Indian Agriculture:

The view from the ground up

APCO worldwide®

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"Agriculture development is central to our growth strategy. Measures taken during the current year have started attracting private investment in agriculture and agro-processing activities. This process has to be deepened further."

– Finance Minister Pranab Mukherjee, Union Budget 2011-2012

With nearly 12 percent of the world's arable land, India is the world's third-largest producer of food grains, the second-largest producer of fruits and vegetables and the largest producer of milk; it also has the largest number of livestock. Add to that a range of agro climatic regions and agri-produce, extremely industrious farmers, a country that is fundamentally strong in science and technology, a government committed to Indian agriculture and an economy that is on the verge of double-digit growth, and you should have the makings of a bumper harvest.

Yet the comprehensive outlook for Indian agriculture is far more complex than those statistics might suggest. The sector supports an estimated 70 percent of the Indian population, but is also the most sluggish, having just extricated itself from a period of negative growth – of -0.1 percent in 2008-2009 – to rise to an unspectacular 0.4 percent in 2009-2010 with around 5.4 percent expected for 2010-11. Adjusted for inflation, even this 5.4 percent growth looks unexciting when compared to the growth rates in services and manufacturing. Today, agriculture accounts for 14.2 percent of the country's gross domestic product, compared to 51 percent in the 1950s. Worse, India is amongst the world's largest wasters of food and faces a potential challenge to provide food security to its growing population in light of increasing global food prices and the declining rate of response of crops to added fertilizers.

Table 1: Agriculture Sector: Key Indicators

Sl. No.	Item	2008-09	2009-10	(per cent) 2010-11 (Advance Estimates)
1	GDP—Share and Growth (at 2004-05 prices)			
	Growth in GDP in agriculture & allied sectors	-0.1	0.4	5.4
	Share in GDP—Agriculture and allied sectors	15.7	14.6	14.2
	Agriculture	13.3	12.3	
	Forestry and logging	1.6	1.5	
	Fishing	0.8	0.8	
2	Share in Total Gross Capital Formation in the Country (at 2004-05 prices)			
	Share of Agriculture & Allied Sectors in total Gross Capital Formation	8.3	7.7	
	Agriculture	7.7	7.1	
	Forestry and logging	0.07	0.06	
	Fisheries	0.56	0.54	
3	Agricultural Imports & Exports (at current prices)			
	Agricultural imports to national imports	2.71	4.38	
	Agricultural exports to national exports	10.22	10.59	
4	Employment in the agriculture sector as share of total workers as per census 2001	58.2		

Source : Central Statistics Office and Department of Agriculture and Cooperation.

The root causes of a poorly-performing agriculture sector that continues to be the primary engine for sustaining the largest segment of the Indian people are primarily two-fold: (a) India's economic growth trends are not inclusive in character and are being driven more by services and manufacturing; and (b) something has gone terribly awry with Indian planning for agriculture.

Conversely, for technology companies, those with the wherewithal to “green” Indian agriculture or those who wish to engage at the grassroots either from a business or CR perspective, it is in agriculture’s myriad problems that opportunities exist.

From the point of view of international investors some of the longer-term opportunities arise on account of a number of factors including,

- India’s large land mass
- A multi-product basket with enormous export potential
- Year-round cropping
- 70 percent of the population dedicated to farming and allied activities
- Excellent domestic demand
- Global game-changers operating in this space
- Enormous funding commitments from the government
- Considered policy support from the government: four-pronged strategy covering agricultural production, reduction in wastage of produce, credit support to farmers, and a thrust to the food-processing sector

Nevertheless, the challenges cannot be wished away. In the following sections, eight of the key challenges that face Indian agriculture are discussed. Later, some ideas on innovative opportunities for investors which fit well with what India requires are explored.

