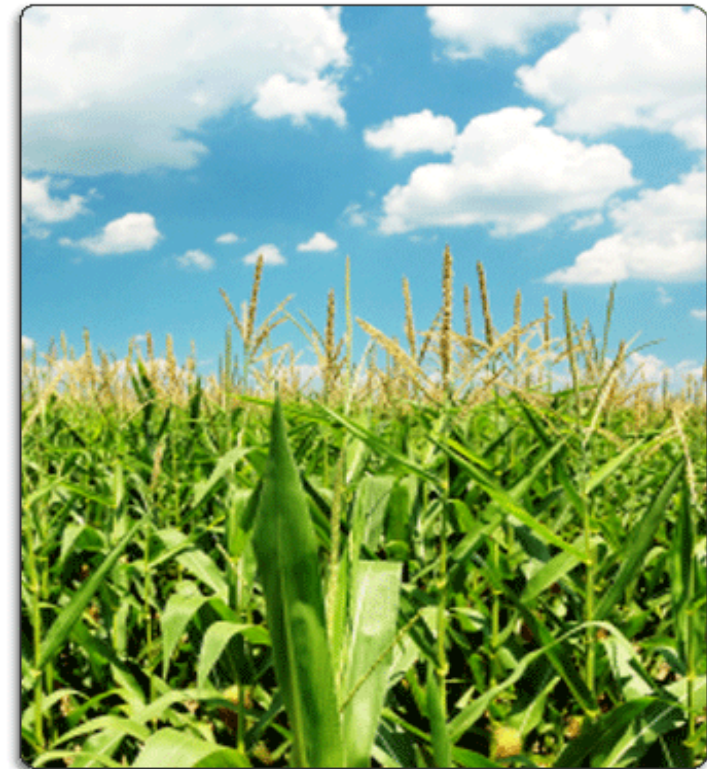


Indian Agriculture Challenges and Prospects



IMA India

Disclaimer

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I. About IMA India

What IMA Does...

- ***Undertakes in-depth market studies and opportunity assessments*** for individual companies: leveraging a full range of business and market research capabilities
- ***Provides ongoing market intelligence and risk assessments*** to country managers; offers research-based interpretations and top-level forecasts of the operating environment in India: economy, politics, key sectors, emerging business issues, etc
- ***Provides closed-door discussion platforms*** that enable focussed and high quality intellectual exchanges between senior executives on current and strategic business issues

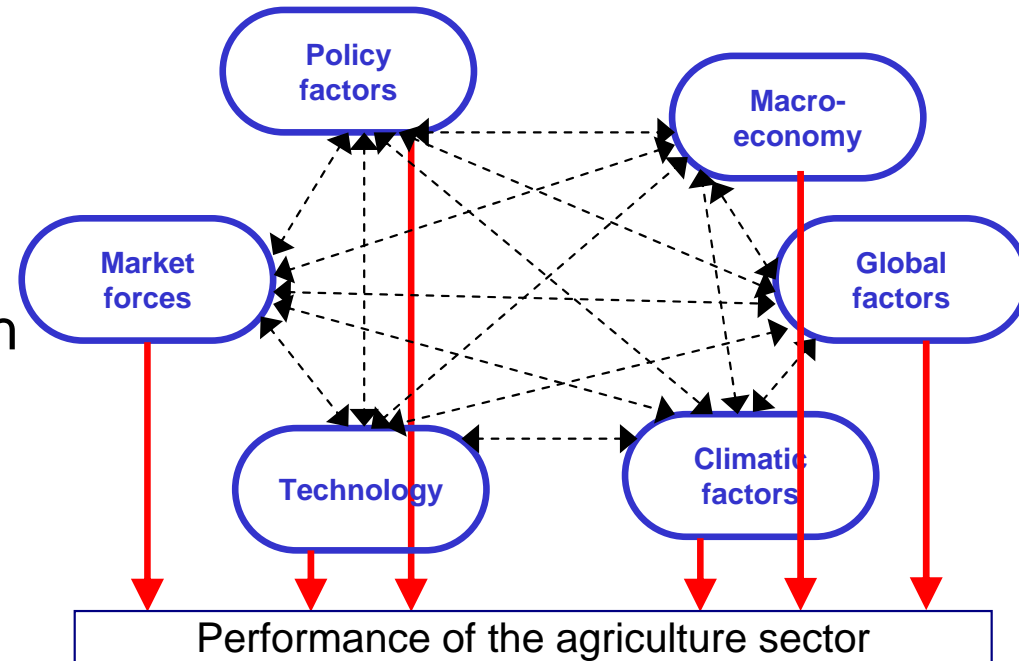
Four Business Streams

- **Research and Advisory Services**
 - Proprietary studies for individual clients across issues and sectors
 - Leveraging a unique methodology comprising extensive desk analysis complemented by expert insights obtained from internal and external domain specialists
- **Peer Group Forums**
 - Membership-based executive briefing and research services: a platform for obtaining country intelligence and exposure to authoritative minds; access to top-level India research
 - An extensive corporate network: a forum for sharing experiences and learning from peers and pioneers
- **Conferences and Business Meetings**
 - Closed-door Roundtables for senior executives
 - Driven by research-based agendas and intense interaction
- **CFO Connect**: first-of-its-kind thought leadership journal for CFOs

II. The Scenario Planning approach for building strategy: an overview

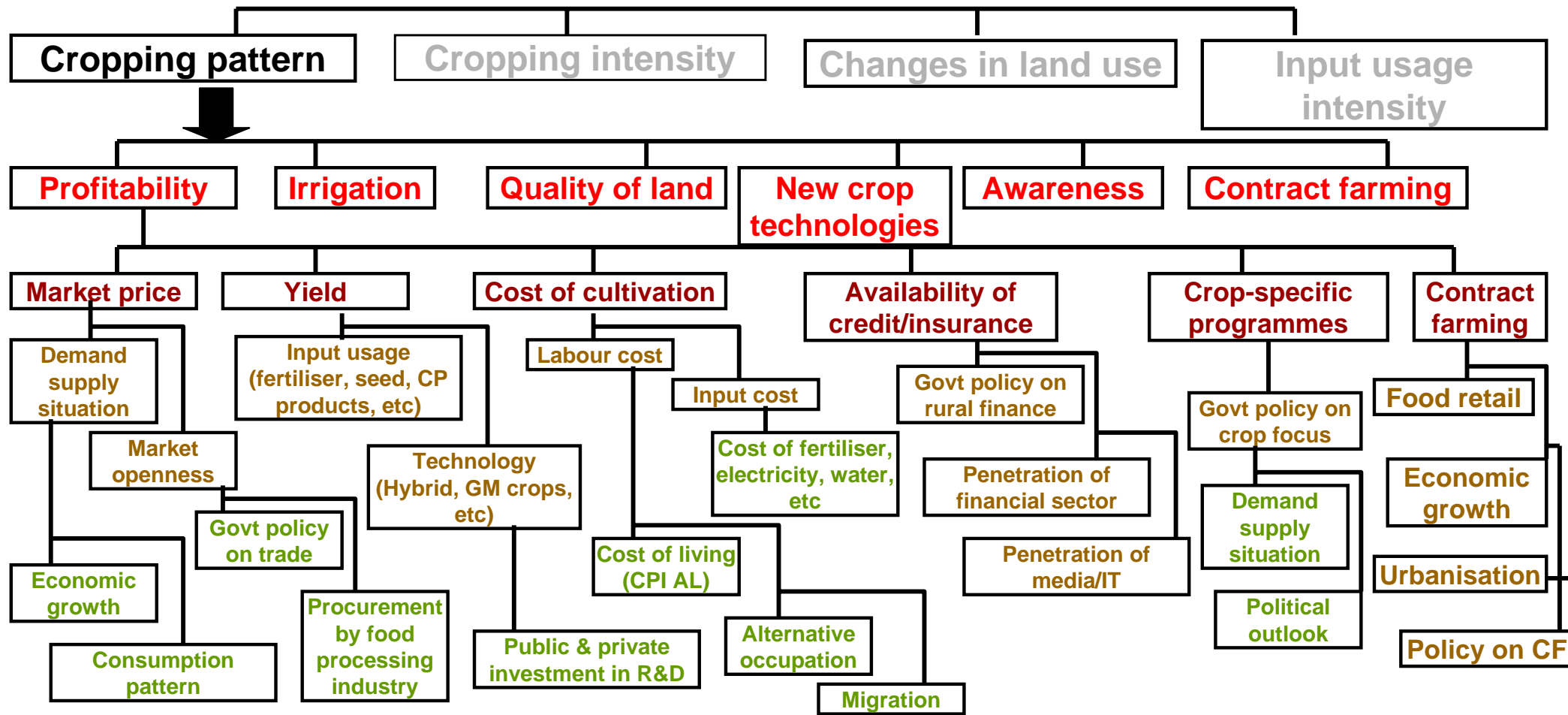
Understanding the drivers of agriculture

