COVID-19’s Disruption of India’s Transformed Food Supply Chains

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COVID-19 has created high transaction costs and uncertainty in India’s transformed food supply chains, putting food security at risk as 92% of food consumption in India is purchased predominantly from the private sector. Government faces the challenge of marshalling resources between mitigating the impending food crisis and containing the contagion as the risk of sociopolitical tensions looms large. It is recommended that the government concentrate on sustaining the food supply chains towards eventual rebound, recognising that government food distribution cannot replace even a tenth of the market.

COVID-19 is spreading through the developing world and has not spared India. In response, the Indian government has imposed rigorous lockdown regulations, which have an impact on all aspects of the economy. How will the COVID-19 affect food supply chains (FSCs) in India?

To understand the impacts of COVID-19 on the Indian FSCs, it is crucial to start by considering some surprising realities of the new Indian FSCs. There has been a deep and rapid transformation that has shifted the FSCs from being “traditional” to largely “transitional” in just two decades, making India one of the fastest changing agrifood economies in the world. The Indian food economy now is mainly urban, fed by long rural–urban supply chains. It is now 80% composed of non-foodgrains and thus fed by perishable FSCs, 60% post-farmgate, and 85% dependent on small and medium sized enterprises (SMEs) that are dynamic and clustered near and in towns. It is 96% dependent on the private sector (with government managing only 4% of India’s food). It is characterised by highly integrated rural hinterlands, peri-urban and urban areas, having tight and fluid connections in both directions.

These facts about the new Indian FSC are a “reality check” relevant for the debate on the pandemic’s implications for India’s FSC. Thus, we begin with an account of these key facts, then hypothesise the impacts of COVID-19 in their context, and conclude with strategies and policy recommendations for mitigating the potential disruptions.

Key Facts of the New Indian FSC

India is very heterogeneous in terms of development across states and zones within the states, with some parts of India being similar to South East Asia in development levels, and other parts similar to that of Africa (Pingali et al 2019). The characteristics we note here are averages, and there is a variation around these averages.

Dominance of purchased food: Of all the food consumed, 92% is purchased. This mirrors the great importance of FSCs for India’s food security. We obtained this 92% as follows:

(i) Of all the food consumed in India, 60% is consumed by urban consumers. This is calculated from the National Sample Survey Office’s (NSSO) 2011–12 data on food consumption per capita in urban and rural areas, in value terms. Essentially, all the food consumed in urban areas is purchased, since almost all urban households are net buyers of food. Note that this exceeds the urban population share because the level of food expenditure per capita is higher in the urban than in the rural areas. There are various estimates of the urban population share in India. The official one is 31% based on the 2011 Census. Onda et al (2019) estimate the share at 43% using a community-detection clustering algorithm to construct urban agglomerations for all of India. Whatever the estimate be, it is below the urban share in the overall food economy (purchases plus own production).

(ii) Of the 40% of India’s food that is consumed in rural areas, 86% (in value
terms) is purchased (while the rest is home-produced on own farms). This 80% figure is a conservative estimate, which in turn is a simple average of two estimates: the first is 84% in rural areas, based on NSSO 2011–12 (GoI 2013); and the second is 75% from the survey villages of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), which tend to be in the “poorer than average” semi-arid zones (Kumar et al 2019). The high share of purchases in overall food consumption in these poor villages shows the high dependency of even the hinterlands on the food markets.

Thus, India’s FSC in terms of the purchased food market is enormous. Using the food balance sheets of the Food and Agriculture Organization Corporate Statistical Database (FAOSTAT) for a rough estimate, one finds that India produced 1.224 billion tonnes of food in 2017, exported 35 million tonnes (or 2.8% of its food output) and imported 29 million tonnes of food (or 2.4% of its food output). Ninety-two percent of 1.224 billion tonnes, that is, 1.12 billion tonnes of food, constitutes the purchased food market of India.

Private sector-dominated purchased food markets: The private sector sells 95% of all purchased food, while only 5% comes from the government via the public distribution system (PDS). Overall, the government plays a tiny direct role in national food security (in terms of distributing food). This implies a very limited capacity of the public sector to “replace” the private sector in supplying food to the Indian consumers.