AGRICULTURAL CHALLENGES IN INDIA

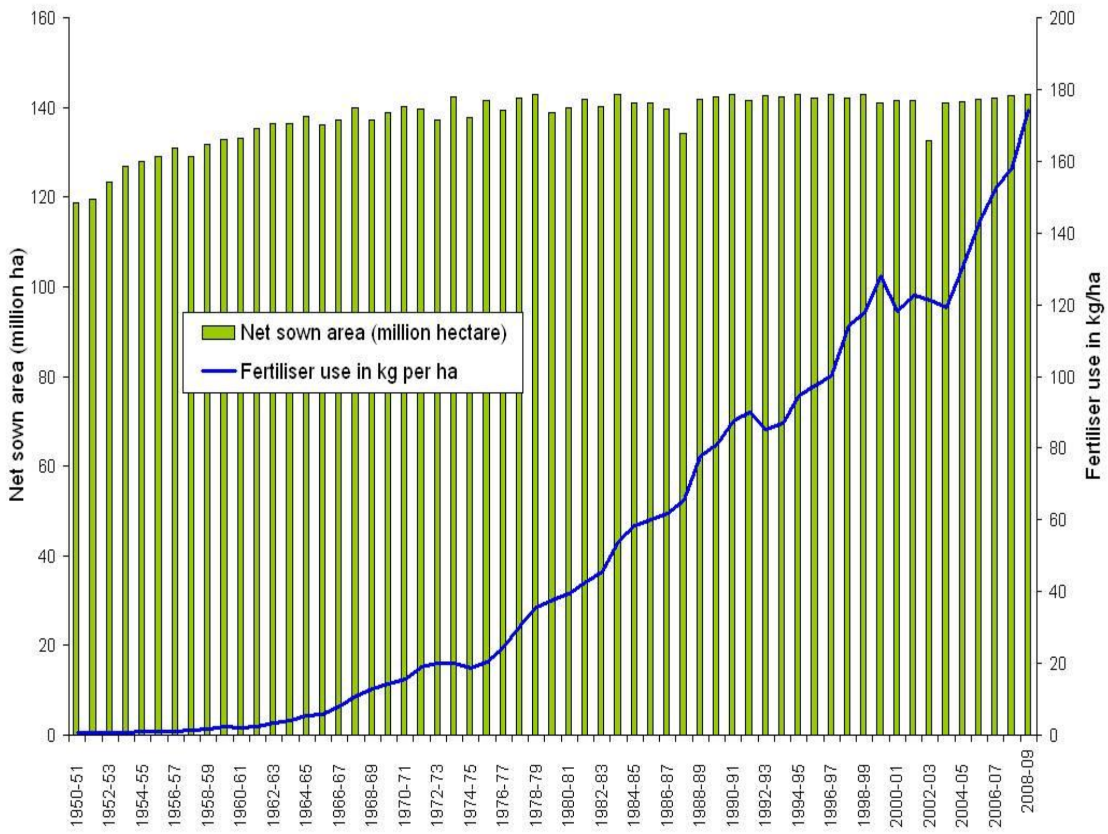
The story of Indian agriculture today is one of farmers at the grassroots stymied for money, advice, basic technology, energy and water. The government, on the other hand, is more focused on the larger though very real issues around food processing, warehousing and logistics.

The **main** issue is that India faces food insecurity even as it wastes large amounts of food. The problem may broadly be examined under the following eight headings and solutions sought under them.

ISSUE 1: FERTILIZER ABUSE

What was traditionally the food bowl of India – the Punjab-Haryana belt – has been devastated by **fertilizer abuse** and consequent soil degradation that has made agriculture an unprofitable business. Fertilizer use has jumped up from merely 0.58 kg per hectare in the early 1950s to 7 kg at the onset of the Green Revolution in 1966-1967 with the adoption of high-yielding varieties of paddy and wheat Fertilizer consumption increased from 784,000 tonnes during 1965-1966 to 1,539,000 tonnes during 1967-1968 to 24,909,000 tonnes in 2008-09. In 2010 the sale of urea in *kharif* (summer or monsoon crop) 2010 season, up to July 31st, was 7.36 million tonnes, up from 6.81 million tonnes in the corresponding period last year.

