas in West Java (and shipped back to Jakarta), while the vegetable areas near Jakarta had started to enter the product differentiation phase, for the local market and for emerging supermarkets. By the mid/late 2000s, the areas near Jakarta (with much higher land and labor costs by then) started to shift to export vegetables and high end products such as hydroponic vegetables, and “supermarket” quality vegetables had shifted to West Java, and commodity vegetables such as bulk potatoes and cabbage started to shift to cheap land areas in Sumatra. There are many similar cases in various parts of Asia (and elsewhere).

**h.2) Food safety is gradually introduced as a requirement, especially for fresh produce and dairy and meat products.** This tends to be first introduced for export markets, for situations where public and private standards are introduced, and for high-end supermarket chains, and in the wake of crises such as the melamine crisis in China or the bird flu crisis in various countries of Asia. An example of a regulatory initiative is China’s first comprehensive Food Safety Law of 2009.

**h.3) Branding cum quality differentiation of products is also gradually being introduced.** In our study of rice in China, India, and Bangladesh, it was particularly in China where mill branding and packaging has developed rapidly recently (Reardon et al. 2012a). In Bangladesh, there has been a differentiation of rice quality over the past decade (with the price premiums mainly captured by millers and traders), see Minten et al.

2013a, and incipient branding in fruit value chains in India, even originating in poor zones like Bihar (Minten et al. 2013b). **I surmise that in Asia over the next decade, the rise of branding (especially by large and medium food companies) will go hand in hand with the rise of consciousness of and public concern about food safety – as it did in the first half of the 1900s in the US** (see Levenstein 2013).

h.4) **There has also been a shift in some cases toward varieties that can ship further or have longer shelf life (such as potato varieties in India, see Reardon et al. 2012a), that are easier to mill, and so on.** That is, varietal development and transformation of the food system are sometimes linked.

i) **Hypotheses concerning general implications for rural areas of urbanization *cum* diet change:**

i.1) **inducement for diversification of agriculture from grains to non-grains, and from commodity grain to differentiated quality grains.**

i.2) **inducement to shift the product and variety mix in agricultural zones as part of product differentiation and the product cycle** (for example, the rise of horticulture in the market-catchment areas of large cities in India and Bangladesh, such as found by Rao et al. 2006).

#### **4. Third Transformation: Food System Transformation in Asia**

The food system (a general term for food supply chains and markets) transformation is taking place along several lines in Asia. Here we will focus on the transformation of the “post-farmgate” segments of the supply chain: wholesale/brokerage/logistics/cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are formed in these segments).

The transformation of the post farmgate segments is intimately connected with urbanization both in terms of the drivers being especially in urban areas, because the majority of the food supply chain in Asia is from rural to urban, and because many of the post-farmgate activities are in towns and secondary cities and primary cities.

In this section I briefly review key evidence on the food system transformation in Asia, drawing from Reardon and Timmer (2012), Reardon et al. (2012abc), and Reardon et al. (2009) which in turn contain reviews of the detailed evidence and literature, much of which was formed in the 2000s.

**A first important qualifier** to the discussion is that the **transformation of food systems in the Asia mega-region took and takes place unevenly – a) in spatial terms**, spreading in waves over regions, sub-regions, countries, and within countries, over tiers of urban areas, and over dynamic versus hinterland rural zones, **and b) in product terms**, happening earliest and fastest

in processed, then semi-processed, then fresh/raw products. Thus, countries like India, and a few years ago, China, are in the earlier phases of transformation, doing them very fast, but doing them with a lag after earlier sets of transformations took place in parts of Southeast Asia like Thailand or Northeast Asia like South Korea, and of course all lagged compared to the “lead goose” both in early industrialization and in food system transformation, developed Japan. The food system transformation is thus broadly correlated with the path of overall economic development, but mediated and conditioned by policy processes that delay or constrain various processes, such as for example retail FDI liberalization that occurred early in Southeast Asia, recently in China, and only a few months ago in India.

**Despite the heterogeneity** of distribution of these conditioners of transformation – over products, over firms, over countries, over regions, over time – and the consequent unevenness in the diffusion of transformation - **there is still surprising regularity and timing of “waves” of diffusion**, which occurred geographically (over countries and within countries, over income classes, and over products), for all the three agrifood industry segments.

**A second important qualifier is that there has been a dual-revolution in food, comprising –**

a) a **“modern revolution” - large scale, largely retail and second-stage processing sector focused transformation, with an important component of FDI** (Reardon and Timmer 2007);

b) a **“Quiet Revolution” – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services – in its great majority domestic capital based** (Reardon et al. 2012a).

Throughout the discussion below of the food system transformation, I have as under-pinning points the above qualifiers concerning the above heterogeneity and duality of the transformation. The key findings concerning the transformation are as follows.

a) **Reardon and Timmer (2007) emphasize that there have been two “broad phases” of agrifood industry transformation over the past 50 years: “pre-liberalization/pre-globalization” (mainly 1960s- mid 1980s) and “liberalization/ globalization” (mainly mid-1980s to now).** Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or later in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

b) **Overlaying the above two broad phases are a series of waves of transformation of food systems. The waves are as follows.**

b.1) **The first wave** tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, **East Asia outside China** (and Japan, which I exclude from this discussion as being already developed). The start of wholesale sector transformation (with major investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation “took off” from the early 1990s.

b.2) **The second wave** tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in **much of Southeast Asia (outside Vietnam, Cambodia, and Laos)**, wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

b.3) **The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others.** Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam. As we show below, the retail revolution only took off in earnest mid 2000s in India and Vietnam, and then grew rapidly. In India, although FDI liberalization in retail occurred only at the end of 2012, the sales of modern retail’s leading food-selling chains leapt from 200 million USD in 2001 to 5 billion in 2010, with a 49% annual sales growth for modern food retail (Reardon and Minten 2011) – mainly driven by domestic conglomerates, themselves creatures of the economic boom. This latter also happened in South Korea.

b.4) One can say that there is a fourth wave that includes **other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are on the initial phases of processing and retail transformation.** There were some striking anomalies in the third wave. For example, India had as early a public-sector transformation of the three segments as any first wave country, and kept this public-sector apparatus to the present, not only intact but enlarged – while transition countries like China, Russia, Vietnam had already moved to privatizing the state processing, wholesale, and retailing in the 1990s and 2000s.

b.5) **Diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi-processed, then fresh products.**

c) **There are several key findings in empirical studies concerning the two-stage transformation of the wholesale/logistics segment.**

c.1) **There has been a trend of rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector.** State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then “feeder” or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India. The growth of public markets was spectacular. For example, China’s wholesale market volume increased 11,000 percent from 1990 to 2000 (Huang et al. 2007; Ahmadi-Esfahani and Locke, 1998), and India’s regulated wholesale markets went from 450 in 1948 to 5500 in 2008. A similar rapid growth had occurred in the first- and second-wave countries in the 1960s-1970s.

c.2) **The large investments in public wholesale markets partially transformed this segment - substantially “de-fragmenting” and integrating markets, by providing “economies of agglomeration”** and channeling wholesale from field brokers into a network of covered markets with in situ wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets. In some countries, domestic regulations have held back the transformation of the wholesale market sector. For example, in parts of India, Minten et al. 2010 note that there has been a limitation (through licensing) of the number of wholesalers in markets.

c.3) **The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries opened the door to progressive “dis-intermediation”** in the rural areas and in supply chains.

This has involved two important trends.

**First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers** – such as development (at least in its incipience) or further development of contract farming by processors and collection centers by supermarket chains.

**Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, has spurred “disintermediation”, of the decline of village traders in diverse settings** (with evidence in horticulture and cereals and fish in various Asian countries), and development of direct purchase from farmers by wholesale market traders who often formerly had to procure via village trader networks (see Reardon et al. (2012a) for cases of rice and potatoes in India, China, and Bangladesh, and Dao (2013) for the case of southern Vietnam for rice, Huang et al. (2007) for vegetables in Shandong, and Natawidjaja et al. (2007) for tomatoes on Java in Indonesia).

Rather, wholesale market traders based in towns and cities now dominate wholesale with the farmers, buying directly and “dis-intermediating” the supply chain by displacing the traditional

village trader. For rice, these same works show the rapid decline especially in the past decade of village mills, which if persisting are relegated to custom milling for local farmers for home consumption, a minority share of their output disposal in the dynamic zones. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns and cities in the province or even in the receiving consumption-cities. And as the urban areas assume the majority of the value of consumption, the urban retailer takes on more importance in the total food supply chain than does the rural retailer, such as the haat in the dynamic zones of India, as shown in the recent surveys.

By contrast, we have found that while less-dynamic areas are starting to follow the above trends, they are doing it with a strong lag and much more slowly than the dynamic areas; see for example field survey analyses of Reardon et al. (2012b) for eastern versus dynamic western Uttar Pradesh and Madhya Pradesh and dynamic eastern Andhra Pradesh versus western Andhra Pradesh.

**Moreover, as in the case of modern cold storages in India, these firms act as de facto wholesale market venues, displacing the “mandis” (regulated wholesale markets).** This change appears to be good for Asian farmers as it allows greater choice of buyer. We have also observed (in the study countries of India, China, and Bangladesh, in rice and potato) a great reduction, even in most places a near disappearance, of “tied output-credit markets” where traders pay advances to farmers and expect their output to be sold to that trader. Interestingly, the main and only places we observed a continuation of this traditional “tied” system was in the hinterland zones (that resemble the “traditional image”). (See Reardon et al. 2012b,c).

**c.4) There has even been an incipient emergence of various “off-market” actors specialized in meeting the sourcing requirements of modern processors and supermarkets.**

**The first of the modern wholesale actors are the “dedicated wholesalers” (such as Bimandiri in Indonesia).** These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers. They add value (relative to the simple spot market of the traditional wholesale segment) by managing the relation, collecting, sorting, grading, packing or processing, and delivering.

**The second of the modern wholesale actors are modern logistics companies.** Commonly they undertake a variety of logistics 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 Indian supermarket chains, Reardon and Minten 2011). FDI has been an important driver of the rise of these second type of firms; **this was spurred with the liberalization of FDI in “distribution” (logistics and wholesale)** as part of general liberalization in the 1990s and 2000s. In China and India, for example, this occurred in the 2000s, and was immediately followed by a rush of foreign companies investing.



**A third element of the modernizing wholesale sector is the “cash & carry” chain.** This is in direct competition with the traditional wholesalers and “stockist” networks, supplying traditional retail and traditional HORECA. Global chains operating in this segment include Metro, Walmart (Sam’s Club), Makro, and others.

**d) There are several key findings in the recent empirical literature on the two-stage transformation of agrifood processing in Asia.**

**d.1) The general debate about food systems appears to me to little realize how high a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 16.8% of food undergoes no processing (like fresh whole fruit); that share is 15.3% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as “first processing” with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

**d.2) The processed food<sup>3</sup> sector has grown quickly in the past several decades; this growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments.** These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

**d.3) The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today, very small.** Although the parastatal grain processing sector has been important in urban food security debates for decades, the government’s direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was often larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

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<sup>3</sup> Processed foods are from cereals and pulses, tubers, fish, meat, dairy/eggs, edible oils, and condiments. These are either minimally (semi-) processed or fully processed. They are sold both packaged (bagged, boxed, wrapped, bottled) and non-packaged (like loose flour).

Only a few countries' governments still have substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al. 2007), and far lower yet in other regions.

**d.4) Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multinationalization, and technological, institutional, and organizational change.**

**In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.**

**On the one hand, there was a proliferation of small and medium scale enterprise (SME)** grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. An example of such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

**On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of processing FDI, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants.** The FDI came first mainly from Western Europe and the US (with global firms like Nestle, Kraft, Danone, seeking less saturated markets with higher profit rates, Gehlhar and Regmi 2005), then Japan, and eventually from regional multinationals such as Thailand's CP or Singapore's Wilmar into China and other Southeast Asian countries and India (last year CP created the largest shrimp processing firm in the world in Indonesia), Philippine's San Miguel into Vietnam and Del Monte Asia (Philippines). Some of this has been in the feed sector; the largest feed company in China (New Hope) is now the lead feed miller in Bangladesh (Rashid et al. 2012).

**The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.**

**d.5) There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. The drivers of this consolidation are as follows.**

**In some cases, such as India, the processing sector was "reserved" to SMEs, 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, regulations affecting the segment appeared to accelerate the pressures on SMEs.** For example, re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food businesses have been important examples imposing special burdens on small firms who lacked the investment surplus and access to bank loans to shift location, register their firm, and adopt all the measures (such as hygiene facilities and cement floors) needed to conform to new laws. This has occurred in poultry and egg companies in Vietnam with avian flu regulations. There is mounting evidence that consumers are drawn to supermarkets as a result of food safety concerns about small processors and traditional markets (for Thailand, see Posri and Chadbunchachai, 2006).

**We expect that the new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector.** There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities just as in the US in the 1910s-1920s (Levenstein, 1988).

**Finally, while the “pie” of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in out-competing many small firms.** The large processing firms have several advantages. Through private standards and “resource provision contracts” with suppliers, they can increase the quality and consistency of their intermediate inputs from farmers, driving down costs, controlling for plant size. Also, large firms can borrow more cheaply than small, and foreign firms more cheaply than domestic. Furthermore, in many categories of processing, larger plants have economies of scale. Moreover, a critical mass of output is needed to defend a brand, and the brand provides a competitive attribute over non-branded product, especially where credence goods like food safety are involved. To these can be added economies of scope, as more lines can be added and thus the company can create a “one stop shop” for retailers to source the diversity they require.

**e) There are several key findings in the empirical literature regarding the two-stage transformation of food retail in developing Asia.**

**e.1) As with processing, many governments had several types of public sector cum cooperative retail mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India and Vietnam and China.** At the end of that period, with structural adjustment or liberalization, most were dismantled or privatized, although some continued into the 1990s/2000s and “morphed” into competitors with modern-private chains.

**e.2) In the 1990’s and 2000s occurred the “take-off” of private-sector modern retail – what has become known as the “supermarket revolution” (Reardon et al. 2003).**

**In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries** (Reardon et al. 2012b): (1) the first wave, with take-off in the early 1990s, was in East Asia (outside Japan and China); the share of modern retail in food retail went from roughly 5-10% in 1990 to some 50-60% by the late 1990s; (2) the second wave, in the mid-late

1990s, was in Southeast Asia (outside transition countries like Vietnam); the share reached some 20-50% by the late 2000s; (3) the third wave, in the late 1990s and 2000s, has been mainly in China, Vietnam, and India. The share climbed to some 5-20% by end 2000s, in a rapid rise.

**There has been a steep crescendo in modern retail growth in the third wave countries in the 2000s.** For example, Reardon et al. 2012b, using raw data from the leading retail data source, Planet Retail, calculated leading modern retail sales (for chains selling food) growth rates in representative Asian countries in the three waves. The rates of growth vary over the “waves” as one would expect: the East Asian “first wave” countries (South Korea and Taiwan) indeed show slower modern-retail sales growth rates (a compound growth rate of 11.2% over the 8 years from 2001 to 2009), the second wave (Indonesia, Malaysia, Philippines, Thailand) in the middle (a compound growth rate of 17.9% annually), and the third wave (China, India, Vietnam) the highest (40.9% compound growth rate), as expected due to the most recent starters advancing fastest and the earliest relatively saturated<sup>4</sup>. These rates can be compared to approximately 5% annual growth in real GDP over 2000-2008 in the first and second wave countries, and 7.5-10% in the third wave countries. Even at these rapid GDP growth rates, modern retail sales grew 2-3 times as fast in the first and second wave, and 4-5 times as fast in the third wave. This implies that modern retail’s share of the retail pie continues to expand.

**e.3) Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce<sup>5</sup>. These paths are essentially the same as occurred “historically” (in the 20<sup>th</sup> century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been used to buying them only in wetmarkets, from hawkers, and from tiny shops.**

**f) The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets’ sales, reflecting, as we noted above, the consumption basket), and recently and incipiently, in fresh produce procurement.** The modernization provides a cost advantage to the large and an acceleration of

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<sup>4</sup> The calculations are based on sales data for leading chains from [www.planetretail.net](http://www.planetretail.net)

<sup>5</sup> For example, in “third wave” China, Goldman and Vanhonacker (2006) found that modern retailers already have a retail market share of 79 percent in packaged and processed goods, 55 percent in baked goods, 46 percent in meat, 37 percent in fruit, 35 percent in poultry, 33 percent in fish, and 22 percent in vegetables in large cities. Compare that to the more advanced (“first wave”) case of Hong Kong, which may represent the average Asian consumer sometime in the medium-term future. Hong Kong supermarkets have a 59 percent share in fruit retail and a 55 percent share in vegetables (thus, a share similar to supermarket penetration of produce retail in Brazil), 52 percent in meat, 39 percent in poultry, and 33 percent in fish (Coca-Cola Retailing Research Council Asia 2005). See Ho (2005) re modern retail penetration of rice retail in Hong Kong.

consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2011). This procurement change is discussed below as part of the treatment of effects on producers.