- The performance of the agriculture sector depends on several drivers, which, rather than impacting the sector in isolation, interact with each other and also depend on sub-drivers, consequently strengthening or weakening specific trends
- The key drivers that directly impact output can be grouped into 6 categories
 - Technology (farming and crop technology)
 - Government policy (availability of credit, crop specific programmes, etc)
 - Cropping pattern (which depends on profitability, awareness, etc)
 - Environmental factors (water availability, soil degradation, climate change, etc)
 - Market forces (market openness, pricing, transparency, integration with downstream sectors)
 - Global factors (supply-demand, trade norms and restrictions, etc)



But they cannot be examined in isolation...

One factor alone – cropping patterns – is a function of several inter-related drivers and sub-drivers



Indian agriculture is not 'one' concept

- The dynamics for **each** crop are different in **each** state – yields, acreage, farmer awareness and psyche, cost structures, Government infrastructure
 - Upstream issues vary substantially – labour availability, credit, soil fertility and agronomy, irrigation, input and technology availability, training
 - Downstream markets are even more varied across states and crops – market openness, procurement chains, processing infrastructure, food retail, etc

Hence, there is a need for a granular assessment (by crop, by state/region, by issue) if a business or investment decision is at stake

'Scenario planning' is therefore, a useful tool

An evaluation of all driving forces yields two dominant themes that will guide the future development of Indian agriculture

– **Agricultural policy** and **Implementation of technology**

A quadrant matrix of these two overarching issues provides **four possible scenarios**

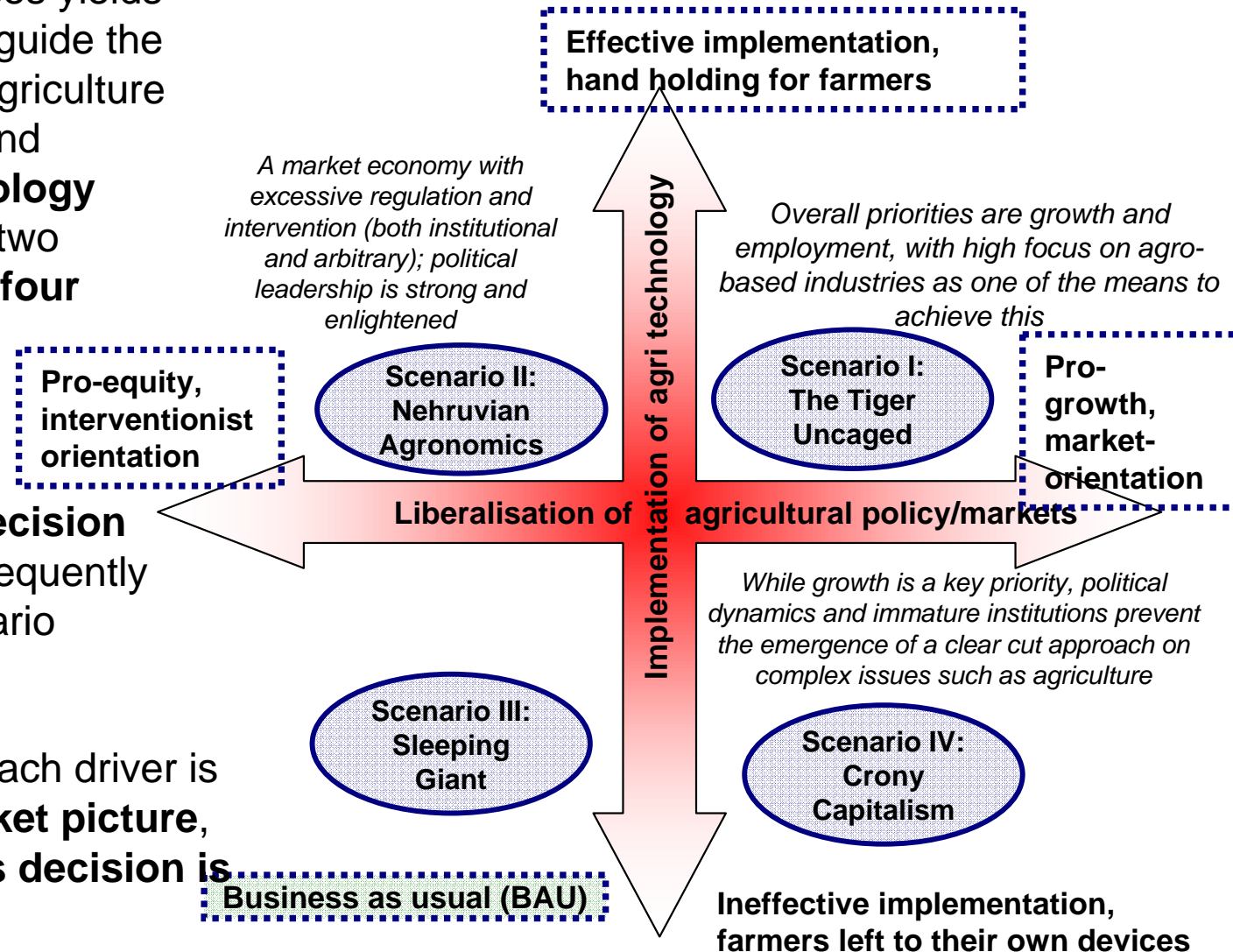


Each driver and its **impact on the business decision under consideration** is subsequently examined for each scenario



Scenario-based forecast of each driver is woven into a **complete market picture**, based on which **the business decision is evaluated**