Table 2: Increasing Fertilizer usages per million hectare of net sown area



Source: Fertiliser Association of India

The fertilizer subsidy bill doubled over the first seven years of the current millennium. The subsidy growth has clearly overtaken the crop growth, with some estimates saying that at least one-third of the subsidy goes to fertilizer producers. The worry is compounded by food productivity not keeping up with the continuous increase in fertilizer application, while soil quality has been simultaneously degraded. Yet another aspect of the fertilizer crisis is around the use of potash. Plants need more potash than any other nutrient, but Indian soils are being continuously mined by crop plants while soils are getting depleted of potash at an alarming rate. Global stocks of mineral potash are not expected to last beyond 30 to 40 years. The implications are grave for Indian agriculture.

Long-term use of synthetic fertilizer has resulted in nutrient imbalance, micro-nutrient deficiency and the deterioration of soil health, causing low agricultural productivity.

Table 3: Increasing fertilizer consumption, but decreasing agricultural productivity

	Fertilizer Nutrient Consumption (Mill Ton)	Foodgrain Production (Mill Ton)	Incremental Fertilizer Nutrient Consumption (Mill Ton)	Incremental Food Grain (Mill Ton)
2004 - 05	18.4	198.4		
2005 – 06	20.34	208.6	1.9	10.2
2006 – 07	21.65	217.3	1.3	8.7
2007 – 08	22.57	230.8	0.9	13.5
2008 – 09	24.91	234.5	2.3	3.7
2009 – 10	26.26	218.2	1.3	-16.3
2010 - 11 (Estimated)	29.93	244.5	3.7	--
Increasing Fertilizer Consumption but Declining Agricultural Productivity				

Source: Fertiliser Association of India

ISSUE 2: REDUCING ARABLE LAND

Further anxiety derives from the **industrial assault on agricultural land** that has led to nationwide turmoil – leading to the impending exit of the Leftists from West Bengal (where they have held sway for more than three decades) and even in Gujarat, which has handled the changing land use professionally. Indeed, the ratio of agricultural land to India's farming population has shrunk to 0.3 hectares per person in India. In advanced nations the area is more than 11 hectares per person.

In a developing country such as India, the dilemma between growth and preservation of the natural habitat will continue to be posed for some time. However, the focus has to be on improving agricultural yields through tried and tested technology, knowledge-sharing and access to energy, credit and decent infrastructure.

ISSUE 3: FRAGMENTATION OF AGRICULTURAL LAND

The **third** associated area of concern is the **fragmentation of agricultural land,** with the average size of the holdings shrinking from 1.69 hectares in 1985-1986 to 1.33 hectares in 2000-2001. The proportion of marginal landholdings (less than a hectare) increased from 57.8 percent in 1985-1986 to 62.3 percent in 2000-2001. More importantly, about 19 percent of the other holdings are in the small farms category: between one and two hectares.

ISSUE 4: AGRICULTURAL INDEBTEDNESS

It is little wonder then that **agricultural indebtedness** has been the bane of the sector. Indeed, at least 10,000 farmers committed suicide every year; the five worst affected states being Maharashtra, Andhra Pradesh, Karnataka, Madhya Pradesh and Chhattisgarh. The government's US$ 1.4bn (INR 71,000 crore) farm loan waiver scheme last year helped large and medium farmers more than small and marginal farmers who are indebted to local moneylenders.

Moreover, increased funding for agriculture and rural development is a partial misconception (see table). Standard credit delivery mechanisms do not help farmers because these banks – even the inept co-operative banks – are not accessible by the bulk of farmers and, when they are, there is no collateral to produce for loans. Finally, when the loans come, they are inherently risky given the vagaries facing Indian agriculture. No out-of-the-box thinking has been deployed in this calamitous space, and the substantial hikes in credit to the farmer have been commandeered by the better-placed agro industry sector.