We estimated the 5% share of the government based on that: (i) the PDS bought 27.6% of rice and wheat output in 2017–18 (Mann 2018), (ii) rice and wheat constitute 74% of all foodgrain output (Tiwari 2020), (iii) foodgrains constitute 21.5% of all food consumption (in value terms) as per the 2011–12 NSSO survey, and (iv) PDS supplies 4.8% (rounded to 5%) of the food consumed in India (with 4.8=4.4/0.92).

Post-farmgate dominates FSC activities: Sixty percent of all FSC activities are post-farmgate. We calculated this from the data on the share of farm production in the final retail prices, obtained from existing empirical studies of rural to urban FSC and weighted the product-specific findings by the shares of grains versus non-grains in total consumption. For example, Reardon et al (2012a) show that the share of post-farmgate segment in total consumer price of rice for supply chains to Delhi is 35%, while for potatoes, it is 70%. A consumption-weighted average gives 60% as the post-farmgate share.

SMEs dominate FSCs: Between 72% and 83% of food consumed in India is handled by private SMEs. The SMEs are in wholesaling (both on-market in mandis and off-market in rural towns), processing, logistics, retailing (for example, kiranas, haats), and food services (such as small restaurants and street meal vendors, or dhabas). These SMEs are proliferating very fast, often in spontaneous clusters as part of supply chains to cities, such as the dynamic clusters of potato cold storages in Agra serving the Delhi market (Das Gupta et al 2010) and in several zones of Bihar, serving the Patna market (Minten et al 2011). The food system related SME sector is especially important to Tier 2 and Tier 3 cities and rural towns that constituted 58% of the urban population in 2011 (Tripathi 2013).

Moreover, the SMEs in the FSCs provide self-employment to large numbers of people and extensive casual employment for day labourers for loading and unloading the produce from trucks and carts in mandis and haats, for workers in numerous small mills and warehouses, and so on. The SMEs have higher labour/output and labour/capital ratios compared to the large firms. Moreover, workers are in dense sets in the workplaces. There are multititudes of domestic hired workers, shopping and cooking for millions of Indian urban homes, commuting in from towns or poor districts (Jain and Mishra 2018).

There is an emerging modern sector of supermarkets (Reardon and Minten 2011; Sutradhar et al 2017), fast food chains, and large processing firms (Nuthalapati et al 2018). While India’s modern food sector is among the fastest growing in Asia (Reardon et al 2012b), it has a relatively small share of the overall food economy, constituting 10%–20% of the volume of FSCs in India. While a given large firm employs many salaried employees and day labourers, these firms tend to have lower labour/capital and labour/output ratios than the SMEs. Thus, the employment effects of the variation in their operations per tonne of food are less than those of the SMEs, and far less in the aggregate.

High share of perishables in FSCs: According to the 2011–12 NSSO data, only 21.5% of all the food consumed in India (in value terms) is foodgrains. This is 25% in rural areas and 19.2% in urban areas. Thus, 78.5% of India’s food consumption is of non-grain, mostly perishable products like vegetables, milk, fish, chicken, edible oils, and fruit. The implication is that nearly 80% of food supply is via supply chains of products with short shelf lives that need to be continuously replenished.

Rural–urban food and labour market integration via FSCs: Rural households are closely linked (directly and indirectly) to FSCs and, at the same time, highly integrated with towns and Tier 1 and Tier 2 cities, and farms rely on labour markets. Several points regarding rural employment stand out that are important for our theme.

Rural areas are densely populated, with a large share of these areas being peri-urban as well as close to and linked with “corridor zones.” The latter are where large highways cross rural areas, creating strong “magnetic” linkages with the swaths of rural areas around (Bhalla 1997). The high population density in rural areas in India and Bangladesh is striking. For example, 80% of rural areas in Bangladesh were classed as “peri-urban” based on density measures used across countries in a pan-developing region employment study by the International Fund for Agricultural Development (2019). While we could find no comparable calculation for rural India, there is ample evidence that peri-urban areas are a broad “urban shadow” (Sharma and Chandrasekhar 2014) and cover an important share of rural areas. For example, 37% of new census towns declared in 2011 are concentrated around major metropolises (Aijaz 2019).
Rural households depend for 61% of their income on rural nonfarm employment (RNFE) based on NSSO 2011–12, while 39% of their income is from agriculture. In the past four decades, the share of agriculture in rural incomes has declined from 72% to 39%; the correlate is that RNFE has increased from 28% to 61% (Chand et al 2017). About 88% of farming households rely on some RNFE (Chandrasekhar and Mehrotra 2016).