**g) The general implications for rural areas of urbanization cum food industry/supply chain transformation emerge as follows from the literature.**

**g.1) The foremost impact of the transformation of retail has been on the processing sector, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding of small processors;** as modern retailers take a larger and larger share of processed foods markets, this procurement trend will mean that concentrating retail will spill over to **accelerate and magnify the trend of consolidation in the processing sector; the latter trend is also encouraged and forced by a host of other trends that we have noted, and illustrated in the case of India.**

**g.2) Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries,** except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (discussed above for the Bimandiri case in Indonesia) who in turn tend to buy from sets of preferred suppliers. Occasionally, such as in the case of Reliance in India or Cargill (a domestic chain) in Sri Lanka, the chain buys via collection centers from farmers.

**g.3) There have been several reviews recently of the impacts of processors' contracting and supermarket chains' direct sourcing, on farmers** (See Barrett et al. 2012; Reardon et al. 2009). The key findings are as follows.

**(1) There seems to be a general tendency for modern processors and retailers to source from dynamic, close-by zones, rather than hinterland and (agroclimatically) un-favored zones.** This tendency then merely reinforces the prior and ongoing "exclusion" of hinterland zones from the fruits of the growth of urban markets.

**(2) There is no clear pattern – but rather mixed findings – regarding whether small or very small farmers are excluded** from supermarket sourcing or processor contracting. The small set of studies of this question in Asia, like elsewhere, find that sometimes they are excluded (mainly where the buyers have fitting and easy alternative suppliers among larger farmers or sometimes from imports), and sometimes they are included (especially where small farmers are the main source of the produce).

**(3) There appears some tendency for non-land asset-poor farmers, regardless of their land size, to be excluded.** This finding makes sense in that the non-land assets are typically the key conditioners of quality and consistency by the farmers – such as irrigation. As quality and safety requirements of buyers gradually rise, from private

demand or from food safety regulation or from import competition, this source of exclusion may rise.

(4) **There is some evidence that large processors and retailers “help” small producers who face constraints of information, credit, and inputs. The modern buyers are thus helping to resolve “idiosyncratic market failures” facing small or non-land asset poor farmers.** This is often just a private initiative of companies; sometimes it is helped and encouraged by government programs, such as the Government of China’s program to help supermarket chains buy direct from farmers. Note that this “helping hand” is not confined to large firms; we found for example that modern cold storage firms, medium sized companies, also provide credit and input sales to potato farmers in western Uttar Pradesh.

## **5. Fourth Transformation: The Rise of the Rural Nonfarm Labor Market**

a) **Rural nonfarm employment (RNFE) has grown over the three decades to be an important share of rural employment and incomes in Asia.**

**RNFE income is important to rural Asians.** Hagglade, Hazell, and Reardon, henceforth HHR (2007, 2010) note that, based on the review of a number of surveys in various Asian countries<sup>6</sup>, that the average share of rural nonfarm employment, RNFE (employment in manufactures and services, in rural areas) is **40% of total rural incomes; migration income is an additional 11% of total rural incomes; these two (local versus migratory nonfarm income) sum to 51% of rural incomes.**

**RNFE income shares in total incomes are usually higher than “full time” RNFE shares in total employment.** For example, HHR find in a review of full time employment censuses in Asia that the share of local RNFE in total employment is only 24%, well below the 40% income. On average over countries, employment shares are some 20% below income shares. **This is because of much of the RNFE is part time and diversification of income is preponderant.** For example, Davis et al. (2010) for Bangladesh, Nepal, and Pakistan, that many households (52%, 53%, and 36%) earn diversified sources, where no one source exceeds 75% of their total income.

**RNFE income has grown over the past several decades, illustrated here by India’s experience.** There is little systematic data over countries to show this; but individual country cases show this. I illustrate the point here with data from India. Lanjouw and Murgai (2009) show a shift, using NSSO rural household survey data over 1983 to 2004, in the share of total rural employment that is in nonfarm self-employment, going from 10.9 to 14.5%; for casual - wage RNFE, from 5.2 to 9.6%; for “regular RNFE” (salaried RNFE), from 6.4 to 7.3%. Summing these, they show the RNFE employment share from 22% to 31% over this period; note that this is “as full time;” recall the caveat above that this understates the share of this employment in income due to diversified incomes or non-specialization). By contrast, the share

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<sup>6</sup> Bangladesh, China, India, South Korea, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

of the “cultivator” as full time employment dropped from 38.4 to 31.9%, and farm wage labor earners, from 24.3 to 21.8%.

Kumar et al. (2011) show that from 1983 to 1994, 60% of rural job growth was from the farm sector; but from 1994 to 2005, 60% of rural job growth came from the RNFE sector. From 2004 to 2010, total rural employment dropped 5 million even while 13 million new RNFE jobs were added.

Corroborating RNFE’s growth in India from a macro perspective, Himanshu et al. (2011) show that from 1983 to 2004, the RNFE GDP grew 7.1% per year (with a jump from 6.4% per year in 1983-1993, and then 7.7% a year from 1993 to 2004); compare those rates with the agriculture GDP that grew 2.6% per year over those 20 years.

Himanshu (2011) also goes down to the micro level by showing data from a single village taken in some sense as representative, that of Palanpur, where from 1983 to 2008/9 the share of RNFE in total village income rose from 34% to 67%. These changes are similar to those shown in HHR, who review survey studies in India that average to show a change in the share of income from RNFE rising from 26% in 1968 to 36% in 1980 to 46% in 2000.

**RNFE employment in general is much more important to rural Asians than migration employment and farm wage labor.** In popular and also research discussion of “off-farm income” in Asia the assumption is that most comes from migration income and from farm wage labor income. This was shown for migration above.<sup>7</sup> For the case of farm wage labor, Davis et al. (2010), for Bangladesh, Nepal, and Pakistan, show that the share of rural income from farm wage labor is 20, 13, and 9%, respectively, while that of RNFE (wage and self-employment) income is 36%, 30%, and 40% for the three countries, respectively. The ratios of farm

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<sup>7</sup> There are some exceptions to that general finding that migration is much less important than migration income. On the one hand, there are some countries, or rather areas within some countries, where migration income outside the local area is an important share of income and employment. For example, in western and central China, income outside cropping can be a third to half of income, and of that non-cropping income, an important share can be from migration; but note that the literature shows that much of that is still “local” in the sense that it is within the local area around the village, within the province: roughly 40% of employment in migration is outside the local province, and 60% is local semi-migration, sometimes called commuting. The converse is also the case, illustrated by the situation in India; much (with estimates around 50-60%) of “rural” nonfarm employment is actually not in the rural areas per se but in commuting to local towns. This spatial aspect has been under-researched so these estimates are based on just a few studies. On the other hand, there are some countries where migration is important but is very concentrated in terms of participation (a small share of households migrate, but those that do earn a substantial amount of their income from that); this is the case in Bangladesh for example.

participation rates for RNFE versus farm wage labor employment for the three countries are 53/35, 52/38, and 58/20%.

**Rural income diversification (away from just dependence on grain income) from the rise in RNFE far exceeded such diversification from the shift from grains to horticulture and other non-grain cash crops.** Kumar et al. 2011 show that the shift in the share of (full time) employment in RNFE over 1983 to 2004 (from 19% to 32%) can be compared with the shift from 1.9 to 3.5% of employment in horticulture and 4.3 to 9.8% of employment from cash crops. Of course the same caveat as noted above comes into play, that these shares of full time or majority employment understate the shares of these categories in total income due to activity diversification.

**b) RNFE is bimodal - composed of low return (equivalent of subsistence cropping) and high return (poverty alleviating) activities.**

RNFE activities tend to be mainly services (commerce/transport, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR 2010). The activities are a mix of: (1) **casual wage employment** (for relatively low wage, sometimes often below or at the agricultural wage (as in Bangladesh) or modestly above the farm wage (as in India); (2) **salaried “regular” employment** (like a government employee like a rural teacher); (3) **self-employment** (such as owning/managing a micro/small enterprise making cheese).

**The casual wage jobs, and the self-employment jobs (although these vary markedly in returns) are typically relatively low return jobs, while the salaried employment (and some self-employment) are high return job.** It is important to note that the returns can differ very widely across these activities; for example, for Bangladesh, Hossain (1986) showed a long list of RNFE activities ranging from earnings of 4 taka/day to 27.5 taka/day.

**Low return activities typically have much lower entry requirements (in terms of physical, financial, and human capital) than high return activities. One tends to see a strong correlation between poorer households and diversification into low-return off-farm activities,** such as farm wage labor, low return self-employment, and casual wage RNFE (HHR, 2007). For example, for India, Lanjouw and Shariff (2004), echoed with later data by Lanjouw and Murgai (2009), show that households in the various income quintiles (ranging from 1146 to 11,226 rupees) have very different income diversification profiles: the lowest has 38% cropping, 28% farm wage labor, 16% casual RNFE, 11% self-employment RNFE (of the less remunerative kind), 4% salaried RNFE, for 32% of their income from RNFE (and 2% from remittances). The highest quintile had 65% cropping, a mere 2% from farm wage labor and another mere 2% from casual RNFE, but fully 15% for (fourth quintile and 8% for 5<sup>th</sup> quintile) in self-employment (of the more remunerative kind), and fully 21% in salaried RNFE, for a total share of RNFE of 39% for the fourth quintile and 31% for the richest quintile.

**c) Drivers: Push and Pull Factors (differing by dynamic and hinterland zones) and links to types of RNFE generated**



**An important reason for the discussion of the types of RNFE is that the growth of RNFE can be thought of as a mix of the proliferation of low-return RNFE analog to subsistence farming, more of a “refuge” activity (Elbers and Lanjouw, 2001) and the development of high-return RNFE that can alleviate poverty and also feed into investment funds for agriculture.**

**HHR (2007) note correlations: (1) between low-return RNFE activities and “un-favored” zones with low aggregate demand for goods and services from nonfarm sectors; and (2) between high-return RNFE activities and zones with high aggregate demand.** High demand for nonfarm products tends to be generated, as Engels Law would predict, from higher incomes and purchasing power, and from investable surplus to invest in nonfarm activity.

**There is some controversy over whether it is necessary for aggregate demand to come from agricultural development** (as Hossain 1988 and Hazell and Haggblade 1991 emphasize, in their analysis of consumption and production linkages from agriculture in Bangladesh and India), or income from nonfarm activity that developed based on an earlier round of agricultural development (HHR 2007) **or some other source of income, such as proximity to cities or highways between cities or towns (as we discuss below)** or some enclave such as a rural tourism complex, or even from large inflows of migration income.

**The converse is that zones with low aggregate demand can manifest low-return RNFE diffusion.** That low aggregate demand can be from poor agriculture without other sources of income (HHR), or growing agriculture in a zone with poor links to cities (such as shown for Bangladesh by Deichmann et al. 2009, discussed further below), or export markets so that the farmers cannot “realize” sufficient profit from the agricultural development; the most extreme case is where production causes a glut and a price decline. One can find then a paradox of a combination of growing or high level of RNFE (of the low return variety) and stagnant agricultural zones.

**This paradox can explain some findings in India that seem to contradict the “farm development is needed for RNFE development”:** (1) Foster and Rosenzweig (2003) found RNF growing fastest in zones with lower agricultural wages (presumably from weaker agricultural growth and thus derived demand for labor); Lanjouw and Murgai (2009) found that self-employment is greatest in zones with low agricultural productivity in India. (This is similar to findings in Latin America; see Elbers and Lanjouw 2001 and Reardon et al. 2001.)

Note however that even low return nonfarm wage employment can be higher than the farm wage (as Himanshu et al. 2011) note for India, so that the growth of that RNFE can increase farm wages, as Lanjouw and Murgai (2009) find.

**d) Spatiality: RNFE develops especially in proximity to cities and towns**

**This is a key point that links our discussion of urbanization and that of RNFE in Asia.**

Renkow (2007) analyzed conceptually the links between RNFE development clustering around cities and towns, and the presence of agglomeration economies from urban and rur-urban areas as a centripetal force of RNFE toward proximity to urban areas, and congestion diseconomies in urban areas as centrifugal forces to push NFE from cities into surrounding rural areas.

**There have been so far several empirical studies that have tested this hypothesis and confirmed it, showing RNFE clusters near cities/towns; this suggests that RNFE may grow with towns and thus urbanization in general.**

(1) For Nepal, Fafchamps and Shilpi (2003) found RNFE spatially concentrated around cities and towns – specifically within 4 hours of large towns and cities, and within 1 hour of the village/rural town market. They also found “von Thünen” patterns for crop production – with vegetable production concentrated within 1-3 hours of cities and towns, and commercial paddy within 3-5 hours. Paddy marketing and fertilizer use fell off very sharply or disappeared beyond 5 hours around cities and towns as one entered the deeper hinterland areas.

(2) For Bangladesh, Deichmann et al. (2008) found that in the areas near cities and towns, the RNFE share of rural incomes was 56%, versus only 41% in the hinterlands. The hinterland features RNFE of the low-return type, while RNFE near towns is higher-return wage and self-employment. Moreover, Deichmann et al. cross the analysis of effects of urban proximity and agricultural potential and find that high potential farm areas that are near to cities have a lot of high-return wage and self-employment RNFE – but that if the high potential farm area is far from the city (and thus aggregate demand sources and agglomeration economies), the share of high return RNFE is low and low return RNFE by far predominates, often just focused on local services; they note that 28% of the latter is at a return below even the low farm labor wage.

(3) For India, similar to Deichmann et al., Lanjouw and Murgai (2009) found that the urban share of the zone is correlated with a higher incidence of “regular RNFE” (high return wage employment) and self-employment, but not casual, low wage RNFE.

(4) For India, Hazell, Ramaswami, and Rajagopalan (1991) found that rural road density radiating from cities and towns heightens the production- and consumption-linkage effects (in creating RNFE) of agricultural development from the Green Revolution.

(5) An extension of the Hazell et al. (1991) findings about the effects of roads can be found in Bhalla’s (1997) finding that major highway “corridors” between big cities in India form magnets and nodes for RNFE development along and around them; in fact she showed that over decades, these infrastructural linear nodes draw RNFE such as small manufacturing from more hinterland areas, and increase the average size of the firm and increase thus the overall wage employment share in RNFE.

(6) Kumar et al. (2011) show for some states in India that fully 57% of the RNFE jobs are actually commuting and/or temporary local migration from more rural to rur-urban areas and rural towns to work.

**However, urbanization in/near rural areas can be a two-edged sword for RNFE: urban manufactures, produced for mass markets using large scale plants enjoying economies of scale, may compete with RNFE-supplied manufactures.** The cities and towns in rural areas, and the rural roads and inter-city highways are conduits from urban industry to rural areas of these products. This can challenge small scale rural manufacturing with both cost and quality and variety competition. An example is the large-scale food manufacturer in Indonesia, Indofood, selling basic processed food items through convenience store chains into rural towns into rural areas and crowding out cottage-industry goods (Reardon, Stamoulis, Pingali, 2007).

#### **e) Effects and Correlates of RNFE growth on Agriculture and Farm Labor Markets in South Asia: Hypotheses and Findings**

##### **e.1) RNFE (and other factors) drive up the farm wage (in turn inducing mechanization)**

**Farm wages have risen over the past three decades. With the Green Revolution, there was at first a period (in the 1970s) of farm employment increase but without wage increase as labor-intensive high yielding varieties diffused (Lipton with Longhurst, 1989), and then a period of moderate wage increase (with greatly varying rates over zones), and then evidence of acceleration in the past 5-10 years in various countries of a sharp upswing.** In India, Lanjouw and Murgai (2009) note that, in 1993 terms, farm wages doubled from 1983 to 2004/5. Gupta and Sidhartha (2011) note that farm wages rose quickly in the second half of the 2000s. These two India pieces emphasized that the wage growth rates differed markedly over zones. Zhang et al. (2011) note that farm wage rates grew steeply from 2003 on in China, and Zhang et al. (2013) note the same for Bangladesh in the late 2000s, in what they describe as evidence of a Lewis Turning Point.