Table 4: Juggling with Agriculture & Rural Development funding

			(Outlay in Rs crores)
Department	**2010-11 revised outlay**	**2011-12 budget outlay**	**% change**
Agri & Cooperative	17695.48	17522.87	-0.97
Agri Research & Education	5165.00	4957.60	-4.02
Animal Husbandry	1355.70	1696.25	25.11
Fertilizers	55215.00	50245.00	-9.00
Food & PDS	68021.08	61606.01	-9.4
Food Processing	409.72	610.09	48.90
Rural Development	76378.15	74143.72	-2.92
Land Resources	2666.05	2706.20	1.50
Drinking Water	10584.94	11005.24	3.97

(Source: Demand for Grants document 2011-12)

As far as the small farmer is concerned, increasing credit flows without a supporting policy framework that safeguards farmers' rights to land and improves the profitability of agriculture may well be of limited value. Short-term loans for high-cost, high-input agriculture are likely to increase indebtedness for small farmers. In Madhya Pradesh, the local press has indicated the farmers had availed of credit for financing land leases and the purchase of agricultural inputs. When frost destroyed their crop, they had no means of repaying the loans.

The finance minister admitted as much in his latest budget speech. Micro-finance as it is practiced in India – despite its promise – has failed to deliver. The gaps in institutional credit, which were to be covered by micro-finance, have thus attracted tremendous interest in recent years. The Andhra Pradesh experience shows that the delivery costs are very high, pushing interest rates up to unacceptable levels in the absence of consumer protection regulation and a perceived absence of a cap on micro-finance interest rates. A proposed plan for the direct transfer of subsidies (proposed in the recent Union Budget) may ensure the subsidy reaches the intended beneficiaries more efficiently.

ISSUE 5: WATER WASTE

The fifth area of concern is the sinister waste of water resources. India's annual precipitation of a handsome 4,000 cu km gets slashed into an effective water availability of no more than 1,123 cu km (utilizable water resources 690 cu km and utilizable ground water 433 cu km). No more than 28.3 percent of the rainwater is utilized, thanks to India's creaking water management infrastructure, lopsided policies, illogical spending patterns on large irrigation projects that pay poor dividends and a comprehensive lack of perspective that haunts the water industry. There is a lack of realization that water has an economic value in all its competing uses and should be recognized as an economic good and supported with sound planning for conservation and efficient allocation.

The rainfall in India is not evenly spread – nearly 80 percent of it coming in the four-month monsoon season from June to September. A sizable part of this water is allowed to flow away wastefully to the seas, eroding precious soil on its way. India needs to conserve this water for year-round use by storing it either in the surface reservoirs or in the sub-surface (underground) water aquifer. None of this is happening to the required extent. The surface water storage capacity created in India through major and medium reservoirs and millions of small ponds, tanks and other water bodies is insufficient to hold enough water to meet the annual needs of the country. Contrast this with the United States, for instance, with water storage capacity good enough to meet three to five years' requirement.

There is worse to come on India's real liquid crisis: it had been said that an additional irrigation capacity of 8.8 million hectares would be created during the 10th Plan at an estimated investment of US$ 1.9 billion (INR 96,720 crores) by both the Centre and states. Yet the Planning Commission admitted in the approach paper for the 11th plan that the additional potential created in the 10th plan was not only 50 percent short of the target but even that did not show up in the land use data, which recorded no net expansion in the total irrigated acreage. Thus, there is a tremendous unmet demand for ground water.

The solution lies in restricting the extraction of ground water to the extent of its annual recharge through rainfall and other means. This requires comprehensive studies to estimate the level of recharge and working out the amount of water that can be allowed to be extracted from each well. This is easier said than done. Most states lack the resources and personnel needed to monitor and regulate water off-take from each well. As pointed out in the World Bank report, electricity authorities in many states had stopped metering power supplies to wells in the 1970s because the costs involved in doing so for the then existing 12 million water pumps was higher than the revenue generated. Today, it is worse because such operations number more than 20 million. That virtually rules out the pricing of ground water, though such a measure may be desirable and in the long-term interest of the farmers as well as those who would not want their wells to go dry. There are other means of curbing excessive withdrawal of ground water. In Punjab, where the rate of receding of the ground water had shot up due to growing tendency towards transplanting paddy early – in May rather than in June after the arrival of the monsoon – the government had passed a law to ban this practice. This has worked and the water table actually began to rise. Haryana also took a similar step with good results.