We posit that a substantial amount of RNFE is linked directly to the fsc (in agrifood wholesale, processing, logistics, retail, and food service) or indirectly to fscs (in logistics and other services). We were not able to find a study with the specific shares of RNFE to these sub-sectors, but the importance of the food economy in rural areas and towns would suggest the link between RNFE and fsc. However, this point should be tempered by the findings of Lanjouw and Murgai (2009) that RNFE employment is not statistically significantly correlated with local agricultural yields but is more strongly correlated with proximity to urban areas.

A large share of RNFE comes from commuting between rural areas and towns (Chandrasekhar 2011). Shocks to the fscs in towns (such as those that we argue are produced by covid-19) reverberate into the livelihoods of large numbers of rural households (DSouza et al 2020) that supply labour to the fscs in the towns.

Farmers depend on (largely landless) farm wage workers for a third of the labour for their farm. Some of these workers commute from local towns to rural areas, while the rural landless depend partly on farm wage labour. We estimate from NABARD (2018) that agricultural wage labour constitutes roughly 32% of rural incomes in 2016–17.

**COVID-19’s Impacts on FSCs**

In light of the aforementioned characteristics of the Indian fscs, we infer that covid-19 will not only affect the overall fsc, but also its distinct segments differently.

**Effects on food security:** COVID-19’s most important effect will be on national food security via its effects on the fscs, as 92% of food consumed in India is purchased from fscs. There is very little “subsistence enclave or refuge” that will be outside of the market effects.

It will have other system-wide effects such as food price inflation and related social unrest that will undermine fsc and, thus, food security in the short term and productivity investments in the medium run. Higher food prices are, in turn, likely to signal impending shortages. These effects can compound each other in a vicious cycle that is likely to cause social unrest (Bellemare 2015).

**Post-farmgate effects:** Most of its effects will be on the post-farmgate fsc—the firms and workers in the midstream wholesale, processing, and logistics segments, and downstream in retail and food service—and much less on farms and farm workers. This is for reasons rooted in the fsc facts as mentioned above: (i) 60% of the fsc and, thus, the formation of food prices and fsc employment come from post-farmgate activities; (ii) post-farmgate activities tend to be clustered in peri-urban rural areas, towns, and secondary cities in areas close to farm areas. Given the properties of covid-19, which is transmitted most easily via human contact, greater population densities tend to facilitate its spread; and (iii) post-farmgate activities are dominated by large numbers of smes that tend to operate in de facto, spontaneous clusters or in dense enclosed areas such as mandis, while farms are spread out by comparison.

**Effects on downstream SMEs:** COVID-19 will have its greatest impact on the smes in the downstream segments of retail and food service. Recall that 92% of Indian food consumption is purchased, and 80%–90% of purchases are from these smes. From the perspective of operations and marketing, downstream smes are labour-intensive, with high densities of workers in small spaces. They have little control over the hygiene practices of their product suppliers or customer habits and crowding. In contrast, large firms face a lower risk of clients and employees contracting the disease as they can enforce hygiene practices and control the flow of entering customers and implement social-distancing measures.

SMEs lack essential tools that supermarkets and fast food chains have for assuring the continuity of access to products and enforcing the hygiene procedures among their suppliers. Large firms use direct purchase arrangements (minimising the middlemen), distribution centres, contracts, private standards, and specialised wholesale agents, to assure supply continuity and hygiene practices. In contrast, the smes must go to the mandis and jostle among many in the auctions and rely on spot market transactions.