**The studies in India, China, and Bangladesh note that farm wage growth was driven by: (1) RNFE and migration tightening the labor market; (2) farm productivity growth in some zones.**

**The rise of the farm wage has in turn spurred the spread of farm mechanization, even on small farms. We discuss this further below.**

**e.2) RNFE and migration remittances in turn appears to facilitate purchase of farm machines (such as Estudillo and Otsuka 1998 and Takahashi and Otsuka 2009 show for Luzon, Philippines in a panel study) and other lumpy investments that permit diversification (such as pumps for fish ponds or irrigation for fruit orchards).**

**e.3) RNFE and migration remittances are one way (beside labor- and capital-led intensification, discussed below) for farm households to continue to farm very small farms – as part time farmers (HHR 2007).**

## **6. Fifth Transformation: Farm Technology and Scale Change and Rise of Intermediate Factor Markets**

### **6.1. Farm Technology Intensification and Rise of Intermediate Factor Markets**

a) **In general** over Asia over the past three decades, there has been “intensification-cum-commercialization/diversification”: (1) farms have commercialized; (2) the agricultural sector has diversified (into non-grains, mirroring the diet diversification) while individual farms have specialized (into cropping, or livestock, poultry, aquaculture); (3) farms have shifted from non-purchased to purchased input use (from human to animal to machine power, from manure, byproducts, and residues to chemical fertilizer, and to use of more pesticides and herbicides) (Pingali and Rosegrant, 1995, as well as in analyses of the Green Revolution stages in Cassman and Pingali, 1995, Estudillo and Otsuka, 1998.) These changes occurred earliest and fastest in the “classical Green Revolution” zones, particularly lowland rice systems and irrigated wheat areas. It should be noted however that in these areas as early as the mid-1990s/early 2000s there were warnings that yield growth had begun to plateau despite this intensification (see Cassman and Pingali as well as Lipton (2000)).

A second wave of this intensification-cum-commercialization occurred, also mainly still in rice and wheat and horticulture areas, in zones that in the 2000s were “catching up” with the initial Green Revolution zones; this is depicted for example in recent studies in western and central Uttar Pradesh in India, northern Bangladesh, and northeast China in rice and potato (see Reardon et al. 2012a). There was another source of intensification with the development of horticulture in the 1990s-2000s (see for India, Joshi et al., 2004, and BIRTHAL et al. 2012).

b) **The increase over several decades of the farm wage (discussed above) drove a continuous rise in the use of farm machinery** – first for “power” replacement of human and animal power, for example in land preparation, and then “control” replacement for harvesting and weeding (with the latter also and especially addressed by the **rise of the use of herbicide**) (Pingali and Rosegrant 1995).

**RNFE (and thus urbanization, by extension, given our discuss above) appears to have two way effects with the increase in the use of farm machines.** On the one hand, **RNFE and migration remittances are associated with ownership of machines**, as RNFE provides cash to buy the machines (as credit for machine purchase is usually limited); Takahashi and Otsuka (2009) illustrate this in the case of Central Luzon in the Philippines over 1979 to 2003. On the other hand, **using farm machines also frees labor for both migration to cities and local RNFE**; a similar effect comes from using RNFE cash to replace home labor on farms with hired farm labor, as shown in Takahashi and Otsuka).

**Empirical studies find that RNFE is poorly correlated with use (rather than ownership) of farm machinery – mainly because of the existence of active rental markets for farm machines,** that appear to have grown quickly over time (for discussion of this in rice zones, see for example a study of the Philippines by Takahashi and Otsuka (2009), and for rice and potato in Bangladesh, China, and India, see Reardon et al. (2012a).

**Rental of farm machines has further developed recently with the spread of outsource-services of teams of labor with large harvesting machines in China that go from province to province harvesting rice** (see a study of a cluster of such operations based in Jiangsu, each serving hundreds of farmers spanning many provinces over months per year of harvesting, discussed in Yang et al. 2013). **This allows economies of scale on the machine side to small farmers (analogous to small farmers on the output market side to deal with post-harvest services that are increasing in scale – thus small farms wedged between consolidating and scale-increasing services on each side of them in the supply chain.**

**A similar arrangement in fruit farming in the unique analysis of “sprayer traders”** found by dela Cruz et al. (2010) on Luzon in the Philippines: teams of labor equipped with pruning and spraying and harvesting equipment service numerous small mango farms both in all the steps of production but also in harvesting and marketing the mangoes. Small farmers thus benefit from equipment expensive for them, labor supply concentrated and managed in one site in a timely way, as well as special skills and expertise of these teams.

**c) Beside the rise of the machinery purchase, rental, and outsourced services markets, there has been a rapid development of “intermediate factor markets” (Johnson et al. 2003) in Asia, such as those of chemical fertilizer and improved seeds, and in some cases private water markets.**

**The development of the supply side of these intermediate factor markets appears to have mirrored the development of output markets discussed in Reardon and Timmer (2012), with a first phase of “modernization” developed as a public sector action (such as the widespread construction of wholesale markets and public grain depots) and then a second phase of private sector (traditional and modern) development of output market facilities and services. In the input supply sector there is a parallelism:** in the 1960s-1980s Asian governments developed fertilizer and seed depots for subsidized input sales to Asian farmers; in the 1990s and 2000s these diminished in importance with a second phase of development of private sector (traditional and modern) input sales outlets. Our surveys showed that farmers in India, Bangladesh, and China source from very little to a minority of their external inputs from state outlets (see Reardon et al. 2012a). An exception is that pesticides/herbicides markets have traditionally mainly been private sector (traditional or modern) rather than state distribution systems.

**d) A very important point for this paper is that both the “capital-led intensification” (to use Lele and Stone’s 1989 phrase) noted above, and commercialization and diversification, have diffused very unevenly over Asian rural areas, as we emphasized for all the**

**transformations in the introduction to this paper.** The reasons for this unevenness meld with a discussion of drivers of the intensification cum mechanization, and we discuss them both in turn here.

**d.1) The most obvious unevenness comes from agroecological differentiation over zones, unmitigated by infrastructure** – for example, zones with low rainfall that have little irrigation (Rajasthan), or zones with high rainfall that have little drainage tiling (eastern Uttar Pradesh) are disadvantaged.

**Geography, performance, and potential are, however, not static, but rather are malleable:** in the past decade, the western area of Gujarat has shifted toward an intensive, multiple cropping grain area, and the eastern area, to a horticulture area, with the installation of large power grids that allowed a shift to extensive use of irrigation. Another example we can derive is comparing Lipton with Longhurst (1989) characterization of Madhya Pradesh as lagging the Punjab in the 1980s, with Reardon et al. (2012a,b) findings of rapid intensification in the western and central areas of MP in the 2000s.

**d.2) Areas well served by rural roads, and those closer to urban areas, have lower transaction costs of getting inputs, and higher use rates, as discussed above.** Striking findings of differences in external input use between hinterland and non-hinterland areas are found in the Fafchamps/Shilpi (2007) study on Nepal, and Reardon et al. (2012b) study in three states in India, comparing dynamic/connected and hinterland areas. There is however the methodological issue of controlling for agroecology when examining the impact of urban distance and rural road density; hinterland areas can often be mountainous or arid areas. That is why the study by Deichmann et al. (2011) in Bangladesh is particularly interesting for its crossing of distance to city with agroecological indices (in studying RNFE; this method needs more application to technology diffusion).

**e) Areas that are generating RNFE and migration remittances can also exhibit capital-led intensification.** This is a more complex and sometimes ambiguous relation. On the one hand, nonfarm income can generate cash to invest in farm machines and inputs, and even hired labor, as Takahashi and Otsuka (2009) illustrate; this may be even more marked in areas with credit constraints. On the other hand, in some areas nonfarm activity can be a substitute for intensification, relieving the need for it (including where agroecological conditions make it impractical) by diversifying income.

## **6.2. Farm Size Distribution Change – and its links to factor market and agricultural technology change**

**a) There is evidence of aggregate decline in farm size in Asian countries.** Eastwood et al. (2010) examined aggregate data from Bangladesh and India, China, India, and South Korea over 1950 to 1990, and found a gradual decline in average farm size.

**b) Asian farm sizes average small but nevertheless there is substantial variation over farm sizes.** Using data from the 1990s, Eastwood et al. show that: (1) South Asian farm sizes average 1.4 ha, with a Gini coefficient of 54%. 92% of the farms are under 2 ha, but fully 60% of the area under farming is of farms great than 2 ha; (2) in East Asia, the average is 1 ha, the Gini is 50%, 92% are under 2 ha, and nearly 40% of the land is of farms above 2 ha; (3) in Southeast Asia, the average is 1.8 ha, with a 60% Gini coefficient; while 57% of the farms are under 2 ha, only 77% of the land is of farms over 2 ha.

**In these figures I have deliberately emphasized three things: (1) the average farm size is indeed small; (2) but the Gini coefficients are fairly large; (3) and in South and Southeast Asia, 60% and 77% of the farmland is operated by farms over 2 ha. These broad findings open the door to exceptions that we have observed in recent field surveys in several countries – where the average farm size in the country is small, but in several study zones the average size is larger, and the share to medium and large farms is substantial.** I return to that below.

**c) The literature generally hypothesizes the following reasons for the persistence of small farms,** and even the average decline of farm size, in Asia:

(c.1) families are growing and divide up their land to sons (Eastwood et al.);

(c.2) land reform in India has been somewhat effective in the long term (Eastwood et al. 2010);

(c.3) RNFE (and remittances from migration) allows small farms to persist as they can be part time farmers (HHR 2007);

(c.4) labor-led and then capital-led intensification allows small farms to grow in productivity and compensate for land constraints;

(c.5) irrigation allows multiple cropping;

(c.6) high-value agricultural diversification such as into vegetables allows even small farms to be viable (Joshi et al. 2004);

(c.7) ability to outsource harvest, land preparation, and spraying-trading services by machine service providers allows small farmers to enjoy input side economies of scale (see above).

(c.8) Some countries, such as China, have had strictures on land transactions (Deininger and Jin 2009).

d) Here I illustrate the above trends with the case of India. The text table below shows both the average decline but paradoxically also the persistence (although with some aggregate decline) of the major farming role of medium/large farmers.

Text Table: Changes in the size and distribution of landholdings in India			
Farm category	1980-81	1991-92	2002-03
% share in holdings			
Small (LTE 2 ha)	75.3	80.6	86.0
Medium (2-4 ha)	14.2	12.0	9.0
Large (GT 4 ha)	10.5	7.4	5.0
Total (millions farmers)	71.0	93.5	101.3
NOTE % of medium/ large in farmers	24.7	19.4	14%
% share in area operated			
Small	28.1	34.3	43.5
Medium	23.6	24.1	22.5
Large	48.4	41.6	34.0
Total (millions ha)	118.6	125.1	107.7
NOTE share of medium + large in operated area	72%	65.7%	56.5%
% of rented-in area	7.18	8.52	6.5%
Average size of holding (ha)			
Small	0.62	0.57	0.53
Medium	2.77	2.69	2.66
Large	7.69	7.53	7.23
All holdings	1.67	1.34	1.06
Source: Government of India (2006)			

The table shows that: (a) the average landholding is declining; (b) the share of the medium and large farmers in total area is declining; (c) but the latter still farm the majority of land: 14% of farmers are medium/large, but farm 57% of the operated land.

e) **Is there any reason to believe that while the above picture over 20 years shows a farm size decline, that a 40 year long table might not map to a U curve of farm size? Or if this does not occur for the country or countries as aggregates, it may occur in substantial regions of countries?**

**While this section is speculative, I offer reasons for a hypothesis that average land size may indeed climb in at least some areas of Asia, even South Asia, over the next two decades.**

e.1) Recent survey evidence in “dynamic zones” of intensifying and diversifying farming, near to cities, shows average farm sizes are higher than average, and rental rates are high



and growing fast. An example of this is in Western and Central Uttar Pradesh (even controlling for Punjabi settlement areas in those zones); see Reardon et al. (2012a) and vegetable areas in West Java (Natawidjaja et al. 2007). Small farmers in these areas are selling or renting out part or all of their grain farms to larger grain farmers or large vegetable or fruit farmers, and then relying on RNFE and migration labor markets. I surmise that as urbanization proceeds, and provides more spillover effects of RNFE development, strong product market development, and migration opportunities, this apparent concentration process will continue in these dynamic areas.

e.2) The above could be accelerated as cost side pressures (such as on energy and water) and demand side pressures (for product quality) affect the viability of at least the marginal farms. Reardon et al. (2012a,b) found in India distinct differences between marginal farms, and small and medium farms in these zones.

e.3) Gradually regulations restricting land transactions will ease, for example in China; this is extrapolating from the gradual but steady reductions in limitation to rent land (Deininger and Jin 2009) and recent experiments in land titling for sale in some parts of China.

e.4) Agribusiness investments in tracts of land (such as FDI in farm land in Cambodia or Lao PDR, or purchase or rental of large tracts of land by domestic agribusinesses such as the Reliance mango plantations in India, or the “long lease of township farmland” by agribusinesses in China) could increase and lead to concentration of land in some areas.

e.5) Food industry and agribusiness sectors are consolidating in Asia. I have noted above that, outside of land investments, this upstream and downstream consolidation does not necessarily imply pressure for consolidation in the farm sector. Agricultural services like mechanization services can lower costs to small farms; processors and supermarkets can implement hub and spoke models to source from small farms via collection centers and specialized wholesalers, or they can rely for some time on the wholesale markets. The way that consolidation downstream can eventually put pressure on farm sector consolidation may be through a combination of forces that led to farm concentration in traditionally small-scale farm sectors like poultry or pig or fish operations in developed countries. The pressures can be to cut costs in ways that eventually just using own labor cannot support, and farm equipment investments are needed, and even more plausibly, that pressure to augment product safety and quality may come from the consolidated downstream firms. One can see this pressure already in the dairy and pig sectors in China, and the fish sector in Bangladesh.

e.6) The mechanization trends displacing farm labor, and the convergence of use rates of chemicals and improved seed, may reduce yield advantages that smaller farmers have in some places. Already, in the intensified agriculture zones we have studied in India, China, and Bangladesh, there is little yield difference over farm size strata.

e.7) There is some evidence of concentration of RNFE, as capital requirements for viable businesses increase under competition from urban areas. This concentration in the labor market may translate into concentration forces in the land market. (This point was argued in Africa by Reardon et al. 2000.)

f) However, that there does indeed appear to be evidence of a “poverty trap” below a certain land threshold, such as we see in our India field surveys, below 1 ha, and in certain poor agroecological and hinterland areas. These traps may not be amenable in the longer run to any of the possible land concentration forces noted and may fragment further.

## **7. Implications for Asian Agricultural Research and Development Strategies of the above 5 inter-linked transformations**

The paper has emphasized that the agrifood sector of Asia is undergoing rapid transformation. The change is so rapid because there are five mutually reinforcing and encouraging transformations occurring at once. I have shown the connections among them in all directions.

Moreover, the paper has emphasized that while a significant part of the transformation is driven by the “private sector”, popularly thought to mean the large and multinational players in the food business, in fact a very large part of the transformation has been due to private domestic investments by small and medium firms and farms in the traditional systems. The state has played a role at the margin in the recent decades, having played an initiating and formative role in the transformation before that.

Finally, the paper has emphasized the extreme differentiation over countries and over zones within countries, pointing to the existence of 3 rural Asia's. (1) The rural Asia zones that are transforming fastest and with the least external needs and help are the dynamic zones around the cities and towns, a substantial part of rural Asia. Capital-led intensification and RNFE development often develop in these zones and complement each other to spur growth. (2) On the other extreme is the most hinterland zone, where agriculture is poor, infrastructure is poor, and aggregate demand is low, leading to RNFE being mainly low return and subsistence. This is the zone with the most need, but also unfortunately appears to be in line for a long period of lagging, and export of labor and perhaps acquisition by large firms for land extensive operations. (3) In between is a substantial area in Asia that has “high potential but low performance”. This area was perfectly identified in the Deichmann et al. study in Bangladesh as having strong agricultural potential but being relatively far from cities.

I have called these latter, “intermediate zones” “the missing middle” in my prior work in Africa. It appears that these zones have the highest promise for return to research and development efforts to promote sustainable capital-led intensification, RNFE, and at the same time to build the infrastructural base to connect to sources of demand, mainly in the growing cities and towns, even rur-urban areas.

I have also emphasized that while there is a small farm domination in numbers, this disguises two trends of strategic importance. The first is that there is substantial heterogeneity in the farm population, with marginal farmers, and asset poor small farmers (as compared with small farmers) least sharing in the benefits of the transformation. The second is that small-medium and medium farmers dominate output supply, and may in the longer run set the cost and quality competition bar for the smaller and poorer farmers to meet, and be challenged by.