The other side of the problem is around the quality and price of water. Low water rates – there has been no revision for years - and a lack of uniform pricing across states and projects adds to the abuse of water. Meanwhile, there is no question of cost recovery or even revenues to cover routine administrative and maintenance work. The water pricing policies are also contrary to the 2002 National Water Policy. That policy said that water charges should be such as to make the users realise its scarcity value and it wanted revenue generated through water use to cover operational and maintenance costs and, subsequently, a part of the capital cost. It also wanted the rates to be linked directly to the quality of the service provided and the subsidy given to the disadvantaged to be better targeted.

The Central Ground Water Authority has issued regulatory directives for more than 100 ground water blocks, and a 2010 World Bank report has warned that if indiscriminate exploitation of the ground water continues unabated, as many as 60 percent of all the ground water blocks will be in a critical condition by 2025.The situation is most worrisome in at least six states – Gujarat, Haryana, Maharashtra, Punjab, Rajasthan and Tamil Nadu – where about 54 percent of the ground water blocks have been tapped excessively.

ISSUE 6: LOW SOIL FERTILITY

Soil fertility is also an area of concern. Maps of India show that only about 11 percent of soils are high in available nitrogen. Similarly, about 20 percent of soils are high in available phosphorus and about 50 percent in potassium. With intensive cropping using only NPK (Nitrogen, Phosphorus and Potassium) fertilisers and limited use of organic manures, soils and crops became deficient in a large numbers of elements even as food production increased with time.

The major issues around soil health today are:

- Physical degradation of soil – compaction, crusting and other effects caused by excessive cultivation
- Chemical degradation of soils due to wide gap between nutrient demand and supply
- High nutrient turnover in soil-plant system coupled with low and imbalanced fertiliser use
- Emerging deficiencies of secondary nature and micronutrients
- Poor nutrient use efficiency
- Insufficient organic resource use because of competitive uses
- Acidification and aluminium toxicity in acidic soils
- Irrigation induced water-logging
- Biological degradation by organic matter depletion and loss of soil fauna and flora
- Soil degradation due to water and wind erosion
- Soil pollution from industrial wastes, excessive use of pesticides and heavy metal contamination

ISSUE 7: CLIMATE CHANGE

Indian agriculture is particularly vulnerable to climate change which A. K. Singh, deputy director-general, natural resource management, of the Indian Council of Agricultural Research, believes could cause yield drops of between 4.5 and 9 percent by 2039. Crop yields may fall by 25 percent or more by 2099.

India has had a taste of what is to come: rain-fed tracts have been experiencing three to four droughts every 10 years. Of these, two to three droughts are generally of moderate intensity and one is severe. Furthermore, there has been a fluctuating weather cycle with unpredictable cold waves, heat waves, floods and heavy one-day downpours. In 2008, the groundnut crop in the Rayalaseema (Andhra Pradesh) was subject to high as well as low rainfall at different stages of crop growth. While heavy rainfall early in the season adversely affected the development of pegs (which bear groundnut pods below the soil), the relatively drier spell at the later stage hit the development of pods. The impact of these dramatic weather cycles on agriculture is baneful.

Climate change affects the small and marginal farmers the most because they can least afford irrigation. Indeed some 80 million hectares (net sown area of around 143 million hectares) is irrigation-deprived and depends on the errant rains, but more than 85 per cent of the pulses and coarse cereals, more than 75 percent of the oilseeds and nearly 65 percent of cotton are produced from land characterized by low yields, usually in semi-arid zones.

ISSUE 8: FOOD WASTAGE

The most inexplicable issue around Indian agriculture is the continued waste of food that has promoted the Supreme Court to castigate heavily the government. The food ministry has admitted that foodgrains of USD 6 billion have gone waste in 2010, most of it in state warehouses.