The scenario matrix

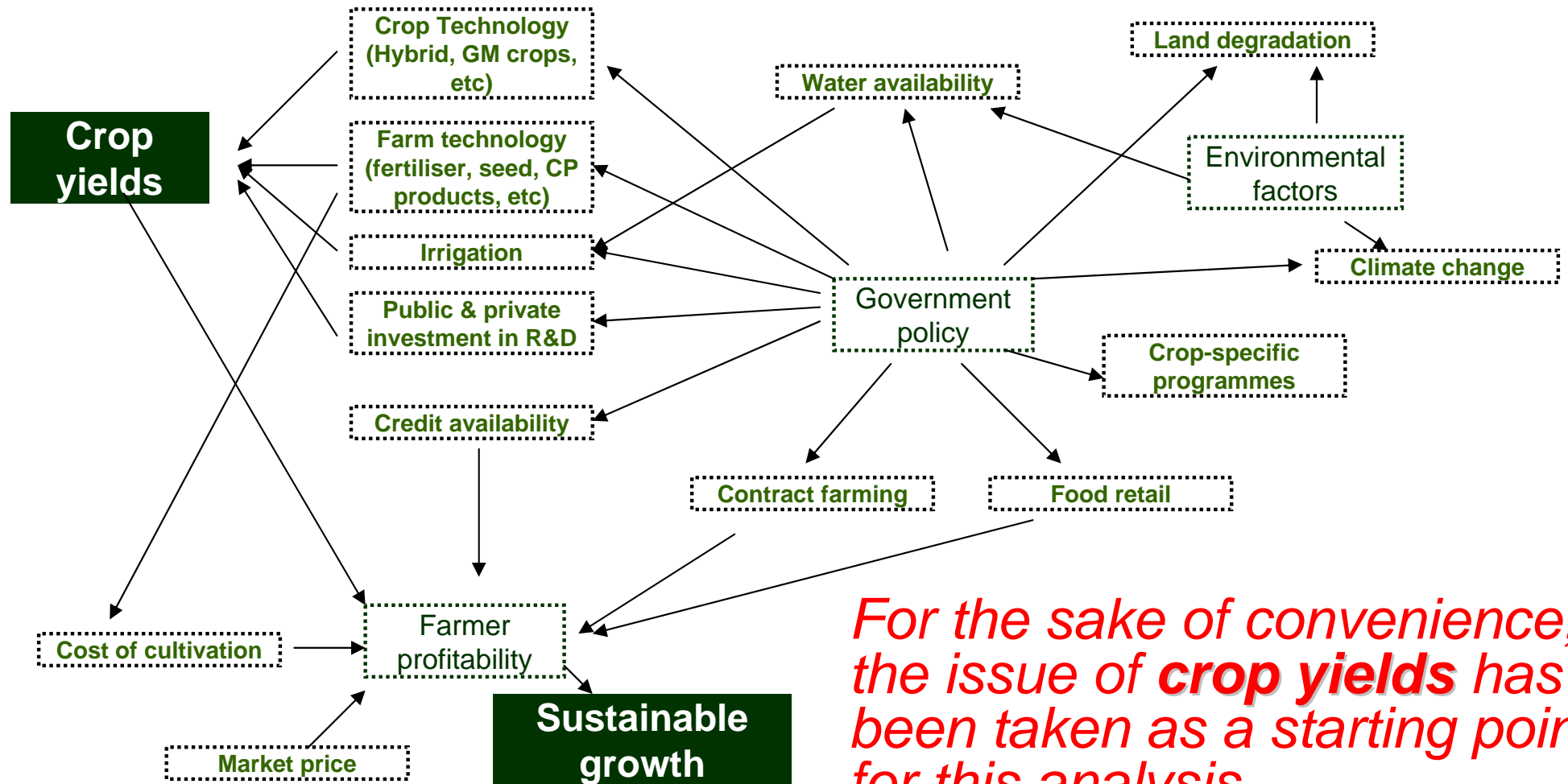


III. Indian Agriculture: challenges and prospects

The overriding challenge is '***sustainable and profitable growth***' in agriculture...

But that's where the generalisation ends

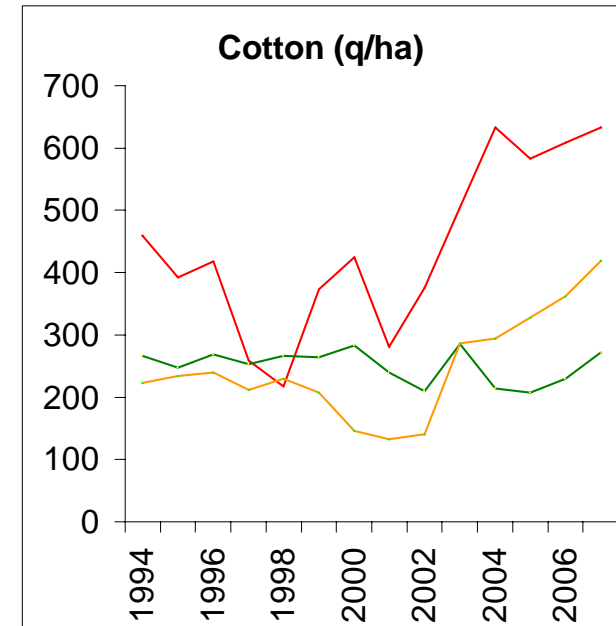
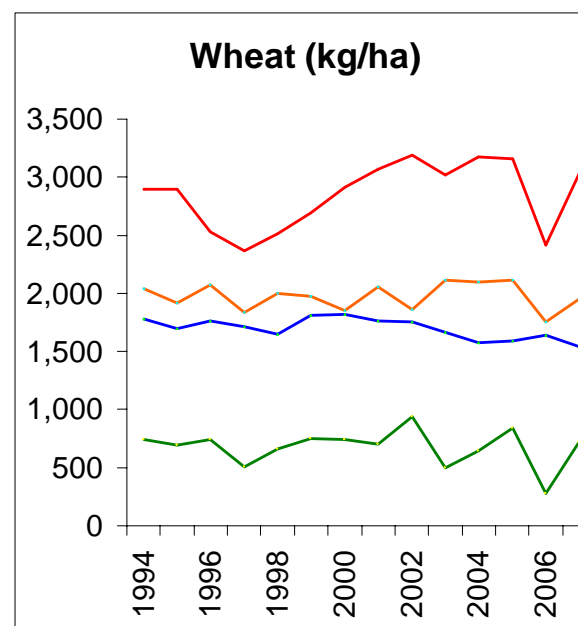
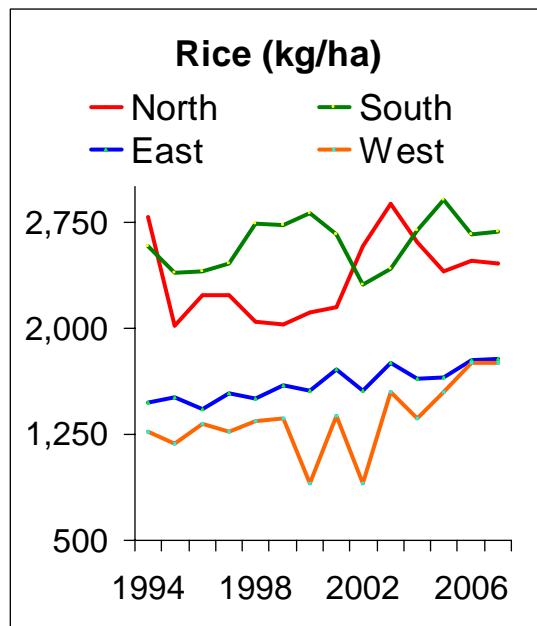
There is a complex web of inter-related causal relationships* which impact growth – and must be evaluated



*For the sake of convenience, the issue of **crop yields** has been taken as a starting point for this analysis...*

* The schematic diagram shown here is largely illustrative. Sub-drivers of each high level driver can be further delineated to demonstrate the complexity and inter-relatedness.