The above points imply the need for differentiated strategies for the geographic and socioeconomic strata.

A final set of points focus on the need for research and development strategies to help the farm areas of Asia to meet demand trends. The overwhelming fact is that the urban food economy is already the majority of food demand in Asia, and in several decades, will be the vast majority of demand. That means that meeting urban demand, and developing the rural-urban supply chains to do so, will be of major importance. This will mean more research and development on post-farmgate segments of the supply chain – processing, logistics/distribution, and retail.

Moreover, the nature of that demand is shifting gradually and steadily toward non-grains for the majority of food needs. Much more focus will need to be made on horticulture, aquaculture, meat, oilseeds, dairy, and feedgrains. There will also need to be more focus on attributes beyond yields (even as yields continue to be important for overall food costs): quality attributes for modern markets, food safety, and ability to withstand climate shocks.

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# Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies

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A Foresight Study of the Independent  
Science and Partnership Council

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Thomas Reardon

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# **Asia Agrifood System's 5 Linked Transformations: Implications for Agricultural Research and Development Strategies**

**Thomas Reardon**

**March 2013<sup>1</sup>**

## **1. Introduction**

“Five interlinked transformations” of the agrifood system are occurring rapidly in Asia: (1) urbanization; (2) diet change; (3) food market transformation, (4) rural factor market transformation, (5) agricultural technology and farm scale (land size) change. The changes are linked in mutually causal ways in all directions – so that we are witnessing the transformation of an integrated system rather than piecemeal, independent changes. This makes the transformation more powerful, more rapid, and more complicated in its impacts and implications for agricultural research strategies.

The transformations are occurring in waves over developing regions and countries within the regions over the past decades, and between types of zones inside the countries. Hence, East Asia (outside Japan) started these transformations earliest, with some of the parts of the set of five transformations starting earlier than other parts there. The second in line was much of Southeast Asia. The third in line were the transition countries, in particular China and Vietnam. The fourth in line were the South Asian countries and recently the Southeast Asian countries that had not been in the second wave. Within each of these regions, there are further waves by countries, such as India initiating the integrated set of transformations earlier than Nepal.

Finally, and a major focus in this paper, is that the transformations are highly correlated with the type of zone – whether: (1) “dynamic, commercial zones” in the 8-10 hour market catchment areas of large and medium cities (and within zones, around towns); (2) “intermediate zones” that are in the pathway, over time, of urban centers’ economic “pull” of supply from rural areas, and that are relatively medium-high potential in agroclimatic terms, but in a situation of medium to under-realization of potential in terms of current performance; and (3) hinterland, traditional,

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semi-subsistence zones” further from cities and in more remote and agroclimatically unfavored areas.

This paper focuses on emerging evidence from surveys and broad trend information of the inter-related five transformations, examined in turn. South Asia is the focus of the paper per the terms of reference for this conference contribution, but to a minimum extent the paper is set in a comparative context with the rest of Asia. Indeed, the underlying trend appears to be that there is a “moving average” where like types of zones are transforming, at various paces, in ways that move them toward convergence with “lead geese” that earlier flew that path. The paper ends with an initial assessment of implications for agricultural development strategies for the different types of zones and farmer strata, countries, and regions.

## **2. First transformation: Urbanization and Rur-urbanization: Patterns, Determinants, Effects**

a) **There is rapid aggregate urbanization occurring in Asia.** Estimates of the urban share by Asian Development Bank show a 60% urban share in population by 2025, from only 20% in 1960 (James et al. 2008); estimates by the United Nations (2011) show Asia is at an urban share of 45% by 2011, and estimate that that share will rise to 56% by 2030 and 64% by 2050; they also estimate that the Asian rural population rose from 1.63 billion in 1970 to 2.31 in 2011, but then will decline absolutely to 2.17 in 2030 and 1.83 billion in 2050.

### **b) Fast Urbanization countries in East and Southeast Asia, but Constrained urbanization countries in South Asia**

In 1960, 1990, and 2005, India had an urban population share of 18%, 26%, and 29%; in China those figures were 16%, 27, and 40%; in Indonesia, 15%, 31, and 48%.<sup>2</sup> Both China and Indonesia look to be on the “urbanization take-off” path of earlier fast-developers, for example South Korea; South Korea in 1960 had (at 28%) an urban share like India today or India in 1990, or China in 1990; by 1970 South Korea had 41% (like China today), and then South Korea rose quickly to 74% in 1990 and 81% by 2005. South Korea achieved a shift in urban share in 20 years that it took 90 years for the US to achieve.

The figures above show India as on a “slow urbanization path,” compared to other large and medium countries in East and Southeast Asia. McKinsey (Ablett et al. 2007) has made the assumption that the slow urbanization will continue in India, as it projects that India will still only have a 37% urbanization rate by 2025 – not even to China’s rate today. This rate of growth in the urban share has been modest. Of course, the absolute increase and current urban population are large: India’s urban population grew six-fold from 1948 to 2001 (Mathur 2005); the urban population in 2006 was 318 million, the size of the US, and by 2025, is projected to be 523 million, larger than the 2008 EU population.

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<sup>2</sup> For urbanization rates, see [www.nationmaster.com](http://www.nationmaster.com).

The question of “why has India’s urbanization been so slow” has been a keen point of debate among demographers and urban sociologists and economists for the past half century. While there is some consensus around why urbanization was slow from 1900 to 1950 (slow economic growth and disruptions), the juxtaposition of rapid industrialization and slow urbanization in the decade of the 1950s and 1960s and again in the 1990s and 2000s has puzzled urban experts in those decades. Several points have dominated the debate, leading us to believe that India’s urbanization process is already faster than is officially stated, and will be faster in the future than in the past.

First, there has been criticism of the criteria used in the censuses to classify areas as urban or rural and thus create an under-estimate of the urban share (Bose 1974). Moreover, in 2001 the number of “villages” (ranked as rural) with more than 10,000 inhabitants surpassed in 2001 for the first time (in the census) the number of official “towns” and “urban areas” having greater than 10,000 population. It is posited that if these large villages that are the size of (officially urban) towns were reclassified (as many do not want to do because of tax advantages of continuing as “rural”), there would be a significant jump in the statistical share of urban in India population (Marius-Gnanou and F. Moriconi-Ebrard, 2007).

Second, the debate has noted that urbanization in India was, in the 1960s-1980s, highly “large city” centric, and that the high rates of unemployment in those cities discouraged rural urban migration, but that towns and medium cities did not have the economic base to grow quickly in the 1960s/1970s (Bose 1974). This point was revived in the 2000s, linked to persistent poor infrastructure, poverty, and absorptive capacity of large cities in India (Mathur 2005).

However, starting in the 1980s and into the 1990s and 2000s the secondary and tertiary cities have “taken off” (especially in the economically dynamic states, see the next point) and led to an increase in urbanization. There are 5,161 cities and towns in India as of the 2001 census. There is no standard categorization of these, but typically used is a four-way taxonomy, of Tier 1, 2, 3, and 4 cities. McKinsey uses a classification with a cutoff of 4 million or more population for Tier 1 cities (e.g., Mumbai, Delhi), Tier 2 cities (26 cities with greater than 1 million and less than 4 million, such as Surat or Indore), Tier 3 cities with more than 500,000 population and less than 1 million (such as Amritsar or Goa), and Tier 4, or small towns. In this set, there is relative concentration: Tiers 1 and 2 have 44% of the urban population. But the trend now is toward relative rapid development of the Tier 2 and 3 cities. Moreover, the middle class is spread over the city categories: two-thirds of the middle class is outside of tier 1 cities, and tier 3 cities have as many middle class as tier 2, and a number of tier 3 cities have higher average incomes than tier 2 cities and even some tier 1 cities. There is, however, a greater average household income comparing the first three tiers and the fourth tier (Weinstein, 1991, Bhalla, 1997, New York Times, 2007, and Ablett et al. 2007).

Third, as there is extreme heterogeneity of economic performance and growth rates over India’s states, there is in turn great heterogeneity over states of urbanization rates; thus, the major Indian states that have grown rapidly have urbanization rates in excess of 40% (like China), and those with lagging growth rates have far lower urbanization rates (Mathur, 2005). In turn, urban

growth is in part conditioned by rural growth; hence, for example, in one of the states with the most dynamic agriculture (Punjab), one also finds among the fastest urbanization with growth of Tier 2 and Tier 3 cities, noted above.

c) **Measuring urban population growth alone understates urbanization's importance to the overall food economy from the demand side - because the urban areas share in the total food economy exceeds its share in population.** I have roughly estimated (using figures for urban share, propensity to consume food from income, and income disparities between rural and urban areas) that already half to two-thirds of the food economy in Asia is urban, in the sense of the share of the value of total food consumed in the countries. Typically, the total food expenditure per person in urban areas is greater than that of rural areas (for example in India in 1999 it was 42% higher, Dev et al. 2004), and thus the population share of urban areas understates the share of urban areas in the total value of food consumed in the country. An example of that kind of reasoning has been done for India for all consumption: Ablett et al. (2007) note that by 2006, while 29% of population is in cities, 43% of overall consumption is in cities (given higher average incomes than in rural areas). They project this share to be 62% by 2025.

d) **Urbanization of population per se understates the role of urban areas in the overall food economy from the supply side - as half to two-thirds of the food supply chain "value added" is off-farm (in wholesale and retail, in mills, in cold storage), much of it clusters in towns and cities in Asia especially in the dynamic zones. There appears to be "rur-urbanization" of the food supply chains in Asia.** Moreover, towns, as nodal points of rural road networks, inter-urban highway and rail interfaces, and electricity-endowed platforms, serve as the staging grounds for clusters of services that are crucial to agricultural development in surrounding rural areas. For example, Rashid et al. (2012) analyze clusters of fish/shrimp related enterprises in towns and secondary cities in Bangladesh, involving nodes of numerous feed mills, hatcheries, nurseries, traders, processors, ice makers, repair shops, and so on.

e) An extension of the above is that **urban population growth as an aggregate concept underplays the effect of urban areas on rural areas depending on the proximity or density of urban areas** (proximity of one city to another, even with rural areas intervening between them) **and the development of rural infrastructure, particularly roads and rails, connecting the cities.** South Asia and China, much of Southeast Asia both on the mainland and on the main islands of archipelagic countries, is peppered densely with cities so that rural areas are constantly close to cities in most zones where most of the rural population resides.

The latter effect is presumably magnified by the **huge investments in rural infrastructure and rural-urban links**, particularly roads and rail made by Asian governments in the past 1-2 decades. For example, over 1991 to 2005, road density increased rapidly in South Asia, per the following annual growth rates: Bangladesh, 4.4%; India, 4.6%; Nepal, 12.6%, and Pakistan, 3.8% (ADB, 2012). In the next section we also examine the massive investments in wholesale market infrastructure that Asian governments have made.

An important variation on the above theme is the development of **highway corridors between cities**. Bhalla (1981; 1997) analyzed the development of rural nonfarm enterprises and employment along major highways connecting large cities in India, sources of derived demand for services and products; she found what we can call “internal coastlines” to be very intense areas of nonfarm development, often involving attracting enterprises from villages well away from the highway.

f) **Urbanization per se abstracts from the “type of city” – that is whether its growth is linked or not to the surrounding rural area.** This point applies the well-known concept of production and consumption linkages to consideration of the nature of town and city development (see Renkow 2007, who makes this link). On the one hand, the urban area may have developed either as an emanation from those linkages, such as in the case of the growth of towns and cities in Shandong or West Java, where the urban areas at least initially are built on clusters of services, upstream and downstream, to the agricultural areas. On the other hand, the urban area may develop as a relative enclave *vis* the surrounding rural area (like resort based towns on the coast of Cambodia, or mining towns in hinterland agricultural areas. In the latter case, urbanization per se may have little effect for the local agricultural area.

g) **Hypotheses concerning general impacts of urbanization on rural areas include:**

g.1.) De facto “de-protection” of rural areas as part of general transaction cost reduction; thus also creating dynamic areas linked to the cities;

g.2.) Facilitation in towns and secondary cities of various clusters and agglomeration of services crucial to capital-led intensification of agriculture, which can also help the survival of small farms.

g.3) Facilitation of development of rural nonfarm activity (and short-distance commuting migration) which in turn affects technology and farm size as discussed below.

g.4) Facilitation of the transformation of food supply chains and agricultural diversification, discussed below.

### **3. Second transformation: Diet Change in Asia**

a) **Income increases (via “Bennett’s Law, Bennett, 1954) and lifestyle changes accompanying urbanization that increase the opportunity cost of women’s time, lead to changes in product composition of demand.**

**These include an increase in the level and shares of: (1) non-grains** (meat, fish, dairy, edible oils, fruit, vegetables), **with derived demand for feed-grain for animals; (2) processed products to cook at home; and (3) prepared foods bought away from home.** There is abundant evidence that these shifts are occurring in Asia (Pingali 2007; Timmer 2013).

**The corollary is that the share and in some cases the level of cereals consumption is declining.** For the India case, the Government of India (2010) shows that the share of cereal consumption in the urban food basket has declined from 36% in 1972 to 23% in 2006. In the same period, the share of cereals in rural areas declined from 56 to 32%. Weighting by urban and rural population (thus abstracting from income differences), Reardon and Minten (2012) find that roughly 29% of India's food economy was in cereals in 2006, versus roughly 52% in 1972. Yet the food security debate tends to focus narrowly on grain. Nongrain food (dairy, pulses, fruits, vegetables, meat, and fish) are 71 percent of India's food consumption and are important sources of calories, protein, and vitamins.

India appears to be going along a diet change continuum that has further expression in the Southeast Asia case, such as in Indonesia, for which Timmer (2013) shows that by 2011 only 10 percent of the food budget goes to rice (on average—it is higher for the poor), so 90 percent of the food budget is spent on other commodities and value added from processing and convenience.

**The same changes take place in rural areas of Asia, but typically just less fast and far.** This manifests itself in cross section: Ahmed (2013) shows a decline in the share of rice as a share of total energy intake as a function of income strata in the poorest zones of rural Bangladesh. It also manifests itself over time: This was noted above for the case of cereals in rural India; moreover, Timmer (2013) shows a decline in rice consumption per capita in all but the lowest quintile in rural areas of Indonesia over the past two decades. The decline is slower than in urban areas, but still significant.

**The converse of the above point is that the consumption of non-grains is growing faster and/or further in urban areas than in rural areas.** In India for instance, Dev et al. (2004) show, in constant 1999/2000 rupees, in rupees per capita per month, that: (1) cereals in rural areas dropped from 137 to 109 from 1983 to 1999, while in urban areas they dropped from 120 to 107; by contrast, (2) fruit and vegetable expenditures jumped from 18 to 38 in rural, and from 55 to 74 in urban areas; (3) dairy jumped from 31 to 43 in rural, and 55 to 74 in urban areas; (4) meats, eggs, and fish actually stayed steady during that period, at about 17 in rural areas and 28 in urban areas; (5) Overall food expenditure nudged up in rural areas from 278 to 289, and in urban areas, from 357 to 410.

b) **Rice is still important in Asia.** Rice is currently and traditionally important in the food consumption basket of Asian countries. For example, nearly all the food grain consumed in Bangladesh was rice, and rice comprised about half the food grain consumed in China and India. However, there are differences between rural and urban areas. For example, in China, in 2004, urban residents consumed 51 kilograms (kg) of rice per capita, while rural residents consumed 93 kg.

c) **However... rice consumption is in a gradual, absolute decline in Asia.** The importance of rice as a share in the diet of most Asian consumers has been declining during the past several decades, as analyzed by Timmer and Dawe (2010). The share of rice in calories for all Asian

countries in the FAO's food balance data sheets was at its highest in 1970 in the midst of the Green Revolution, at 38.2%, and then trended down to 29.3% by 2007 (FAOSTAT 2012). The shift has been marked in China, for example, from rice being 38.7% of calories in 1970 to 26.8% in 2007) and Bangladesh (from 75.1% in 1970 to 69.8% in 2007), Indonesia, from 58% in 1961 to 47% in 2009, and India, from 32.4% in 1970 to 29.9% in 2007. The downward drift was very slow until 1990 and then much faster (as Asian incomes increased) (Timmer and Dawe 2010, and Timmer 2013).