Given a production (in 2010) of around 80 million tonnes but the combined storage space of the Food Corporation of India, State Warehousing Corporations and other agencies of just 60 million tonnes, some 20 million tonnes of food is left out for the elements to ravage. The estimated loss was around INR 270 billion rupees (US $6 billion). Between 1.2 million metric tonnes of rice and wheat was wasted in Punjab alone, forcing the Supreme Court to order the Centre to distribute free food grains, especially to those in the drought and flood-hit areas. The highest court also directed the Centre to establish a large state run Food Corporation of India (FCI) warehouse in every state and small warehouses in all districts. In addition, the recent introduction of a negotiable warehouse receipt (WR) system and effective enforcement by a Warehousing Development and Regulatory Authority (WDRA) is likely to add new storage capacity through private-sector participation.

The Agriculture Produce Marketing Committee (APMC) Act is another tangled web. The anti-retail and land acquisition lobby has, however, strongly opposed the Act, which allows private companies to procure produce directly from farmers. Those for the change allege that the Act forces farmers to sell perishable items like fruits and vegetables only to a limited number of licensed traders at APMC *mandis* (wholesale markets), thereby encouraging cartel activity in agricultural marketing. However, the traders' lobby insists that "the Act does not require any amendment," says Ashok Walunj, head of the onion-potato market at Vashi APMC: "Trade cannot survive without middlemen. Were it not for us, the farmers would not be paid a fair price for their goods on the spot. Exports should rather be resumed so farmers get a better deal."

The APMC Act of most states does not encourage direct marketing and contract farming, and the prohibitions under the APMC Act do not allow investment by the private sector for improving the infrastructure. They do not facilitate procurement of agricultural produce directly from the fields. The purchaser has to be a registered agent at the wholesale market.

OPPORTUNITIES IN THE CHALLENGES

It is encouraging to note that marketing reforms are expected to become one of the top priorities in the 12th five-year plan. The APMC Act has been repelled in Bihar and amended in a further 16 other states. Industry bodies are lobbying hard to delist perishables such as fruits and vegetables from Schedule 1 of the APMC Act and allow for competition. In the states where APMC has been amended, the government is providing financial incentives to set up Terminal Market Complexes with a hub-and-spoke model in the public-private partnership (PPP) mode.

The latest Union budget has thus focused on aspects of food preservation, storage and logistics. Mukherjee has talked of the need to have warehousing and cold chains. On January 1st, 2011, the food grain stock in the Central pool reached 4.7 million metric tonnes, 2.7 times higher than 1.74 million metric tonnes on January 1st, 2007, and the storage capacity for such large quantities requires augmentation.

The process to create new storage capacity of 1.5 million metric tonnes through private entrepreneurs and warehousing corporations has been fast-tracked. The decision to create 0.2 million metric tonnes of storage capacity under the Public Entrepreneurs Guarantee (PEG) Scheme through modern silos has been taken. The addition will reach 4 million tonnes by March 2012. During 2010-2011, another 2.4 million metric tonnes of storage capacity has been created under the Rural Godown (Warehouse) Scheme.

A CRISIL Research study estimates allowing foreign direct investment in multi-brand retail could reduce wastage by about US$ 12 billion (INR 630 billion) in the fruit and vegetable subsectors alone every year, or about 30 percent of total output.

Foreign retailers who want entry into India, such as Wal-Mart, say foreign investment is key to minimising waste and lowering prices to consumers.

While the government permits foreign investment in the supply chain, foreign retailers have been unwilling to commit large sums of money, as there are still restrictions in multi-brand retail.

Bharti-Wal Mart estimates that it could take a decade to build a supply chain of international quality in India, and indeed numerous presentations have been made to move India from an indigent-farmer model to one that relies on cold chains.

While all this looks encouraging on paper, there is enormous confusion at a policy-making level because agriculture is a state responsibility and central decisions often get ignored. Indeed, pan-Indian solutions may sometimes be difficult to implement at the state level and for Indian agriculture to get out of its moribund state, it is important for growth and development impulses to flow from the ground upward.