1. Crops Yields: Patchy improvement over the years...



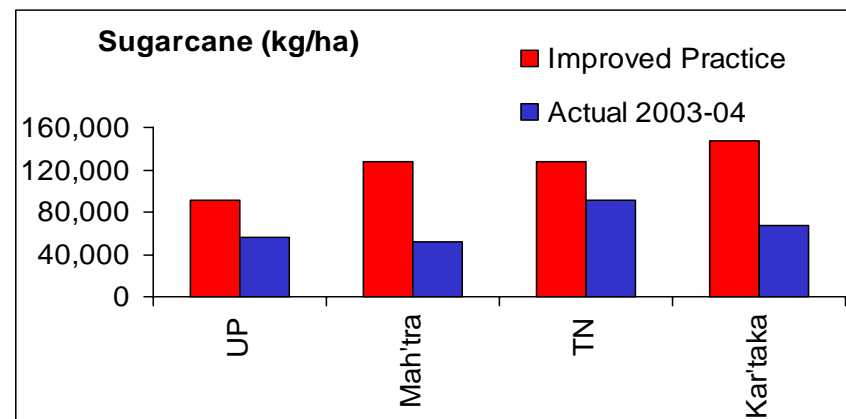
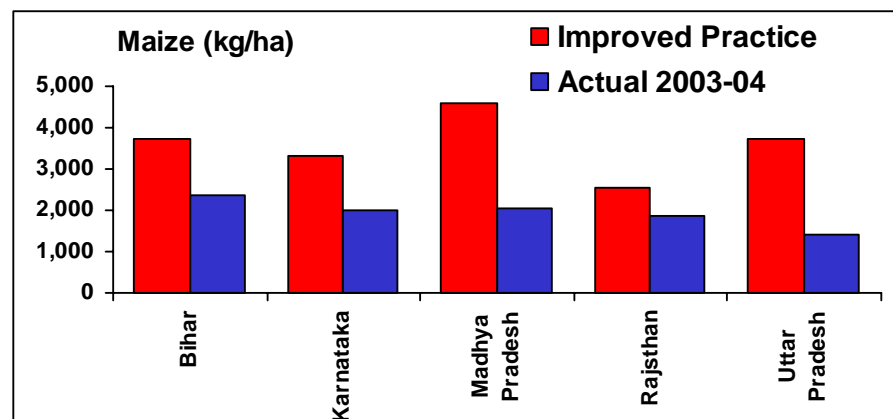
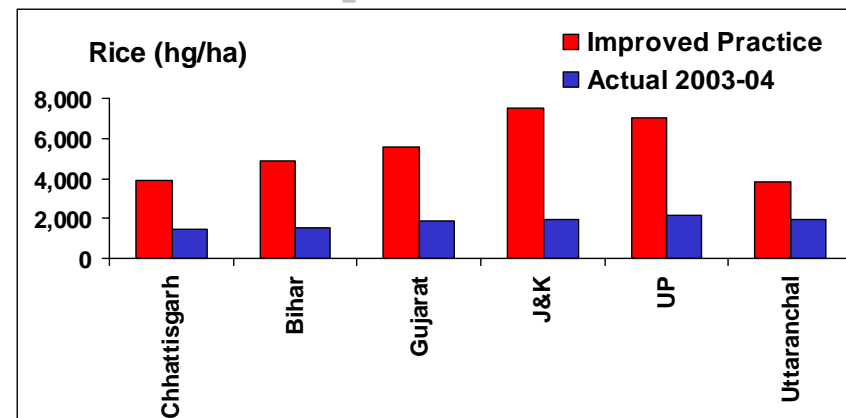
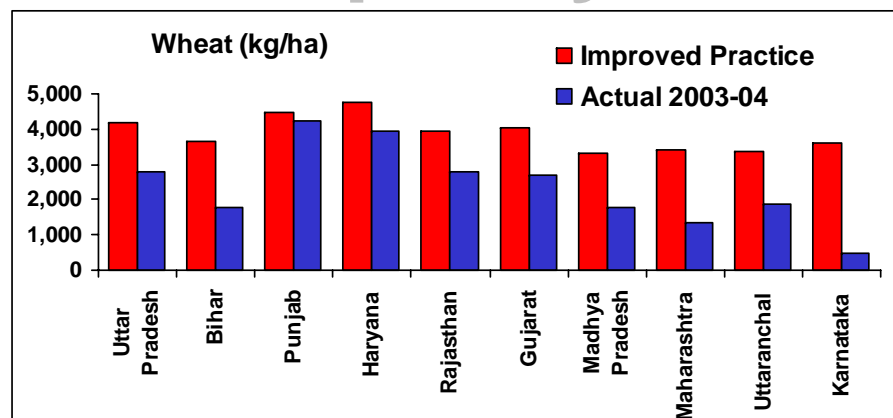
- Mainstream food crops have seen a plateau-ing of yields after the effects of the Green Revolution subsided in the late 80s
- However, there are important exceptions – such as cotton, which has benefited from the introduction of Bt Cotton
- Across the board, there are significant regional variations in yields

...and still below world standards

Comparison of yields in selected commodities (Metric tonnes/ hectare)									
Rice/paddy		Wheat		Maize		Cotton		Major Oilseeds	
Egypt	9.8	UK	7.7	USA	9.1	China	11.1	Germany	4.0
USA	7.8	France	7.5	France	7.5	Brazil	10.9	USA	2.6
Korea	6.7	China	4.2	Germany	6.6	USA	9.5	Argentina	2.5
Japan	6.4	World	2.8	China	4.9	Uzbekistan	7.9	Brazil	2.4
World	3.9	India	2.7	World	3.3	Pakistan	7.6	China	2.0
India	2.9	Pakistan	2.3	Philippines	2.1	World	7.3	World	1.8
Thailand	2.6	Iran	2.0	India	1.1	India	4.6	India	0.8
Myanmar	2.4	Australia	1.6			Nigeria	1.0		

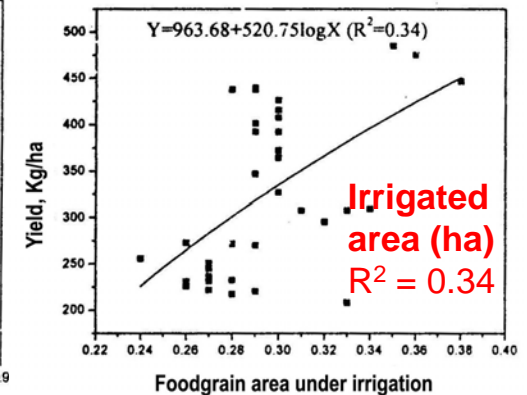
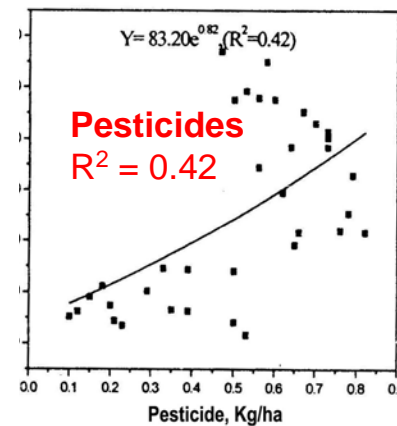
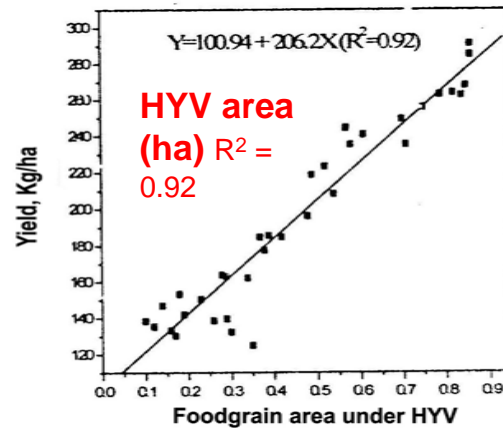
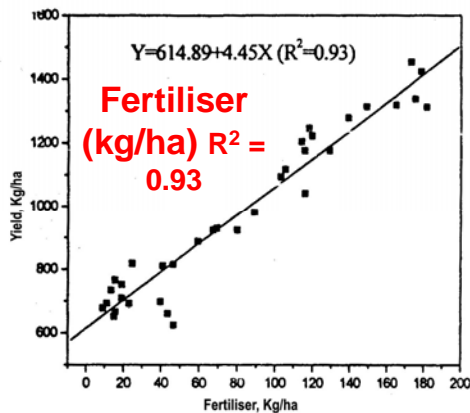
- Despite 30 years of intense Government efforts, India's yields for most major crops are still below global averages, and far below the highest standards
- Equally, this indicates the potential untapped opportunity – for GM crops, better farming practices, improved input usage, re-balancing of labour utilisation, etc