**By 2007, only 30% of calories in Asian consumers' diets came from rice (comprising 5% of their food budget in money terms).** The calories from rice changed in the PRC (from a low of 444 in 1961 to a high of 872 in 1990, then dropped to 799 by 2007) and India (from a low in the 600s in the 1960s–1970s to a high of 781 in 1990, then dropped to 703 in 2007). The calories from rice rose slightly in Bangladesh in absolute terms (from a high in the 1,500s in the 1960s–1970s, down to 1,311 in 1980 and 1,473 in 1990, and up to 1,591 in 2007), as Bangladesh rode through the Green Revolution, a prolonged crisis, and a long recovery.

Timmer and Dawe (2010) noted that the decline had accelerated in the last decade, and should be expected to continue for some time because (1) the income elasticity of rice demand is falling over time; (2) as rural-to-urban migration occurs and incomes rise, the elasticity trends downward; and (3) the income elasticity is lower in urban than in rural areas and among richer than poorer consumers. This general decline of course disguises heterogeneity among age groups, regions within countries, and across the economies themselves, but the overall trend is clear.

**d) But there has been a rise in wheat consumption – and wheat imports.** Wheat is still minor in most Asian countries compared with rice (except in India and China). But the rise of wheat from a low base to a significant presence in consumption is especially marked in Southeast Asia, as Timmer (2013) shows: from 1 million metric tons of imports of wheat in 1961 to 13 million tons by 2010; wheat was 2.8% of the level of rice consumption in 1961, and by 2009 was up to 11.5%. Senauer et al. (1986) documented the early stages of this rise of wheat in Sri Lanka in the 1980s. In both cases, the rise of wheat brought increases in imports as Sri Lanka and Southeast Asian countries do not produce them significantly. By contrast, wheat consumption in China and India are important but they are also major producers of wheat and imports are minor. Of course, some countries like Bangladesh are still focused on rice and the imports of wheat are minor.

**e) Note that the current changes in cereal consumption (secular decline of rice, rise of wheat) and tuber consumption (rapid decline of sweet potatoes, rise of white potatoes) are not the first time consumption composition changes have taken place. In the 1960's through 1980s, as a rough approximation, there was a decline in coarse grains, especially millet and sorghum, in India (ICRISAT 1982) – displaced by the rise of rice and wheat and somewhat maize (as it was doing in Africa at the same time, see Reardon 1993).**

**f) Diet patterns are malleable in Asia, with “traditional food culture” appearing to be only moderately constraining of shifts.** Several points stand out.



**f.1) Many non-traditional food products have quickly become “traditional” and widely diffused in Asia.** (1) Central/South America’s products (potatoes, tomatoes, chili peppers, sweet corn, pineapple, papaya) have become leading produce items in Asia (potatoes are the leading vegetable in India, Bangladesh, China, Indonesia - all places they are utterly non-traditional and recent). (2) Shifts from Africa to Asia also are common: sorghum and millet (ICRISAT 1982) were introduced into India from Africa and highly diffused into large tracts of India where only recently (mainly in the past half century) did rice and wheat (and pulses) enter and displace those “traditional” crops. Oil-palms were brought to Southeast Asia from Nigeria in 1961, to become major crop in Southeast Asia and major edible oil in much of Asia. (3) Dairy, non-traditional in the great majority of East/Southeast Asia (except in the far north in the grasslands such as in Inner Mongolia or Mongolia), emerged as a significant sector in many countries of the region in only the past few decades.

**f.2) Traditionally “vegetarian” areas, such as the (mainly-Hindu) India and (mainly Buddhist) Southeast Asia have rapidly growing fish, poultry, and even red meat consumption.** For example, 31% of Indians are strict vegetarians, and thus in a sense may be “structurally constrained” in diet habits, but the working hypothesis is that many of the rest will increase at least fish and poultry consumption as incomes grow.

**f.3) New forms of consumption and buying** (in processed form, from away-from-home sources, and from modern retail or fast food chains, as discussed further below) **also have spread very quickly**, even though these are highly non-traditional (just as they were in the “West” only 50-80 years before);

**f.4) There has been a proliferation of grain and potato varieties amenable to longer storage, easier processing, and long-distance shipment**, such as in the case of potatoes in India (Reardon et al. 2012a).

**g) Shift toward more consumption of non-grain foods and more processed foods is conditioned by supply side factors that vary a lot over time, over countries, and over product types – but factors that in Asia in the past 20 years have been very amenable to the shift, as follows.**

**g.1) One such supply side factor is in general NOT imports – imports are not driving diet change. Imports as a source of food are minor as a share of total food consumed. Exceptions are the rise of wheat imports, although even that is a tiny share of total food, and of soy imports for livestock production.** Asia’s situation of near full self-sufficiency in food (measured merely as the share of domestic production in total food consumption) is in contrast to a greater dependence on imports that has been more important in for example Africa (for West Africa for the issue of growing cereal imports especially of cereals not produced in the region, see Reardon 1993). For more on this subject for Southeast Asia, see Timmer (2013).

g.2) **Domestic farm side supply of nongrains is rapidly increasing: farmers are undertaking agricultural diversification** toward fruits, vegetables, fish, meat, and dairy has been proceeding apace in Asian countries, such as noted in Pingali (2006) for a number of Asian countries, Joshi et al. (2004) for all South Asian countries, and Birthal et al. (2012) for India.

Rao et al. (2006) note for India that there is a **strong correlation between agricultural diversification on the one hand, and the urban share and road and population density of the district in India**; urbanization and infrastructure development have thus encouraged that diversification over the past several decades. There have been large investments in irrigation in horticultural areas such as in Gujarat in India and Comilla in Bangladesh, and in fish and shrimp ponds in Bangladesh (Rashid et al. 2012), Indonesia (Yi et al. 2012), India, and China. There have been massive investments by farmers in inexpensive clay greenhouses in Shandong (Wang et al. 2012).

g.3) **Domestic supply chain development after the farm-gate is facilitating the supply of non-grain products to Asian cities. Supply chain actors (off-farm) have invested enormous sums in the aggregate in rural-urban supply chains for non-grain products: storage, packing, logistics/shipping, and commercial services.** The emerging evidence is abundant concerning the rapid development of these services in Asia, both in the modern large-scale sector and in the informal, small-scale sector. Examples include the very rapid emergence especially in the 2000s of potato cold storage facilities in western Uttar Pradesh (to serve the Delhi market, where fully two-thirds of potato consumption is now from cold storages in nearby production areas) (Reardon et al. 2012a) and even in poor areas of Bihar (Minten et al. 2011). There has also been a rapid emergence of cold storage and logistics companies that operate increasingly pan-India; part of this has been from FDI from Japan and the US and others (Reardon and Minten 2012). Domestic and multinational packaging companies are also important to this trend. For example, the Swedish multinational Tetrapak, so important in dairy packaging that spurred dairy sector development in Latin America in the 1980s/1990s (see Farina et al. 2005) is making large investments in a number of Asian countries for milk and juice packaging in the 2000s.

g.4) **The growth of non-grain supply chains (as well as grain supply chains) has hastened and been facilitated by intra-country (inter-region) market integration as cities across a given country demand similar products** (northern India, before a wheat consumer (and before that a sorghum and millet consumer) starts demanding more rice, southern India and southern China demand more potatoes (produced in the mountain/hills and northern areas of the countries); fish is marketed over regions in Bangladesh, from the pond-strewn and river-laced south to the drier north; japonica rice is shipped increasingly from northern China into southern China even as the consumption of indica rice wanes).

**Probably over time food market integration and development of pan-region supply chains will be and is being hastened and facilitated by the spread of fast food chains in urban areas:** Northern India cuisine has spread by this vector to Southern India, and vice versa; as has the consumption of French fries (see Scott and Suarez (2012) for latter in China). This is similar to what happened in the US.

**h) Quality demanded of farmers and by consumers increases also with urbanization, in several ways:**

**h.1) Demand does not only differentiate over broad categories – but within categories over niches, commodities, and differentiated products which create new series of niches which are then commoditized, as in the “product cycle”.** This is a cycle of cost then quality competition, cost then quality competition, and so on. A good example of this is the kiwi fruit: it started as a wild/local niche fruit in China, then moved to commoditized phase after introduction into New Zealand (and Italy and California and others) to then commoditize in China too; the kiwi was then differentiated into various varieties (such as golden kiwi) as part of the third phase of the cycle, product differentiation, “climbing the value ladder.” This same process can be seen in the fish sector in Bangladesh (Rashid et al. 2012).

**The product cycle often manifests itself in geographical differentiation over the phases.** For example, land shifts from rice into commodity vegetables near Jakarta in the early 1990s; by the late 1990s, the commodity vegetable production had shifted to cheaper land and labor areas in West Java (and shipped back to Jakarta), while the vegetable areas near Jakarta had started to enter the product differentiation phase, for the local market and for emerging supermarkets. By the mid/late 2000s, the areas near Jakarta (with much higher land and labor costs by then) started to shift to export vegetables and high end products such as hydroponic vegetables, and “supermarket” quality vegetables had shifted to West Java, and commodity vegetables such as bulk potatoes and cabbage started to shift to cheap land areas in Sumatra. There are many similar cases in various parts of Asia (and elsewhere).

**h.2) Food safety is gradually introduced as a requirement, especially for fresh produce and dairy and meat products.** This tends to be first introduced for export markets, for situations where public and private standards are introduced, and for high-end supermarket chains, and in the wake of crises such as the melamine crisis in China or the bird flu crisis in various countries of Asia. An example of a regulatory initiative is China’s first comprehensive Food Safety Law of 2009.

**h.3) Branding cum quality differentiation of products is also gradually being introduced.** In our study of rice in China, India, and Bangladesh, it was particularly in China where mill branding and packaging has developed rapidly recently (Reardon et al. 2012a). In Bangladesh, there has been a differentiation of rice quality over the past decade (with the price premiums mainly captured by millers and traders), see Minten et al.

2013a, and incipient branding in fruit value chains in India, even originating in poor zones like Bihar (Minten et al. 2013b). **I surmise that in Asia over the next decade, the rise of branding (especially by large and medium food companies) will go hand in hand with the rise of consciousness of and public concern about food safety – as it did in the first half of the 1900s in the US** (see Levenstein 2013).

h.4) **There has also been a shift in some cases toward varieties that can ship further or have longer shelf life (such as potato varieties in India, see Reardon et al. 2012a), that are easier to mill, and so on.** That is, varietal development and transformation of the food system are sometimes linked.

i) **Hypotheses concerning general implications for rural areas of urbanization *cum* diet change:**

i.1) **inducement for diversification of agriculture from grains to non-grains, and from commodity grain to differentiated quality grains.**

i.2) **inducement to shift the product and variety mix in agricultural zones as part of product differentiation and the product cycle** (for example, the rise of horticulture in the market-catchment areas of large cities in India and Bangladesh, such as found by Rao et al. 2006).

#### **4. Third Transformation: Food System Transformation in Asia**

The food system (a general term for food supply chains and markets) transformation is taking place along several lines in Asia. Here we will focus on the transformation of the “post-farmgate” segments of the supply chain: wholesale/brokerage/logistics/cold chain, processing, and retail. About 50-70% of the total costs of food (depending on the product and the situation) to the urban consumer are formed in these segments).

The transformation of the post farmgate segments is intimately connected with urbanization both in terms of the drivers being especially in urban areas, because the majority of the food supply chain in Asia is from rural to urban, and because many of the post-farmgate activities are in towns and secondary cities and primary cities.

In this section I briefly review key evidence on the food system transformation in Asia, drawing from Reardon and Timmer (2012), Reardon et al. (2012abc), and Reardon et al. (2009) which in turn contain reviews of the detailed evidence and literature, much of which was formed in the 2000s.

**A first important qualifier** to the discussion is that the **transformation of food systems in the Asia mega-region took and takes place unevenly – a) in spatial terms**, spreading in waves over regions, sub-regions, countries, and within countries, over tiers of urban areas, and over dynamic versus hinterland rural zones, **and b) in product terms**, happening earliest and fastest

in processed, then semi-processed, then fresh/raw products. Thus, countries like India, and a few years ago, China, are in the earlier phases of transformation, doing them very fast, but doing them with a lag after earlier sets of transformations took place in parts of Southeast Asia like Thailand or Northeast Asia like South Korea, and of course all lagged compared to the “lead goose” both in early industrialization and in food system transformation, developed Japan. The food system transformation is thus broadly correlated with the path of overall economic development, but mediated and conditioned by policy processes that delay or constrain various processes, such as for example retail FDI liberalization that occurred early in Southeast Asia, recently in China, and only a few months ago in India.

**Despite the heterogeneity** of distribution of these conditioners of transformation – over products, over firms, over countries, over regions, over time – and the consequent unevenness in the diffusion of transformation - **there is still surprising regularity and timing of “waves” of diffusion**, which occurred geographically (over countries and within countries, over income classes, and over products), for all the three agrifood industry segments.

**A second important qualifier is that there has been a dual-revolution in food, comprising –**

a) a **“modern revolution” - large scale, largely retail and second-stage processing sector focused transformation, with an important component of FDI** (Reardon and Timmer 2007);

b) a **“Quiet Revolution” – mainly small and medium scale, largely first-stage processing and wholesale as well as upstream agricultural services – in its great majority domestic capital based** (Reardon et al. 2012a).

Throughout the discussion below of the food system transformation, I have as under-pinning points the above qualifiers concerning the above heterogeneity and duality of the transformation. The key findings concerning the transformation are as follows.

a) **Reardon and Timmer (2007) emphasize that there have been two “broad phases” of agrifood industry transformation over the past 50 years: “pre-liberalization/pre-globalization” (mainly 1960s- mid 1980s) and “liberalization/ globalization” (mainly mid-1980s to now).** Contained within those two stages are the successive transformations of the three segments of the agrifood industry. The timing of the transformation of each segment is approximate, as it differs by region and country: (1) transformation of wholesaling, in two waves, with a public-sector driven stage mainly in the 1960s-1990s, and a private-sector driven stage mainly in the 2000s; (2) transformation of processing, with a public sector phase mainly up through the 1970s, and then a private sector stage mainly in the 1980s to now; (3) and then the transformation of retailing, with a small public sector stage in the 1960s-1980s (or later in some cases such as India), then a private sector stage mainly in the 1990s-2000s.

b) **Overlaying the above two broad phases are a series of waves of transformation of food systems. The waves are as follows.**

b.1) **The first wave** tended to be the Asian developing countries that started their post-WWII growth spurt earlier, urbanized and started industrializing somewhat earlier – in particular, **East Asia outside China** (and Japan, which I exclude from this discussion as being already developed). The start of wholesale sector transformation (with major investment in wholesale markets) started in the 1960s-1980s, processing transformation occurred with FDI liberalization and the start of privatization in the mid-1980s to early 1990s, and retail transformation “took off” from the early 1990s.

b.2) **The second wave** tended to be the countries that had their growth and urbanization spurts later and/or had strong internal pressure to limit FDI; these limits were often more for retail FDI than processing FDI. Hence one found that in **much of Southeast Asia (outside Vietnam, Cambodia, and Laos)**, wholesale sector transformation started in the 1970s, processing transformation took off in the 1980s but retail transformation did not start until the mid to late 1990s.

b.3) **The third wave tended to be countries that had their growth and urbanization spurts mainly in the 1990s/2000s, and/or had lagged liberalization into the 1990s. This was the case of China, India, and Vietnam, among others.** Wholesale sector transformation mainly occurred (in its wholesale market investment phase) variously over the 1970s to the 1990s; processing transformation then occurred somewhat before retail, with the latter mainly in the late 1990s and into the 2000s, with China starting well before India and Vietnam. As we show below, the retail revolution only took off in earnest mid 2000s in India and Vietnam, and then grew rapidly. In India, although FDI liberalization in retail occurred only at the end of 2012, the sales of modern retail’s leading food-selling chains leapt from 200 million USD in 2001 to 5 billion in 2010, with a 49% annual sales growth for modern food retail (Reardon and Minten 2011) – mainly driven by domestic conglomerates, themselves creatures of the economic boom. This latter also happened in South Korea.

b.4) One can say that there is a fourth wave that includes **other South Asian and Southeast Asian countries, like Bangladesh and Cambodia, that are on the initial phases of processing and retail transformation.** There were some striking anomalies in the third wave. For example, India had as early a public-sector transformation of the three segments as any first wave country, and kept this public-sector apparatus to the present, not only intact but enlarged – while transition countries like China, Russia, Vietnam had already moved to privatizing the state processing, wholesale, and retailing in the 1990s and 2000s.

b.5) **Diffusion of the transformation (in all three segments) tended to occur earliest in more urban and later in more rural areas, and earliest and fastest in processed, then semi-processed, then fresh products.**

c) **There are several key findings in empirical studies concerning the two-stage transformation of the wholesale/logistics segment.**

c.1) **There has been a trend of rapid growth, then transformation, and then in some cases decline, of the public wholesale market sector.** State wholesale markets were substantial investments by cities or provinces, and were put in place in waves mainly from the 1960s on, starting with main cities, then secondary cities, and so on. A typical pattern was a hub-and-spokes model, with a set of primary wholesale markets in big cities and then “feeder” or secondary wholesale markets in smaller cities and rural areas, such as one finds in China, Indonesia, and India. The growth of public markets was spectacular. For example, China’s wholesale market volume increased 11,000 percent from 1990 to 2000 (Huang et al. 2007; Ahmadi-Esfahani and Locke, 1998), and India’s regulated wholesale markets went from 450 in 1948 to 5500 in 2008. A similar rapid growth had occurred in the first- and second-wave countries in the 1960s-1970s.

c.2) **The large investments in public wholesale markets partially transformed this segment - substantially “de-fragmenting” and integrating markets, by providing “economies of agglomeration”** and channeling wholesale from field brokers into a network of covered markets with in situ wholesalers, and thus also altering its technology and organization. By imposing regulations, it changed its institutions, at least for the portion that passed via the regulated markets. In some countries, domestic regulations have held back the transformation of the wholesale market sector. For example, in parts of India, Minten et al. 2010 note that there has been a limitation (through licensing) of the number of wholesalers in markets.

c.3) **The massive proliferation (even into towns) of wholesale markets, the extension and improvement of rural roads, and the regulatory liberalization of their operations in most countries opened the door to progressive “dis-intermediation”** in the rural areas and in supply chains.