After the food safety and disease shocks in the fscs internationally, it is common to see a consolidation; examples are the avian flu in Egypt (Dixon 2015) and dairy food safety in Brazil (Farina et al 2005). The less competitive smes often exit the market because of the initial income shocks and investment requirements to re-enter the market and meet more stringent food safety and biosecurity regulations. There is likely to be an acceleration in the shift towards e-commerce both for retail and for restaurant delivery. This appears to be already emerging in India (Mukherjee and Malviya 2020) when stay-at-home regulations are in place. It is likely that consumers will not fully return to prior buying habits. E-commerce firms and supermarket and fast food chains, and delivery services may see an acceleration of their displacement of the kiranas and the dhabas.

**Effects of midstream SMEs:** COVID-19 will also strongly affect smes in the midstream segments of wholesale, logistics, and processing. It will have less impact on large-scale processors.

The line of argument for wholesale and logistics is similar to our points about retail. The mandis will be under strong constraints, particularly to the extent that logistics controls are enforced for truckers and rural field brokers (Biswa 2020). The implementation of these constraints will probably be more rigorous in the Tier 1 and Tier 2 city mandis and the main highway routes. However, huge mandis like the Azadpur mandi in Delhi and Vaish mandi in Mumbai usually
receive tens of thousands of trucks and other vehicles per day. A full stoppage may be impracticable. Mobility is also likely to be less controllable in the rural wholesale markets in villages and small rural towns.

The processing SMEs, such as the thousands making atta and achar will be faced with the same challenge as the kiranas and the dhabas. They tend to be in dense clusters with strong vulnerability of their employees’ health, markets to kirana stores that usually source from them, and face uncertainty of access to ingredient supply chains. Again, large processors are in a better position as the latter tend to have their own logistics operations and stocks of ingredients in warehouses to tide them over. They also produce packaged goods that may be perceived as more hygienic and storable by consumers.

**Effects on farm sector:** The direct effect of COVID-19 on farms is likely to be limited. Because farms are relatively spread out, the human density in farm areas will be less than in the cities. However, as noted above, India’s rural areas are far denser than other regions suffering from COVID-19; much of the rural areas is in fact a peri-urban dense area (Pingali et al 2019), so COVID-19 spread may still occur in farm areas.

However, the indirect effect of COVID-19 on farms is likely to be substantial, through several channels. First, COVID-19’s main effect on farmers will be through constraining effective demand from consumers via the constraints on the midstream and downstream of the FSC and because of reduction in consumers’ real incomes in the crisis. The effect will be strongest on perishable products such as milk, fruits and vegetables, and fish and chicken, which require more handling and are more income-elastic in demand. Second, its effects on the midstream of input supply chains such as fertiliser and seed will hurt farmers.

Third, COVID-19 could affect farmers’ access to labour. While most farm labour (70%) is own labour, recall that 30% of farm labour is hired. The flow of hired workers from towns to villages or across villages may be constrained by mobility restrictions. That would accelerate a long-term trend of farm wage increase, inducing accelerated mechanisation, which would affect the landless.

However, if urban economic conditions rapidly deteriorate with the crisis, urban workers may return to family villages and swell the farm labour ranks. That would depress farm wages and depress the incomes of the landless. The effects will be more pronounced on rural women, since 39% of rural women work in causal non-farm jobs (Dsouza et al 2020).

Fourth, COVID-19 will likely reduce RNFE, hurting the households of both farmers and the landless. Recall that as per NSSO 2011-12, RNFE forms 61% of rural incomes in India, and that much of RNFE is linked to the FSC directly or indirectly. RNFE is important to fund food purchase as well as farm input purchase and will thus affect food security and medium-term productivity of farms.

**Effects on informal sector:** COVID-19 will have a massive impact on the incomes and jobs of millions of informal sector workers in the rural and urban areas. These workers are with no formal safety nets. We showed that half of rural employment is in RNFE, and half of that is commuting, involving daily or weekly commuting that can be stopped or constrained by mobility regulations. Masses of informal male and female workers operate hundreds of thousands of agri-food SMEs that provide 80% of India’s food, and depend on mandis and haats, and on continuous movement as hawkers, as kiosk operators, as dudhyas and dhaba waiters, and day workers loading tens of thousands of trucks in the great mandis of the land. They are, along with the farmers, the food system heroes, but themselves live hand to mouth.

**Policy Implications**

Policy responses for mitigating COVID-19 will create economic hardships. Enforcing social distancing and limits on internal and external logistics in FSCs, will transform health risk problems into income and employment risks, and political risks.