There is plenty of scope for improvement



- **Even with current technology**, yields can be raised significantly: by optimising farm practices – input usage, sowing techniques, timing, etc
- In other studies (e.g. paddy cultivation in UP), it was found that the **best farmer's overall profitability is 77% higher than the average farmer's** profitability – purely because of better farming techniques

But much else can and needs to be done



*Regression-based analysis of field data indicates that, when measured on an individual basis, up to **93% yield variations** can be 'explained' (accounted for) by fertiliser usage; 92% can be accounted for by the area under high yielding varieties seeds; 42% can be accounted for by usage of pesticides and 34% by greater irrigation*

Greater fertiliser usage and area under high yielding varieties can greatly boost yields; greater irrigation as well as pesticide usage can help too

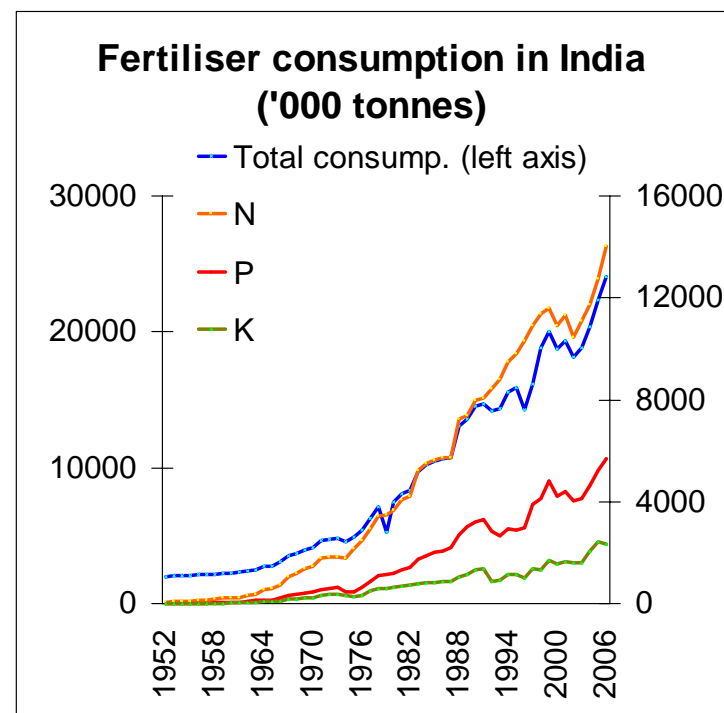
2. Better seeds can raise yields by 40%

- An effective means to raise yields is through better seeds – seeds have an ~40% impact on yield variations
- Development of dramatically better seeds has been almost non-existent in the last decade – hence, greater focus on increasing adoption rates of existing seed technologies
- However, the key constraint is production/availability of certified seeds: as compared to an ideal of 1:40, average multiplication ratios (for certified good quality seeds) are 1:17 to 1:23
- Meanwhile, GM seeds have fared well: bt cotton has seen rapid adoption across states since its introduction in 2002; the launch of Bollgard II in 2006 has given a new push despite higher seed prices
- Most states are approaching 80-90% rates of adoption – this should reach 100% in the next 2-3 years
- The next in line is Bt Brinjal...

Key risks include price controls (e.g. Andhra Pradesh); regulatory issues around GM technology in food crops; and activism

3. Balanced fertiliser usage is equally critical

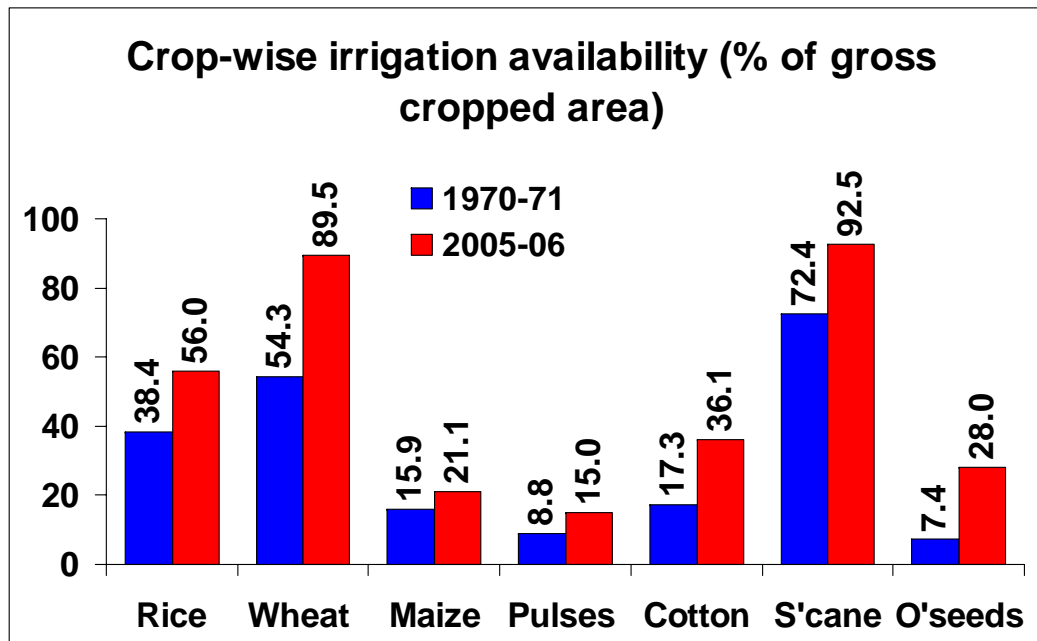
- Unbalanced fertiliser usage is one of the biggest reasons for stagnant yield and depleting soil fertility
- Fertiliser usage continues to be skewed due to irrational subsidy structure that favours Nitrogenous fertilisers over others
- Poor fund management by the Government often leads to acute shortage as fertiliser companies complain of delayed payments
- The rising subsidy bill on this account has reached worrisome levels – by issuing off-budget fertiliser bonds, the Government is only postponing the inevitable



The average NPK ratio in the past two decades has been 7:3:1, against the recommended 4:2:1

Lack of political will has been the single most important constraint so far – with a strong Government now in office, there is reason to hope for gradual improvement