This has involved two important trends.

**First, the regulatory changes (such as in some states in India) that have liberalized the wholesale sector have also favored direct private sector relations with farmers** – such as development (at least in its incipience) or further development of contract farming by processors and collection centers by supermarket chains.

**Second, the diffusion of wholesale markets in towns near or in rural areas, and the improvement of road systems leading from rural areas to urban wholesale markets, has spurred “disintermediation”, of the decline of village traders in diverse settings** (with evidence in horticulture and cereals and fish in various Asian countries), and development of direct purchase from farmers by wholesale market traders who often formerly had to procure via village trader networks (see Reardon et al. (2012a) for cases of rice and potatoes in India, China, and Bangladesh, and Dao (2013) for the case of southern Vietnam for rice, Huang et al. (2007) for vegetables in Shandong, and Natawidjaja et al. (2007) for tomatoes on Java in Indonesia).

Rather, wholesale market traders based in towns and cities now dominate wholesale with the farmers, buying directly and “dis-intermediating” the supply chain by displacing the traditional

village trader. For rice, these same works show the rapid decline especially in the past decade of village mills, which if persisting are relegated to custom milling for local farmers for home consumption, a minority share of their output disposal in the dynamic zones. Instead, small but especially medium and larger scale mills have risen to dominance and are located in the towns and cities in the province or even in the receiving consumption-cities. And as the urban areas assume the majority of the value of consumption, the urban retailer takes on more importance in the total food supply chain than does the rural retailer, such as the haat in the dynamic zones of India, as shown in the recent surveys.

By contrast, we have found that while less-dynamic areas are starting to follow the above trends, they are doing it with a strong lag and much more slowly than the dynamic areas; see for example field survey analyses of Reardon et al. (2012b) for eastern versus dynamic western Uttar Pradesh and Madhya Pradesh and dynamic eastern Andhra Pradesh versus western Andhra Pradesh.

**Moreover, as in the case of modern cold storages in India, these firms act as de facto wholesale market venues, displacing the “mandis” (regulated wholesale markets).** This change appears to be good for Asian farmers as it allows greater choice of buyer. We have also observed (in the study countries of India, China, and Bangladesh, in rice and potato) a great reduction, even in most places a near disappearance, of “tied output-credit markets” where traders pay advances to farmers and expect their output to be sold to that trader. Interestingly, the main and only places we observed a continuation of this traditional “tied” system was in the hinterland zones (that resemble the “traditional image”). (See Reardon et al. 2012b,c).

**c.4) There has even been an incipient emergence of various “off-market” actors specialized in meeting the sourcing requirements of modern processors and supermarkets.**

**The first of the modern wholesale actors are the “dedicated wholesalers” (such as Bimandiri in Indonesia).** These wholesalers are dedicated to either one company or a segment (such as modern retail, processing, or HORECA (hotels, restaurants, catering) or exports), tend to be specialized in a category, and handle procurement relations suppliers. They add value (relative to the simple spot market of the traditional wholesale segment) by managing the relation, collecting, sorting, grading, packing or processing, and delivering.

**The second of the modern wholesale actors are modern logistics companies.** Commonly they undertake a variety of logistics 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 Indian supermarket chains, Reardon and Minten 2011). FDI has been an important driver of the rise of these second type of firms; **this was spurred with the liberalization of FDI in “distribution” (logistics and wholesale)** as part of general liberalization in the 1990s and 2000s. In China and India, for example, this occurred in the 2000s, and was immediately followed by a rush of foreign companies investing.



**A third element of the modernizing wholesale sector is the “cash & carry” chain.** This is in direct competition with the traditional wholesalers and “stockist” networks, supplying traditional retail and traditional HORECA. Global chains operating in this segment include Metro, Walmart (Sam’s Club), Makro, and others.

**d) There are several key findings in the recent empirical literature on the two-stage transformation of agrifood processing in Asia.**

**d.1) The general debate about food systems appears to me to little realize how high a share of food in developing Asia undergoes some processing.** Morisset and Kumar (2008) show for Indian urban areas that only 16.8% of food undergoes no processing (like fresh whole fruit); that share is 15.3% in rural areas. In India that means about 85% of all food undergoes some processing: grain milled, made into bread or polished rice; milk churned, fermented; and so on. Of course, a high share can be classed as “first processing” with low value added (up to 5%), with 35% of urban food, and 44% of rural food, in this category; first processing high value added (5-15%, is some 38 and 35% respectively. Second-processing food reaches only 10 and 6% of food in urban and rural areas.

**d.2) The processed food<sup>3</sup> sector has grown quickly in the past several decades; this growth is mainly in the first-stage high value added and the second stage processed food subsectors, such as milled and second-stage processed cereals, dairy, processed meat and fish, and condiments.** These trends are driven by increases in income, urbanization, women increasing their participation in labor markets outside the home and wanting to save time cooking, improvements in packaging and processing technologies, and eventually by diversification of the variety of processed foods, abetted by modern retail (Gehlhar and Regmi 2005).

**d.3) The public-sector role in food processing has always been limited (more so than it seems when viewing the large role it had in public policy debate), and today, very small.** Although the parastatal grain processing sector has been important in urban food security debates for decades, the government’s direct role in inducing food processing transformation has been limited in most countries, even in its heyday in the 1960s/1970s. It was mainly confined to grain sold to urban markets. In that period, the urban population share and the marketed share of grain were lower than today. The local small-scale (and thus not parastatal) share of grain processing was higher. And the parallel market (not via parastatals) was often larger than the government channels. There was then rapid privatization of grain parastatals in most countries in the late 1980s or 1990s.

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<sup>3</sup> Processed foods are from cereals and pulses, tubers, fish, meat, dairy/eggs, edible oils, and condiments. These are either minimally (semi-) processed or fully processed. They are sold both packaged (bagged, boxed, wrapped, bottled) and non-packaged (like loose flour).

Only a few countries' governments still have substantial food processing operations into the 2000s. For example, in Asia it is only India that maintains a substantial presence via its grain parastatal; even that only procures 20% of India's grain output (and 40% of the market, which is even higher than in the 1970s). The numbers are far lower in other Asian countries (Rashid et al. 2007), and far lower yet in other regions.

**d.4) Since the late 1980s (earlier than the supermarket revolution in most cases), there has been rapid growth in the private-sector food processing sector in developing Asia - combined with rapid consolidation, multinationalization, and technological, institutional, and organizational change.**

**In many countries, with structural adjustment in the 1980s and 1990s, state grain mills and slaughterhouses were privatized or eliminated, and import licenses disbanded. The private sector has made significant investment in processing. This led to two competing lines of consequences.**

**On the one hand, there was a proliferation of small and medium scale enterprise (SME)** grain mills and dairy, meat, fish, and produce processing, encouraged by market de-regulation, competing for the gap left by the demise of public sector operations and de-licensing of processing, and diversifying products for growing urban and rural markets. An example of such proliferation was observed for example in rice mills and potato cold stores in India, Bangladesh, and China (Reardon et al. 2012a).

**On the other hand, privatization led not only to domestic private sector bids, but due to widespread liberalization of processing FDI, a wave of FDI, as well as domestic private and domestic state investments in large-scale plants.** The FDI came first mainly from Western Europe and the US (with global firms like Nestle, Kraft, Danone, seeking less saturated markets with higher profit rates, Gehlhar and Regmi 2005), then Japan, and eventually from regional multinationals such as Thailand's CP or Singapore's Wilmar into China and other Southeast Asian countries and India (last year CP created the largest shrimp processing firm in the world in Indonesia), Philippine's San Miguel into Vietnam and Del Monte Asia (Philippines). Some of this has been in the feed sector; the largest feed company in China (New Hope) is now the lead feed miller in Bangladesh (Rashid et al. 2012).

**The consequence was that foreign firms formed a major share of the large processing sector in a number of first and second wave countries by the 2000s, while that process appears to be just starting in third wave countries like China and India in the 2000s.**

**d.5) There has been rapid consolidation in developing Asia food processing, again, in the sequence roughly of the three waves. The drivers of this consolidation are as follows.**

**In some cases, such as India, the processing sector was "reserved" to SMEs, 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, regulations affecting the segment appeared to accelerate the pressures on SMEs.** For example, re-zoning of cities to reduce congestion, application of business registration laws to increase municipal revenues, and application of food safety and hygiene regulations to food businesses have been important examples imposing special burdens on small firms who lacked the investment surplus and access to bank loans to shift location, register their firm, and adopt all the measures (such as hygiene facilities and cement floors) needed to conform to new laws. This has occurred in poultry and egg companies in Vietnam with avian flu regulations. There is mounting evidence that consumers are drawn to supermarkets as a result of food safety concerns about small processors and traditional markets (for Thailand, see Posri and Chadbunchachai, 2006).

**We expect that the new generation of food safety laws emerging in developing countries, such as the ones in China and India, may further accelerate consolidation in the processing sector.** There is evidence that this occurred in the US with the impact of the food law of 1908 on food SMEs through the 1910s, such as with the exit of 90% of dairy SMEs in the main eastern cities just as in the US in the 1910s-1920s (Levenstein, 1988).

**Finally, while the “pie” of the sector was increasing rapidly, the massive investments by domestic and foreign firms, creating or enlarging large-scale processors, has resulted in out-competing many small firms.** The large processing firms have several advantages. Through private standards and “resource provision contracts” with suppliers, they can increase the quality and consistency of their intermediate inputs from farmers, driving down costs, controlling for plant size. Also, large firms can borrow more cheaply than small, and foreign firms more cheaply than domestic. Furthermore, in many categories of processing, larger plants have economies of scale. Moreover, a critical mass of output is needed to defend a brand, and the brand provides a competitive attribute over non-branded product, especially where credence goods like food safety are involved. To these can be added economies of scope, as more lines can be added and thus the company can create a “one stop shop” for retailers to source the diversity they require.

**e) There are several key findings in the empirical literature regarding the two-stage transformation of food retail in developing Asia.**

**e.1) As with processing, many governments had several types of public sector cum cooperative retail mainly in the 1970s/1980s and even into the 1990s/2000s in the cases of India and Vietnam and China.** At the end of that period, with structural adjustment or liberalization, most were dismantled or privatized, although some continued into the 1990s/2000s and “morphed” into competitors with modern-private chains.

**e.2) In the 1990’s and 2000s occurred the “take-off” of private-sector modern retail – what has become known as the “supermarket revolution” (Reardon et al. 2003).**

**In broad strokes, the diffusion of modern food retail has rolled out in three waves over Asian countries** (Reardon et al. 2012b): (1) the first wave, with take-off in the early 1990s, was in East Asia (outside Japan and China); the share of modern retail in food retail went from roughly 5-10% in 1990 to some 50-60% by the late 1990s; (2) the second wave, in the mid-late

1990s, was in Southeast Asia (outside transition countries like Vietnam); the share reached some 20-50% by the late 2000s; (3) the third wave, in the late 1990s and 2000s, has been mainly in China, Vietnam, and India. The share climbed to some 5-20% by end 2000s, in a rapid rise.

**There has been a steep crescendo in modern retail growth in the third wave countries in the 2000s.** For example, Reardon et al. 2012b, using raw data from the leading retail data source, Planet Retail, calculated leading modern retail sales (for chains selling food) growth rates in representative Asian countries in the three waves. The rates of growth vary over the “waves” as one would expect: the East Asian “first wave” countries (South Korea and Taiwan) indeed show slower modern-retail sales growth rates (a compound growth rate of 11.2% over the 8 years from 2001 to 2009), the second wave (Indonesia, Malaysia, Philippines, Thailand) in the middle (a compound growth rate of 17.9% annually), and the third wave (China, India, Vietnam) the highest (40.9% compound growth rate), as expected due to the most recent starters advancing fastest and the earliest relatively saturated<sup>4</sup>. These rates can be compared to approximately 5% annual growth in real GDP over 2000-2008 in the first and second wave countries, and 7.5-10% in the third wave countries. Even at these rapid GDP growth rates, modern retail sales grew 2-3 times as fast in the first and second wave, and 4-5 times as fast in the third wave. This implies that modern retail’s share of the retail pie continues to expand.

**e.3) Inside a country, typically the diffusion has spread in the following two sets of paths: (1) from large cities to small cities and finally into rural towns in adapted formats, and from upper to middle to poorer classes; (2) from processed foods to semi-processed foods to fresh produce<sup>5</sup>. These paths are essentially the same as occurred “historically” (in the 20<sup>th</sup> century) in developed countries; for example, it took almost 40 years for US supermarkets to start selling vegetables, as consumers had been used to buying them only in wetmarkets, from hawkers, and from tiny shops.**

**f) The descriptive work on these trends has also found the gradual diffusion of modernization in retail and processing company procurement systems, mainly in semi-processed and processed foods (that form 85% of supermarkets’ sales, reflecting, as we noted above, the consumption basket), and recently and incipiently, in fresh produce procurement.** The modernization provides a cost advantage to the large and an acceleration of

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<sup>4</sup> The calculations are based on sales data for leading chains from [www.planetretail.net](http://www.planetretail.net)

<sup>5</sup> For example, in “third wave” China, Goldman and Vanhonacker (2006) found that modern retailers already have a retail market share of 79 percent in packaged and processed goods, 55 percent in baked goods, 46 percent in meat, 37 percent in fruit, 35 percent in poultry, 33 percent in fish, and 22 percent in vegetables in large cities. Compare that to the more advanced (“first wave”) case of Hong Kong, which may represent the average Asian consumer sometime in the medium-term future. Hong Kong supermarkets have a 59 percent share in fruit retail and a 55 percent share in vegetables (thus, a share similar to supermarket penetration of produce retail in Brazil), 52 percent in meat, 39 percent in poultry, and 33 percent in fish (Coca-Cola Retailing Research Council Asia 2005). See Ho (2005) re modern retail penetration of rice retail in Hong Kong.

consolidation inside the modern retail segment, even at early stages. This allowed the driving down of prices (such as has been observed in Delhi, see Minten et al. 2011). This procurement change is discussed below as part of the treatment of effects on producers.

**g) The general implications for rural areas of urbanization cum food industry/supply chain transformation emerge as follows from the literature.**

**g.1) The foremost impact of the transformation of retail has been on the processing sector, as some 85% of the food sold is processed to some degree. There is emerging evidence that supermarket chains' buying direct from processors is excluding of small processors;** as modern retailers take a larger and larger share of processed foods markets, this procurement trend will mean that concentrating retail will spill over to **accelerate and magnify the trend of consolidation in the processing sector; the latter trend is also encouraged and forced by a host of other trends that we have noted, and illustrated in the case of India.**

**g.2) Direct purchase of fresh produce by supermarkets from farmers is still rare in most Asian countries,** except where there are larger agribusiness producers on the supply side (such as supermarket chains in Indonesia buying directly from large potato production companies). Rather, supermarket chains tend either to still buy from wholesale markets, or to buy fresh produce from specialized/dedicated wholesalers (discussed above for the Bimandiri case in Indonesia) who in turn tend to buy from sets of preferred suppliers. Occasionally, such as in the case of Reliance in India or Cargill (a domestic chain) in Sri Lanka, the chain buys via collection centers from farmers.