The problem lies in the disconnect between the farmer, the administration and the agriculture knowledge worker, which is why critical information does not travel to the small farmer even though there is a multiplicity of agencies at the policy-making levels.

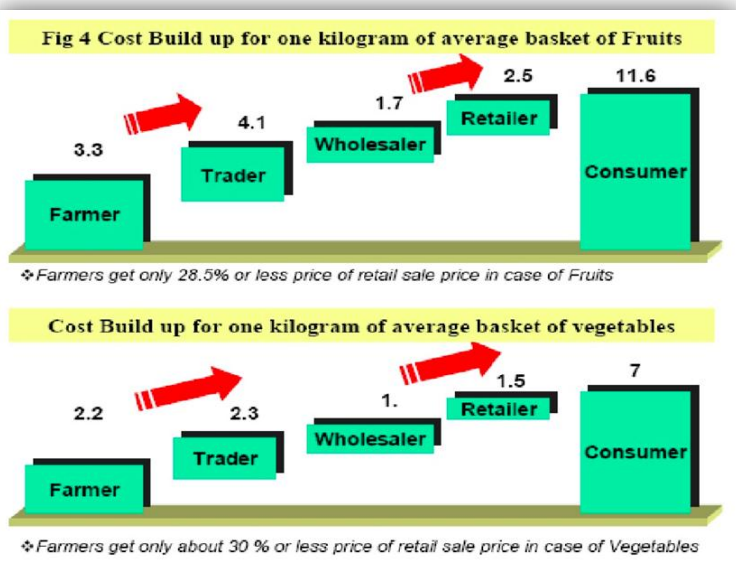
ESSENTIAL COMMODITIES ACT

The other obstructive legislation is the Essential Commodities Act (ECA), which was put in place in 1955 after Independence to control the production, supply and distribution of essential agricultural commodities. India was then facing acute food shortages, and the Act was meant to ensure the availability of food products. Conditions have changed since, and there is recognition that controlling the movement of products by licensing of dealers, limits on stocks and control on movements will hamper the growth of the agricultural sector and the promotion of food-processing industries. This Act was amended in 2003 to encourage free movement of agricultural commodities across regions.

The larger issues are around the fact that India's growing population has to be fed, and that will need some drastic and dramatic changes in the way agriculture is being run. It needs to be borne in mind that with economic growth, the diet of large segment of India's population is changing: there is far greater demand for dairy and meat products, and this is an area that will demand special attention. It also means that the rate of increase in food consumption will be higher than the rate of population growth. Furthermore, Indian agriculture will have to grow amidst unsustainable increases in the price of inputs, with petroleum costs making all food grain and input movements expensive and food, therefore, dearer.

CONCLUSION AND WAY FORWARD

The answer to these issues lies in science and technology and in research. Merely copying Western solutions will not suit the Indian need. In any event, unlike in the corporate sector – where multinationals and their technology could gain easy entry because Indian companies were at par or nearly at par with them – agriculture is one area where global technologies will encounter resistance and, in many cases, for good reason. The need is to look at acceptable Indian or regional options and to implement them with a sense of purpose. Those who discount fears that MNC seed suppliers will control price and availability of seeds point out that prices are controlled and manipulated not by the entry of multinationals but by poor government policy, lack of marketing reforms and denying access to new players in agri-marketing.



Source: Agricultural Marketing Division for State Agriculture/ Agriculture Marketing Ministers Conference (23.04.2008) by UKS Chauhan

The point is that multinationals in the agri space are a reality, and India needs to engage with them through a policy regime that takes account of Indian conditions. Again, it is effective policy intervention that will help reverse unacceptable price increases, though there is no doubt that the farmer, faced with higher input costs, must get more for his produce or perish. Sustaining agriculture as a profession is extremely important for national food security. Whether that can be achieved by granting more freedom to the farmer or not is something for policymakers to decide. Indeed, there are critical decisions to be made before policy is finally determined. If farm inputs costs go up, how will the government introduce subsidies to ensure that the end product price is held within limits, if that is indeed possible? Where are the bottlenecks that exacerbate the price situation? What is the role of the middleman, and can or should India eliminate the middleman/trader who has kept the wheels of commerce oiled for several millennia?