4. Irrigation can raise incomes

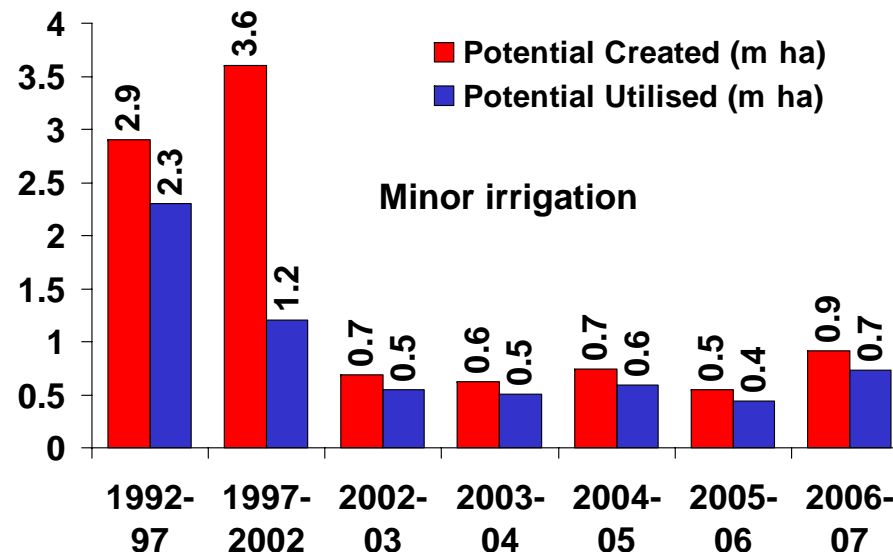
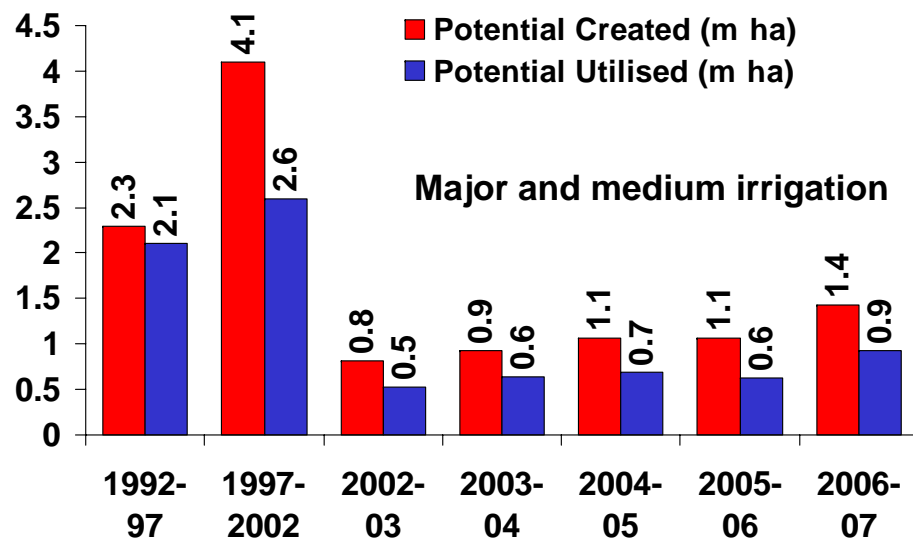


Fruits and vegetables can benefit enormously from irrigation

Returns (Rs/ha) from F&V cultivation		
Type of irrigation	Irrigated farm	Un-irrigated farm
Flow	25,842	4,741
Tube Well	9,666	8,200
Lift	79,776	6,000
Tank (flow)	73,225	8,010
Tank (sprinkler)	64,685	10,188

Rice, wheat and sugarcane have received focus for irrigation provision – largely the outcome of the government’s paranoia about achieving ‘self-sufficiency in food’; other crops have been neglected, despite the fact that irrigation can generate enormous economic returns for them

But irrigation progress has been slow



- In the latter half of the 90s, the Government’s investment efficiency (in terms of completing irrigation targets and utilising potential) dipped to below 50%; in the 2000s, efficiency improved marginally
- Overall, efficiency in minor irrigation has been higher than in major and medium irrigation; hence, minor irrigation is receiving increasing attention from policy planners

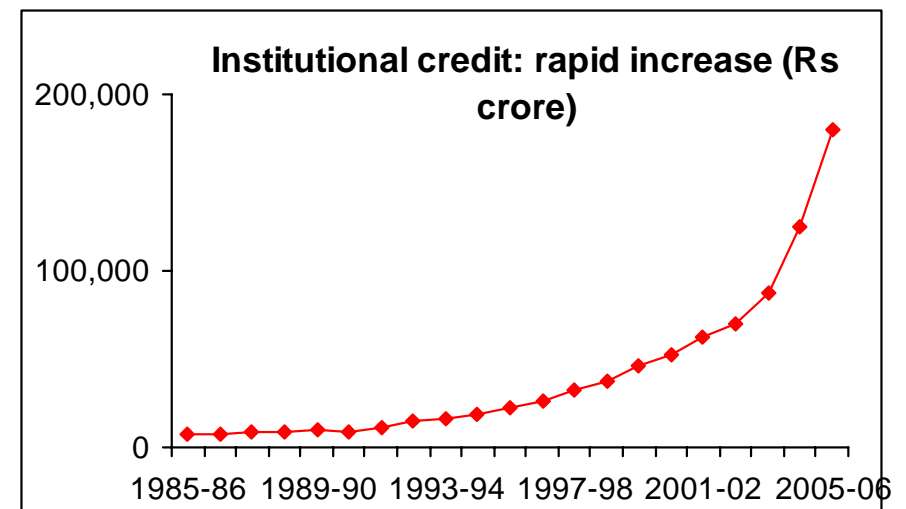
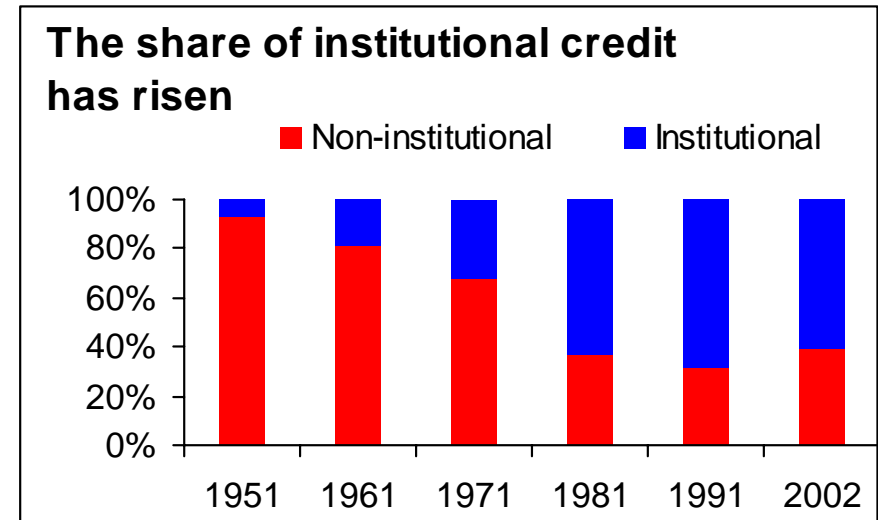
5. Credit and land holdings are critical from an economic perspective

Land size (acre)	Profit/acre (farmers without credit)		Profit/acre (farmers with credit)	
	Non food	Food	Non food	Food
< 1	42,500	4,000	73,500	5,900
1-2	60,000	4,500	70,000	5,675
2-3	62,000	5,000	65,000	5,200
>3	65,000	5,000	62,000	5,200
Avg	57,375	4,625	67,625	5,494