**g.3) There have been several reviews recently of the impacts of processors' contracting and supermarket chains' direct sourcing, on farmers** (See Barrett et al. 2012; Reardon et al. 2009). The key findings are as follows.

**(1) There seems to be a general tendency for modern processors and retailers to source from dynamic, close-by zones, rather than hinterland and (agroclimatically) un-favored zones.** This tendency then merely reinforces the prior and ongoing "exclusion" of hinterland zones from the fruits of the growth of urban markets.

**(2) There is no clear pattern – but rather mixed findings – regarding whether small or very small farmers are excluded** from supermarket sourcing or processor contracting. The small set of studies of this question in Asia, like elsewhere, find that sometimes they are excluded (mainly where the buyers have fitting and easy alternative suppliers among larger farmers or sometimes from imports), and sometimes they are included (especially where small farmers are the main source of the produce).

**(3) There appears some tendency for non-land asset-poor farmers, regardless of their land size, to be excluded.** This finding makes sense in that the non-land assets are typically the key conditioners of quality and consistency by the farmers – such as irrigation. As quality and safety requirements of buyers gradually rise, from private

demand or from food safety regulation or from import competition, this source of exclusion may rise.

(4) **There is some evidence that large processors and retailers “help” small producers who face constraints of information, credit, and inputs. The modern buyers are thus helping to resolve “idiosyncratic market failures” facing small or non-land asset poor farmers.** This is often just a private initiative of companies; sometimes it is helped and encouraged by government programs, such as the Government of China’s program to help supermarket chains buy direct from farmers. Note that this “helping hand” is not confined to large firms; we found for example that modern cold storage firms, medium sized companies, also provide credit and input sales to potato farmers in western Uttar Pradesh.

## **5. Fourth Transformation: The Rise of the Rural Nonfarm Labor Market**

a) **Rural nonfarm employment (RNFE) has grown over the three decades to be an important share of rural employment and incomes in Asia.**

**RNFE income is important to rural Asians.** Hagglade, Hazell, and Reardon, henceforth HHR (2007, 2010) note that, based on the review of a number of surveys in various Asian countries<sup>6</sup>, that the average share of rural nonfarm employment, RNFE (employment in manufactures and services, in rural areas) is **40% of total rural incomes; migration income is an additional 11% of total rural incomes; these two (local versus migratory nonfarm income) sum to 51% of rural incomes.**

**RNFE income shares in total incomes are usually higher than “full time” RNFE shares in total employment.** For example, HHR find in a review of full time employment censuses in Asia that the share of local RNFE in total employment is only 24%, well below the 40% income. On average over countries, employment shares are some 20% below income shares. **This is because of much of the RNFE is part time and diversification of income is preponderant.** For example, Davis et al. (2010) for Bangladesh, Nepal, and Pakistan, that many households (52%, 53%, and 36%) earn diversified sources, where no one source exceeds 75% of their total income.

**RNFE income has grown over the past several decades, illustrated here by India’s experience.** There is little systematic data over countries to show this; but individual country cases show this. I illustrate the point here with data from India. Lanjouw and Murgai (2009) show a shift, using NSSO rural household survey data over 1983 to 2004, in the share of total rural employment that is in nonfarm self-employment, going from 10.9 to 14.5%; for casual - wage RNFE, from 5.2 to 9.6%; for “regular RNFE” (salaried RNFE), from 6.4 to 7.3%. Summing these, they show the RNFE employment share from 22% to 31% over this period; note that this is “as full time;” recall the caveat above that this understates the share of this employment in income due to diversified incomes or non-specialization). By contrast, the share

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<sup>6</sup> Bangladesh, China, India, South Korea, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam.

of the “cultivator” as full time employment dropped from 38.4 to 31.9%, and farm wage labor earners, from 24.3 to 21.8%.

Kumar et al. (2011) show that from 1983 to 1994, 60% of rural job growth was from the farm sector; but from 1994 to 2005, 60% of rural job growth came from the RNFE sector. From 2004 to 2010, total rural employment dropped 5 million even while 13 million new RNFE jobs were added.

Corroborating RNFE’s growth in India from a macro perspective, Himanshu et al. (2011) show that from 1983 to 2004, the RNFE GDP grew 7.1% per year (with a jump from 6.4% per year in 1983-1993, and then 7.7% a year from 1993 to 2004); compare those rates with the agriculture GDP that grew 2.6% per year over those 20 years.

Himanshu (2011) also goes down to the micro level by showing data from a single village taken in some sense as representative, that of Palanpur, where from 1983 to 2008/9 the share of RNFE in total village income rose from 34% to 67%. These changes are similar to those shown in HHR, who review survey studies in India that average to show a change in the share of income from RNFE rising from 26% in 1968 to 36% in 1980 to 46% in 2000.

**RNFE employment in general is much more important to rural Asians than migration employment and farm wage labor.** In popular and also research discussion of “off-farm income” in Asia the assumption is that most comes from migration income and from farm wage labor income. This was shown for migration above.<sup>7</sup> For the case of farm wage labor, Davis et al. (2010), for Bangladesh, Nepal, and Pakistan, show that the share of rural income from farm wage labor is 20, 13, and 9%, respectively, while that of RNFE (wage and self-employment) income is 36%, 30%, and 40% for the three countries, respectively. The ratios of farm

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<sup>7</sup> There are some exceptions to that general finding that migration is much less important than migration income. On the one hand, there are some countries, or rather areas within some countries, where migration income outside the local area is an important share of income and employment. For example, in western and central China, income outside cropping can be a third to half of income, and of that non-cropping income, an important share can be from migration; but note that the literature shows that much of that is still “local” in the sense that it is within the local area around the village, within the province: roughly 40% of employment in migration is outside the local province, and 60% is local semi-migration, sometimes called commuting. The converse is also the case, illustrated by the situation in India; much (with estimates around 50-60%) of “rural” nonfarm employment is actually not in the rural areas per se but in commuting to local towns. This spatial aspect has been under-researched so these estimates are based on just a few studies. On the other hand, there are some countries where migration is important but is very concentrated in terms of participation (a small share of households migrate, but those that do earn a substantial amount of their income from that); this is the case in Bangladesh for example.

participation rates for RNFE versus farm wage labor employment for the three countries are 53/35, 52/38, and 58/20%.

**Rural income diversification (away from just dependence on grain income) from the rise in RNFE far exceeded such diversification from the shift from grains to horticulture and other non-grain cash crops.** Kumar et al. 2011 show that the shift in the share of (full time) employment in RNFE over 1983 to 2004 (from 19% to 32%) can be compared with the shift from 1.9 to 3.5% of employment in horticulture and 4.3 to 9.8% of employment from cash crops. Of course the same caveat as noted above comes into play, that these shares of full time or majority employment understate the shares of these categories in total income due to activity diversification.

**b) RNFE is bimodal - composed of low return (equivalent of subsistence cropping) and high return (poverty alleviating) activities.**

RNFE activities tend to be mainly services (commerce/transport, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR 2010). The activities are a mix of: (1) **casual wage employment** (for relatively low wage, sometimes often below or at the agricultural wage (as in Bangladesh) or modestly above the farm wage (as in India); (2) **salaried “regular” employment** (like a government employee like a rural teacher); (3) **self-employment** (such as owning/managing a micro/small enterprise making cheese).

**The casual wage jobs, and the self-employment jobs (although these vary markedly in returns) are typically relatively low return jobs, while the salaried employment (and some self-employment) are high return job.** It is important to note that the returns can differ very widely across these activities; for example, for Bangladesh, Hossain (1986) showed a long list of RNFE activities ranging from earnings of 4 taka/day to 27.5 taka/day.

**Low return activities typically have much lower entry requirements (in terms of physical, financial, and human capital) than high return activities. One tends to see a strong correlation between poorer households and diversification into low-return off-farm activities,** such as farm wage labor, low return self-employment, and casual wage RNFE (HHR, 2007). For example, for India, Lanjouw and Shariff (2004), echoed with later data by Lanjouw and Murgai (2009), show that households in the various income quintiles (ranging from 1146 to 11,226 rupees) have very different income diversification profiles: the lowest has 38% cropping, 28% farm wage labor, 16% casual RNFE, 11% self-employment RNFE (of the less remunerative kind), 4% salaried RNFE, for 32% of their income from RNFE (and 2% from remittances). The highest quintile had 65% cropping, a mere 2% from farm wage labor and another mere 2% from casual RNFE, but fully 15% for (fourth quintile and 8% for 5<sup>th</sup> quintile) in self-employment (of the more remunerative kind), and fully 21% in salaried RNFE, for a total share of RNFE of 39% for the fourth quintile and 31% for the richest quintile.

**c) Drivers: Push and Pull Factors (differing by dynamic and hinterland zones) and links to types of RNFE generated**



**An important reason for the discussion of the types of RNFE is that the growth of RNFE can be thought of as a mix of the proliferation of low-return RNFE analog to subsistence farming, more of a “refuge” activity (Elbers and Lanjouw, 2001) and the development of high-return RNFE that can alleviate poverty and also feed into investment funds for agriculture.**

**HHR (2007) note correlations: (1) between low-return RNFE activities and “un-favored” zones with low aggregate demand for goods and services from nonfarm sectors; and (2) between high-return RNFE activities and zones with high aggregate demand.** High demand for nonfarm products tends to be generated, as Engels Law would predict, from higher incomes and purchasing power, and from investable surplus to invest in nonfarm activity.

**There is some controversy over whether it is necessary for aggregate demand to come from agricultural development** (as Hossain 1988 and Hazell and Haggblade 1991 emphasize, in their analysis of consumption and production linkages from agriculture in Bangladesh and India), or income from nonfarm activity that developed based on an earlier round of agricultural development (HHR 2007) **or some other source of income, such as proximity to cities or highways between cities or towns (as we discuss below)** or some enclave such as a rural tourism complex, or even from large inflows of migration income.

**The converse is that zones with low aggregate demand can manifest low-return RNFE diffusion.** That low aggregate demand can be from poor agriculture without other sources of income (HHR), or growing agriculture in a zone with poor links to cities (such as shown for Bangladesh by Deichmann et al. 2009, discussed further below), or export markets so that the farmers cannot “realize” sufficient profit from the agricultural development; the most extreme case is where production causes a glut and a price decline. One can find then a paradox of a combination of growing or high level of RNFE (of the low return variety) and stagnant agricultural zones.

**This paradox can explain some findings in India that seem to contradict the “farm development is needed for RNFE development”:** (1) Foster and Rosenzweig (2003) found RNF growing fastest in zones with lower agricultural wages (presumably from weaker agricultural growth and thus derived demand for labor); Lanjouw and Murgai (2009) found that self-employment is greatest in zones with low agricultural productivity in India. (This is similar to findings in Latin America; see Elbers and Lanjouw 2001 and Reardon et al. 2001.)

Note however that even low return nonfarm wage employment can be higher than the farm wage (as Himanshu et al. 2011) note for India, so that the growth of that RNFE can increase farm wages, as Lanjouw and Murgai (2009) find.

**d) Spatiality: RNFE develops especially in proximity to cities and towns**

**This is a key point that links our discussion of urbanization and that of RNFE in Asia.**

Renkow (2007) analyzed conceptually the links between RNFE development clustering around cities and towns, and the presence of agglomeration economies from urban and rur-urban areas as a centripetal force of RNFE toward proximity to urban areas, and congestion diseconomies in urban areas as centrifugal forces to push NFE from cities into surrounding rural areas.

**There have been so far several empirical studies that have tested this hypothesis and confirmed it, showing RNFE clusters near cities/towns; this suggests that RNFE may grow with towns and thus urbanization in general.**

(1) For Nepal, Fafchamps and Shilpi (2003) found RNFE spatially concentrated around cities and towns – specifically within 4 hours of large towns and cities, and within 1 hour of the village/rural town market. They also found “von Thünen” patterns for crop production – with vegetable production concentrated within 1-3 hours of cities and towns, and commercial paddy within 3-5 hours. Paddy marketing and fertilizer use fell off very sharply or disappeared beyond 5 hours around cities and towns as one entered the deeper hinterland areas.

(2) For Bangladesh, Deichmann et al. (2008) found that in the areas near cities and towns, the RNFE share of rural incomes was 56%, versus only 41% in the hinterlands. The hinterland features RNFE of the low-return type, while RNFE near towns is higher-return wage and self-employment. Moreover, Deichmann et al. cross the analysis of effects of urban proximity and agricultural potential and find that high potential farm areas that are near to cities have a lot of high-return wage and self-employment RNFE – but that if the high potential farm area is far from the city (and thus aggregate demand sources and agglomeration economies), the share of high return RNFE is low and low return RNFE by far predominates, often just focused on local services; they note that 28% of the latter is at a return below even the low farm labor wage.

(3) For India, similar to Deichmann et al., Lanjouw and Murgai (2009) found that the urban share of the zone is correlated with a higher incidence of “regular RNFE” (high return wage employment) and self-employment, but not casual, low wage RNFE.

(4) For India, Hazell, Ramaswami, and Rajagopalan (1991) found that rural road density radiating from cities and towns heightens the production- and consumption-linkage effects (in creating RNFE) of agricultural development from the Green Revolution.

(5) An extension of the Hazell et al. (1991) findings about the effects of roads can be found in Bhalla’s (1997) finding that major highway “corridors” between big cities in India form magnets and nodes for RNFE development along and around them; in fact she showed that over decades, these infrastructural linear nodes draw RNFE such as small manufacturing from more hinterland areas, and increase the average size of the firm and increase thus the overall wage employment share in RNFE.

(6) Kumar et al. (2011) show for some states in India that fully 57% of the RNFE jobs are actually commuting and/or temporary local migration from more rural to rur-urban areas and rural towns to work.

**However, urbanization in/near rural areas can be a two-edged sword for RNFE: urban manufactures, produced for mass markets using large scale plants enjoying economies of scale, may compete with RNFE-supplied manufactures.** The cities and towns in rural areas, and the rural roads and inter-city highways are conduits from urban industry to rural areas of these products. This can challenge small scale rural manufacturing with both cost and quality and variety competition. An example is the large-scale food manufacturer in Indonesia, Indofood, selling basic processed food items through convenience store chains into rural towns into rural areas and crowding out cottage-industry goods (Reardon, Stamoulis, Pingali, 2007).

#### **e) Effects and Correlates of RNFE growth on Agriculture and Farm Labor Markets in South Asia: Hypotheses and Findings**

##### **e.1) RNFE (and other factors) drive up the farm wage (in turn inducing mechanization)**

**Farm wages have risen over the past three decades. With the Green Revolution, there was at first a period (in the 1970s) of farm employment increase but without wage increase as labor-intensive high yielding varieties diffused (Lipton with Longhurst, 1989), and then a period of moderate wage increase (with greatly varying rates over zones), and then evidence of acceleration in the past 5-10 years in various countries of a sharp upswing.** In India, Lanjouw and Murgai (2009) note that, in 1993 terms, farm wages doubled from 1983 to 2004/5. Gupta and Sidhartha (2011) note that farm wages rose quickly in the second half of the 2000s. These two India pieces emphasized that the wage growth rates differed markedly over zones. Zhang et al. (2011) note that farm wage rates grew steeply from 2003 on in China, and Zhang et al. (2013) note the same for Bangladesh in the late 2000s, in what they describe as evidence of a Lewis Turning Point.

**The studies in India, China, and Bangladesh note that farm wage growth was driven by: (1) RNFE and migration tightening the labor market; (2) farm productivity growth in some zones.**

**The rise of the farm wage has in turn spurred the spread of farm mechanization, even on small farms. We discuss this further below.**

**e.2) RNFE and migration remittances in turn appears to facilitate purchase of farm machines (such as Estudillo and Otsuka 1998 and Takahashi and Otsuka 2009 show for Luzon, Philippines in a panel study) and other lumpy investments that permit diversification (such as pumps for fish ponds or irrigation for fruit orchards).**

**e.3) RNFE and migration remittances are one way (beside labor- and capital-led intensification, discussed below) for farm households to continue to farm very small farms – as part time farmers (HHR 2007).**

## **6. Fifth Transformation: Farm Technology and Scale Change and Rise of Intermediate Factor Markets**

### **6.1. Farm Technology Intensification and Rise of Intermediate Factor Markets**

a) **In general** over Asia over the past three decades, there has been “intensification-cum-commercialization/diversification”: (1) farms have commercialized; (2) the agricultural sector has diversified (into non-grains, mirroring the diet diversification) while individual farms have specialized (into cropping, or livestock, poultry, aquaculture); (3) farms have shifted from non-purchased to purchased input use (from human to animal to machine power, from manure, byproducts, and residues to chemical fertilizer, and to use of more pesticides and herbicides) (Pingali and Rosegrant, 1995, as well as in analyses of the Green Revolution stages in Cassman and Pingali, 1995, Estudillo and Otsuka, 1998.) These changes occurred earliest and fastest in the “classical Green Revolution” zones, particularly lowland rice systems and irrigated wheat areas. It should be noted however that in these areas as early as the mid-1990s/early 2000s there were warnings that yield growth had begun to plateau despite this intensification (see Cassman and Pingali as well as Lipton (2000)).