**Policy challenge:** In the short term, millions of FSC businesses will face lower foot traffic, lower incomes, and substantial unemployment. In the medium term, COVID-19 impacts on these segments may be like the past episodes of avian flu in South East Asia in the 2000s, which induced concentration, leading to rapid increases in market shares of large processing firms and supermarkets.

The above means that the government is juggling with three challenges: (i) reducing COVID-19 with health measures such as movement restrictions and hygiene investments; (ii) supporting FSC’s output and employment in the face of movement restrictions linked to health measures; and (iii) marshalling scarce government’s resources to implement the first two as fast as possible, given the ascending social and political tensions attendant to food price increases, job losses, and the diseases.

**Policy recommendations:** How should the Indian government respond to minimise supply chain disruptions and fallout from lockdowns and other restrictions? The general strategy must be two-pronged: (i) implementing robust public health measures to slow the spread of disease; and (ii) addressing food security impacts, particularly the potentially enormous effects on income and employment.

Recall that, of the enormous volume of food consumed, the Indian government directly supplied only 4% of it. It is clear that even if the Indian government doubles its sales or even transfers of food, it has the capacity of covering 8% or just one month of the food market. It is probable that the “burn down” rate of COVID-19 and the disruption in the food economy will last much more than one month.

Our key recommendation is thus to not start with the idea of government emergency supplies replacing the market, but rather focusing on how to combine health measures with strategies to make the market work, and helping the FSC heal and rebound. That is the only way to avert a food security and employment crisis.

Addressing the FSC issues will require three complementary policy paths.
Implementing new, broad safety nets for the SMEs and workers in the midstream and downstream segments of the RCS is necessary in the short run: (i) for the SMEs, especially in the midstream and downstream, the government could provide immediate support to meet rents and energy and water input needs and labour bills, (ii) for the consumers, the government could provide direct income support for the neediest to meet rents and buy food and energy, indirectly helping SMEs because it will enhance demand, and (iii) for the workers, the government can also establish cash-for-work schemes to employ workers to distribute emergency food rations, to upgrade sanitation in wholesale markets and wet markets, and to maintain essential operations in their own enterprises so that these will exist when the crisis passes.

While food distribution should be mostly through the private sector, we recommend that the government monitor hotspots requiring emergency food distribution, and public action can augment private sector supply channels in those areas. In the short and medium term, it is crucial for the government to make sure that logistics services are left free to operate smoothly. Where there are shortfalls in logistics capacity, the government should augment it.

The government should monitor and regulate wholesale markets, retail wet markets, and processing clusters more strictly, and urgently upgrade and redesign their sites for improved health practices. It should establish clear mechanisms to monitor, implement and enforce the emergency programmes.

Finally, the government needs to make long-term investments to help the SMEs change their hygiene practices and provide better site designs for mandis and small business cluster districts that will enhance health while helping them remain competitive.

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NOTES

1 This average share abstracts from distinctions over net food sellers, net buyers, autarkic, and landless.

2 PDS supplies 5% of the food consumed in India (4.4/70.92).

3 We arrive at this figure based on the estimates that (i) 80%–90% of the volume of purchased food is handled by the SMEs and 10%–20% by supermarkets (Nalapat et al, 2018). (ii) purchased food is 92% of all food consumed in India, and (iii) 96% of purchased food is sold by the private sector, and 4% by government.

4 NABARD (2018) reports shares of income from different sources for farm households and landless. Casual (daily wage) labour (from two components, agricultural wage labour and non-agricultural wage labour) constitutes 54% of farm households’ income, and 54% of landless households’ income. The former are 48% of the nationwide sample and the landless are 52%. The overall casual labour share is 54%. NABARD does not break this down by the two components. We, thus, roughly estimate agricultural wage labour’s share in total rural income by multiplying 54% by 75%, which is the share of farm households engaged in agricultural wage income based on NSSO (GoI 2013). We realise this is a rough assumption. But it produces a share for agricultural wage labour in rural areas nationally of 32%. This may be close to correct as Lanjouw and Murgai (2009) show for the employment share (not income share) 30% for all India from agricultural wage labour.

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