Overall profitability per acre rises with size of land holdings, but access to credit can compensate for this and raise profitability by up to 50%; with access to credit, farmers with smaller land holdings were found to be more profitable than those with larger farms

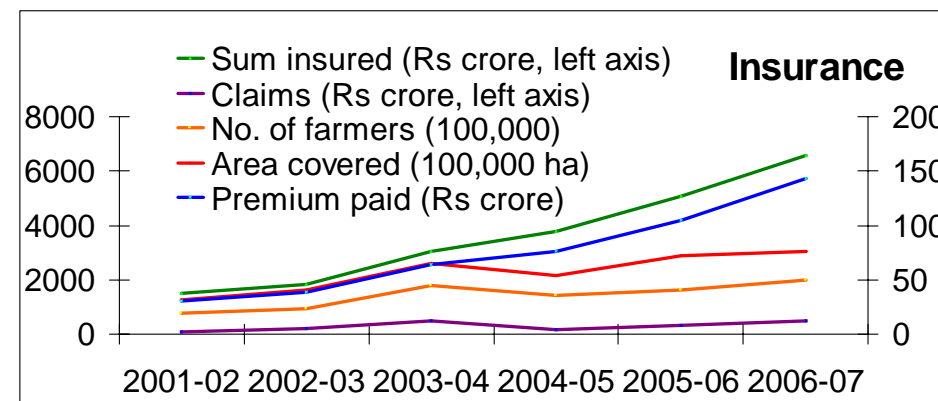
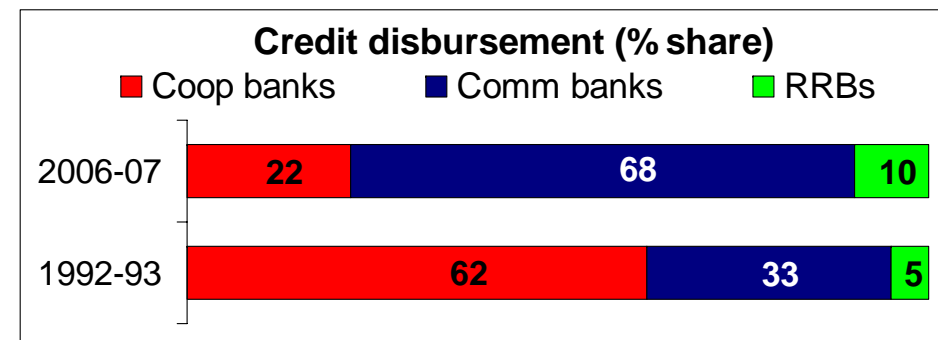
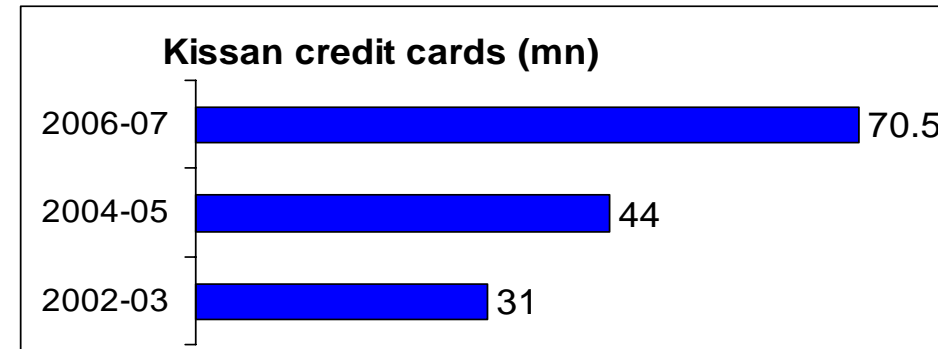
Fortunately, credit provision is improving

- Two important developments in credit are the consistent increase in penetration of organised lending (institutional finance) and the penetration of the Kissan Credit Card
- Meanwhile, the success of micro-finance initiatives and joint industry financing programmes, will be critical to watch for



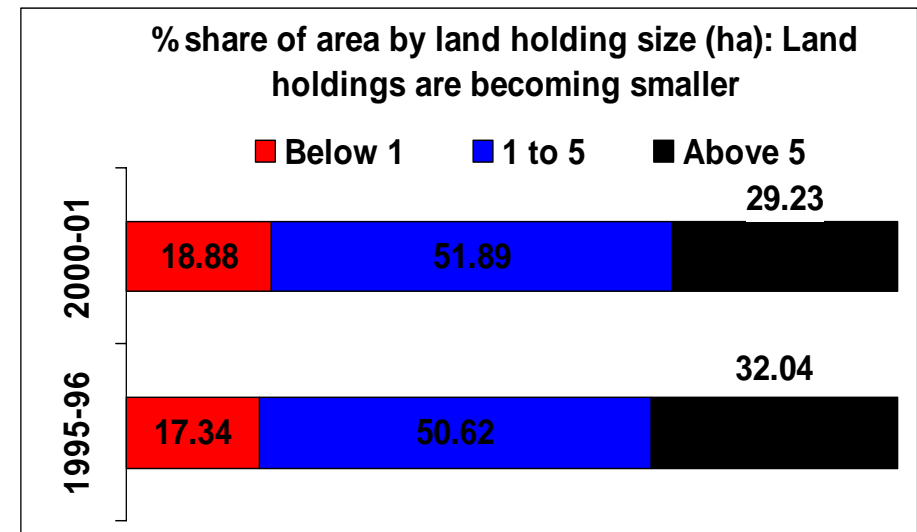
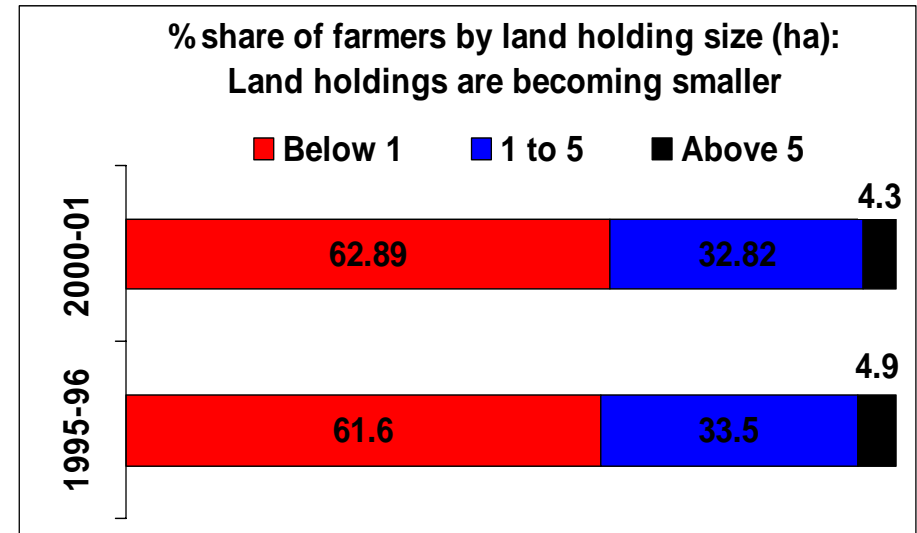
Improved credit: an important achievement