**A second wave of this intensification-cum-commercialization occurred, also mainly still in rice and wheat and horticulture areas, in zones that in the 2000s were “catching up” with the initial Green Revolution zones;** this is depicted for example in recent studies in western and central Uttar Pradesh in India, northern Bangladesh, and northeast China in rice and potato (see Reardon et al. 2012a). There was another source of intensification with the development of horticulture in the 1990s-2000s (see for India, Joshi et al., 2004, and Birthal et al. 2012).

b) **The increase over several decades of the farm wage (discussed above) drove a continuous rise in the use of farm machinery** – first for “power” replacement of human and animal power, for example in land preparation, and then “control” replacement for harvesting and weeding (with the latter also and especially addressed by the **rise of the use of herbicide**) (Pingali and Rosegrant 1995).

**RNFE (and thus urbanization, by extension, given our discuss above) appears to have two way effects with the increase in the use of farm machines.** On the one hand, **RNFE and migration remittances are associated with ownership of machines**, as RNFE provides cash to buy the machines (as credit for machine purchase is usually limited); Takahashi and Otsuka (2009) illustrate this in the case of Central Luzon in the Philippines over 1979 to 2003. On the other hand, **using farm machines also frees labor for both migration to cities and local RNFE**; a similar effect comes from using RNFE cash to replace home labor on farms with hired farm labor, as shown in Takahashi and Otsuka).

**Empirical studies find that RNFE is poorly correlated with use (rather than ownership) of farm machinery – mainly because of the existence of active rental markets for farm machines,** that appear to have grown quickly over time (for discussion of this in rice zones, see for example a study of the Philippines by Takahashi and Otsuka (2009), and for rice and potato in Bangladesh, China, and India, see Reardon et al. (2012a).

**Rental of farm machines has further developed recently with the spread of outsource-services of teams of labor with large harvesting machines in China that go from province to province harvesting rice** (see a study of a cluster of such operations based in Jiangsu, each serving hundreds of farmers spanning many provinces over months per year of harvesting, discussed in Yang et al. 2013). **This allows economies of scale on the machine side to small farmers (analogous to small farmers on the output market side to deal with post-harvest services that are increasing in scale – thus small farms wedged between consolidating and scale-increasing services on each side of them in the supply chain.**

**A similar arrangement in fruit farming in the unique analysis of “sprayer traders”** found by dela Cruz et al. (2010) on Luzon in the Philippines: teams of labor equipped with pruning and spraying and harvesting equipment service numerous small mango farms both in all the steps of production but also in harvesting and marketing the mangoes. Small farmers thus benefit from equipment expensive for them, labor supply concentrated and managed in one site in a timely way, as well as special skills and expertise of these teams.

**c) Beside the rise of the machinery purchase, rental, and outsourced services markets, there has been a rapid development of “intermediate factor markets” (Johnson et al. 2003) in Asia, such as those of chemical fertilizer and improved seeds, and in some cases private water markets.**

**The development of the supply side of these intermediate factor markets appears to have mirrored the development of output markets discussed in Reardon and Timmer (2012), with a first phase of “modernization” developed as a public sector action (such as the widespread construction of wholesale markets and public grain depots) and then a second phase of private sector (traditional and modern) development of output market facilities and services. In the input supply sector there is a parallelism:** in the 1960s-1980s Asian governments developed fertilizer and seed depots for subsidized input sales to Asian farmers; in the 1990s and 2000s these diminished in importance with a second phase of development of private sector (traditional and modern) input sales outlets. Our surveys showed that farmers in India, Bangladesh, and China source from very little to a minority of their external inputs from state outlets (see Reardon et al. 2012a). An exception is that pesticides/herbicides markets have traditionally mainly been private sector (traditional or modern) rather than state distribution systems.

**d) A very important point for this paper is that both the “capital-led intensification” (to use Lele and Stone’s 1989 phrase) noted above, and commercialization and diversification, have diffused very unevenly over Asian rural areas, as we emphasized for all the**

**transformations in the introduction to this paper.** The reasons for this unevenness meld with a discussion of drivers of the intensification cum mechanization, and we discuss them both in turn here.

**d.1) The most obvious unevenness comes from agroecological differentiation over zones, unmitigated by infrastructure** – for example, zones with low rainfall that have little irrigation (Rajasthan), or zones with high rainfall that have little drainage tiling (eastern Uttar Pradesh) are disadvantaged.

**Geography, performance, and potential are, however, not static, but rather are malleable:** in the past decade, the western area of Gujarat has shifted toward an intensive, multiple cropping grain area, and the eastern area, to a horticulture area, with the installation of large power grids that allowed a shift to extensive use of irrigation. Another example we can derive is comparing Lipton with Longhurst (1989) characterization of Madhya Pradesh as lagging the Punjab in the 1980s, with Reardon et al. (2012a,b) findings of rapid intensification in the western and central areas of MP in the 2000s.

**d.2) Areas well served by rural roads, and those closer to urban areas, have lower transaction costs of getting inputs, and higher use rates, as discussed above.** Striking findings of differences in external input use between hinterland and non-hinterland areas are found in the Fafchamps/Shilpi (2007) study on Nepal, and Reardon et al. (2012b) study in three states in India, comparing dynamic/connected and hinterland areas. There is however the methodological issue of controlling for agroecology when examining the impact of urban distance and rural road density; hinterland areas can often be mountainous or arid areas. That is why the study by Deichmann et al. (2011) in Bangladesh is particularly interesting for its crossing of distance to city with agroecological indices (in studying RNFE; this method needs more application to technology diffusion).

**e) Areas that are generating RNFE and migration remittances can also exhibit capital-led intensification.** This is a more complex and sometimes ambiguous relation. On the one hand, nonfarm income can generate cash to invest in farm machines and inputs, and even hired labor, as Takahashi and Otsuka (2009) illustrate; this may be even more marked in areas with credit constraints. On the other hand, in some areas nonfarm activity can be a substitute for intensification, relieving the need for it (including where agroecological conditions make it impractical) by diversifying income.

## **6.2. Farm Size Distribution Change – and its links to factor market and agricultural technology change**

**a) There is evidence of aggregate decline in farm size in Asian countries.** Eastwood et al. (2010) examined aggregate data from Bangladesh and India, China, India, and South Korea over 1950 to 1990, and found a gradual decline in average farm size.

**b) Asian farm sizes average small but nevertheless there is substantial variation over farm sizes.** Using data from the 1990s, Eastwood et al. show that: (1) South Asian farm sizes average 1.4 ha, with a Gini coefficient of 54%. 92% of the farms are under 2 ha, but fully 60% of the area under farming is of farms great than 2 ha; (2) in East Asia, the average is 1 ha, the Gini is 50%, 92% are under 2 ha, and nearly 40% of the land is of farms above 2 ha; (3) in Southeast Asia, the average is 1.8 ha, with a 60% Gini coefficient; while 57% of the farms are under 2 ha, only 77% of the land is of farms over 2 ha.

**In these figures I have deliberately emphasized three things: (1) the average farm size is indeed small; (2) but the Gini coefficients are fairly large; (3) and in South and Southeast Asia, 60% and 77% of the farmland is operated by farms over 2 ha. These broad findings open the door to exceptions that we have observed in recent field surveys in several countries – where the average farm size in the country is small, but in several study zones the average size is larger, and the share to medium and large farms is substantial.** I return to that below.

**c) The literature generally hypothesizes the following reasons for the persistence of small farms,** and even the average decline of farm size, in Asia:

(c.1) families are growing and divide up their land to sons (Eastwood et al.);

(c.2) land reform in India has been somewhat effective in the long term (Eastwood et al. 2010);

(c.3) RNFE (and remittances from migration) allows small farms to persist as they can be part time farmers (HHR 2007);

(c.4) labor-led and then capital-led intensification allows small farms to grow in productivity and compensate for land constraints;

(c.5) irrigation allows multiple cropping;

(c.6) high-value agricultural diversification such as into vegetables allows even small farms to be viable (Joshi et al. 2004);

(c.7) ability to outsource harvest, land preparation, and spraying-trading services by machine service providers allows small farmers to enjoy input side economies of scale (see above).

(c.8) Some countries, such as China, have had strictures on land transactions (Deininger and Jin 2009).

d) Here I illustrate the above trends with the case of India. The text table below shows both the average decline but paradoxically also the persistence (although with some aggregate decline) of the major farming role of medium/large farmers.

Text Table: Changes in the size and distribution of landholdings in India			
Farm category	1980-81	1991-92	2002-03
% share in holdings			
Small (LTE 2 ha)	75.3	80.6	86.0
Medium (2-4 ha)	14.2	12.0	9.0
Large (GT 4 ha)	10.5	7.4	5.0
Total (millions farmers)	71.0	93.5	101.3
NOTE % of medium/ large in farmers	24.7	19.4	14%
% share in area operated			
Small	28.1	34.3	43.5
Medium	23.6	24.1	22.5
Large	48.4	41.6	34.0
Total (millions ha)	118.6	125.1	107.7
NOTE share of medium + large in operated area	72%	65.7%	56.5%
% of rented-in area	7.18	8.52	6.5%
Average size of holding (ha)			
Small	0.62	0.57	0.53
Medium	2.77	2.69	2.66
Large	7.69	7.53	7.23
All holdings	1.67	1.34	1.06
Source: Government of India (2006)			

The table shows that: (a) the average landholding is declining; (b) the share of the medium and large farmers in total area is declining; (c) but the latter still farm the majority of land: 14% of farmers are medium/large, but farm 57% of the operated land.

e) **Is there any reason to believe that while the above picture over 20 years shows a farm size decline, that a 40 year long table might not map to a U curve of farm size? Or if this does not occur for the country or countries as aggregates, it may occur in substantial regions of countries?**

**While this section is speculative, I offer reasons for a hypothesis that average land size may indeed climb in at least some areas of Asia, even South Asia, over the next two decades.**

e.1) Recent survey evidence in “dynamic zones” of intensifying and diversifying farming, near to cities, shows average farm sizes are higher than average, and rental rates are high



and growing fast. An example of this is in Western and Central Uttar Pradesh (even controlling for Punjabi settlement areas in those zones); see Reardon et al. (2012a) and vegetable areas in West Java (Natawidjaja et al. 2007). Small farmers in these areas are selling or renting out part or all of their grain farms to larger grain farmers or large vegetable or fruit farmers, and then relying on RNFE and migration labor markets. I surmise that as urbanization proceeds, and provides more spillover effects of RNFE development, strong product market development, and migration opportunities, this apparent concentration process will continue in these dynamic areas.

e.2) The above could be accelerated as cost side pressures (such as on energy and water) and demand side pressures (for product quality) affect the viability of at least the marginal farms. Reardon et al. (2012a,b) found in India distinct differences between marginal farms, and small and medium farms in these zones.

e.3) Gradually regulations restricting land transactions will ease, for example in China; this is extrapolating from the gradual but steady reductions in limitation to rent land (Deininger and Jin 2009) and recent experiments in land titling for sale in some parts of China.

e.4) Agribusiness investments in tracts of land (such as FDI in farm land in Cambodia or Lao PDR, or purchase or rental of large tracts of land by domestic agribusinesses such as the Reliance mango plantations in India, or the “long lease of township farmland” by agribusinesses in China) could increase and lead to concentration of land in some areas.

e.5) Food industry and agribusiness sectors are consolidating in Asia. I have noted above that, outside of land investments, this upstream and downstream consolidation does not necessarily imply pressure for consolidation in the farm sector. Agricultural services like mechanization services can lower costs to small farms; processors and supermarkets can implement hub and spoke models to source from small farms via collection centers and specialized wholesalers, or they can rely for some time on the wholesale markets. The way that consolidation downstream can eventually put pressure on farm sector consolidation may be through a combination of forces that led to farm concentration in traditionally small-scale farm sectors like poultry or pig or fish operations in developed countries. The pressures can be to cut costs in ways that eventually just using own labor cannot support, and farm equipment investments are needed, and even more plausibly, that pressure to augment product safety and quality may come from the consolidated downstream firms. One can see this pressure already in the dairy and pig sectors in China, and the fish sector in Bangladesh.

e.6) The mechanization trends displacing farm labor, and the convergence of use rates of chemicals and improved seed, may reduce yield advantages that smaller farmers have in some places. Already, in the intensified agriculture zones we have studied in India, China, and Bangladesh, there is little yield difference over farm size strata.

e.7) There is some evidence of concentration of RNFE, as capital requirements for viable businesses increase under competition from urban areas. This concentration in the labor market may translate into concentration forces in the land market. (This point was argued in Africa by Reardon et al. 2000.)

f) However, that there does indeed appear to be evidence of a “poverty trap” below a certain land threshold, such as we see in our India field surveys, below 1 ha, and in certain poor agroecological and hinterland areas. These traps may not be amenable in the longer run to any of the possible land concentration forces noted and may fragment further.

## **7. Implications for Asian Agricultural Research and Development Strategies of the above 5 inter-linked transformations**

The paper has emphasized that the agrifood sector of Asia is undergoing rapid transformation. The change is so rapid because there are five mutually reinforcing and encouraging transformations occurring at once. I have shown the connections among them in all directions.

Moreover, the paper has emphasized that while a significant part of the transformation is driven by the “private sector”, popularly thought to mean the large and multinational players in the food business, in fact a very large part of the transformation has been due to private domestic investments by small and medium firms and farms in the traditional systems. The state has played a role at the margin in the recent decades, having played an initiating and formative role in the transformation before that.

Finally, the paper has emphasized the extreme differentiation over countries and over zones within countries, pointing to the existence of 3 rural Asia's. (1) The rural Asia zones that are transforming fastest and with the least external needs and help are the dynamic zones around the cities and towns, a substantial part of rural Asia. Capital-led intensification and RNFE development often develop in these zones and complement each other to spur growth. (2) On the other extreme is the most hinterland zone, where agriculture is poor, infrastructure is poor, and aggregate demand is low, leading to RNFE being mainly low return and subsistence. This is the zone with the most need, but also unfortunately appears to be in line for a long period of lagging, and export of labor and perhaps acquisition by large firms for land extensive operations. (3) In between is a substantial area in Asia that has “high potential but low performance”. This area was perfectly identified in the Deichmann et al. study in Bangladesh as having strong agricultural potential but being relatively far from cities.

I have called these latter, “intermediate zones” “the missing middle” in my prior work in Africa. It appears that these zones have the highest promise for return to research and development efforts to promote sustainable capital-led intensification, RNFE, and at the same time to build the infrastructural base to connect to sources of demand, mainly in the growing cities and towns, even rur-urban areas.

I have also emphasized that while there is a small farm domination in numbers, this disguises two trends of strategic importance. The first is that there is substantial heterogeneity in the farm population, with marginal farmers, and asset poor small farmers (as compared with small farmers) least sharing in the benefits of the transformation. The second is that small-medium and medium farmers dominate output supply, and may in the longer run set the cost and quality competition bar for the smaller and poorer farmers to meet, and be challenged by.

The above points imply the need for differentiated strategies for the geographic and socioeconomic strata.

A final set of points focus on the need for research and development strategies to help the farm areas of Asia to meet demand trends. The overwhelming fact is that the urban food economy is already the majority of food demand in Asia, and in several decades, will be the vast majority of demand. That means that meeting urban demand, and developing the rural-urban supply chains to do so, will be of major importance. This will mean more research and development on post-farmgate segments of the supply chain – processing, logistics/distribution, and retail.

Moreover, the nature of that demand is shifting gradually and steadily toward non-grains for the majority of food needs. Much more focus will need to be made on horticulture, aquaculture, meat, oilseeds, dairy, and feedgrains. There will also need to be more focus on attributes beyond yields (even as yields continue to be important for overall food costs): quality attributes for modern markets, food safety, and ability to withstand climate shocks.

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