What about justifiable fears that there are seed monopolies that may vitiate the Indian space in terms of some specific seeds? The counterpoint is that these monopolies have been created by huge investments over prolonged period in research. Bt Cotton has been hugely beneficial to farmers who have opted for it, and some have done it entirely the organic way. Again, while the jury is still out on GM foods, what is not in doubt are the infinite possibilities that new technology offers. Imagine: if India grew wheat or rice that produced their own nitrogen requirement - as is done with legumes - the country could be rid of fertilizers and chemicals forever! Once again, India is not really engaging with sufficient seriousness in the research required by a country spread over so many agro climatic zones.

Where are the opportunities for technology companies and those keen to engage in CR projects around India's farm sector? They exist at two levels: at the higher end with cold chains, sophisticated systems for the greening of Indian agriculture, large-scale warehousing and storage in the public private partnership space, agri-retail, handling agriculture/ food products and dairy/livestock logistics, water table management, the rejuvenation of traditional embankments/water management systems, crop insurance, soil revival technology and intelligent irrigation systems.

At the other end there is work to be done at the grassroots level beginning with tiny processing units and stand-alone energy units (in the solar space) for warehouses, as well as in micro-financing. There is also the Unique Identity Project – an idea whose time has come in India – but the sheer dimensions of the task and the challenges at the grassroots remain daunting.

At a totally unconventional level there is an opportunity to partner with the Krishi Vigyan Kendras (KVK), a project of Indian Council for Agricultural Research (ICAR) for testing and transfer of Agricultural technologies to bridge the gap between production and productivity. There are around 589 KVKs in the country with a mandate to function as knowledge and resource centres for agricultural technology at the district levels. An alternative, and even more radical, partnership would be to integrate professional/private initiatives with the KVK so that India can experience a true paradigm shift from subsistence agriculture to commercialized agri-business. Making agriculture extension services – under the existing business-as-usual attitude – is not likely to work because these services have to become proactive, through better-trained people with accountability for the areas that they are working with. No sector can extricate itself from systemic decay without information, knowledge and technology, and the KVKs are the designated vehicles with the requisite knowledge.

Will there be objections to such privatization of services? Yes, but rejuvenation of the KVKs cannot be achieved through legislation alone; they can be achieved through training and monitoring. This is where appropriate PPP models have to be formulated.

There are also opportunities in the dairy and livestock sectors through bio-technology to strengthen conventional breeding methodology by evolving plant varieties resistant to pest and diseases, tolerant to adverse weather conditions, with better nutritional value and enhanced durability. Here too, appropriate PPP models are being examined.

It is in the character of and the motivation behind this examination of agri-solutions that India's food security will lie. Most importantly, there must be the realization that Indian agriculture is at the mercy of too many ministries, quite aside from the conflicting control by the states and the Centre. This multiple parentage does not bode well for a holistic policy framework.

If you would like more information on APCO Worldwide's India operations, please contact:

Sukanti Ghosh
Managing Director
Office No. 421, Level 4
Dynasty Business Park, A Wing
Andheri-Kurla Road, Andheri (East)
Mumbai 400059
India
Phone +91.22.4006.3380
sghosh@apcoworldwide.com

Samiran Gupta
Executive Director
2nd Floor
255, Okhla Industrial Estate
Phase III
New Delhi 110020
India
Phone +91.11.4605.7700
sgupta@apcoworldwide.com

Asitava Sen
Director, Corporate Advisory and Public Affairs
Head, Food and Consumer Practices (India)
2nd Floor
255, Okhla Industrial Estate
Phase III
New Delhi 110020
India
Phone +91.11.46057700
asen@apcoworldwide.com