- Trend changes witnessed
 - Commercial banks are participating in a bigger way
 - After initial hiccups, agri-insurance appears to be improving as well
- On the horizon
 - The Multi Application Smart Card will create a billion credit cards in circulation
 - Tradeable deficits for directed bank lending will deepen commercial bank participation

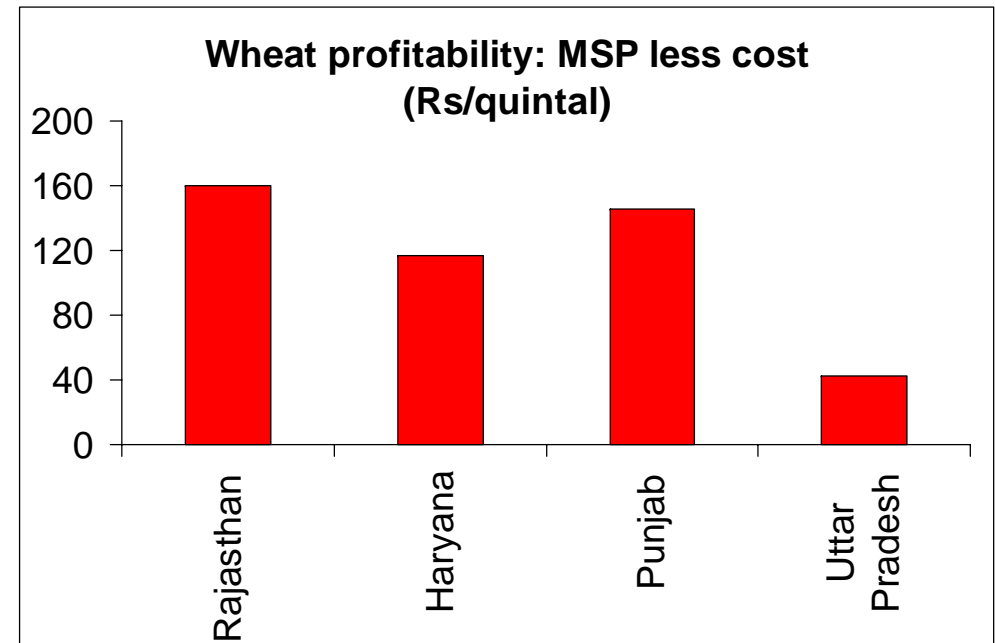
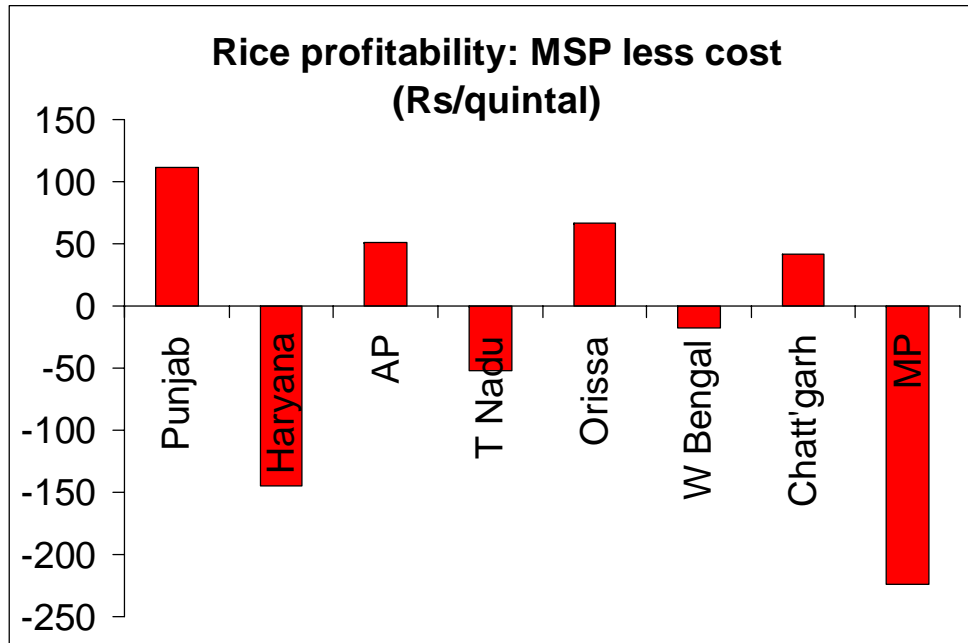


6. But land fragmentation is difficult to reverse

- The percentage of farmers with marginal holdings (< 1 ha) has increased from 61.6% to 62.9%, while that of large farmers (> 5 ha) has fallen from 4.9% to 4.3% between 1995 and 2000
- The reasons for this are intrinsic to farming societies – fathers’ land moves to children, who tend to divide holdings amongst themselves
- To reverse this trend, the Government will need to implement far reaching changes in land laws to encourage consolidation or corporatisation – highly unlikely, given the political ramifications

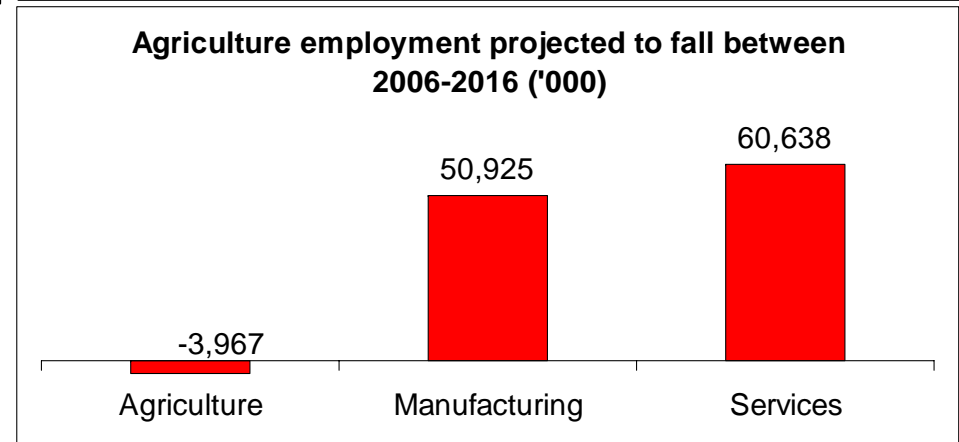
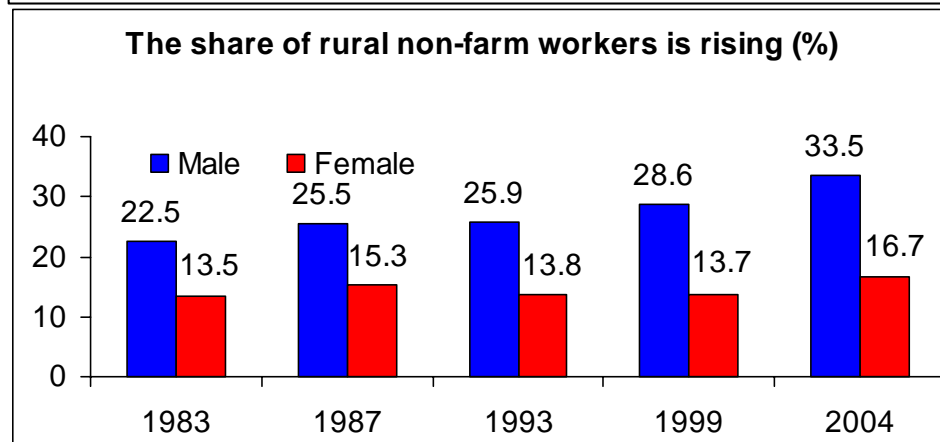
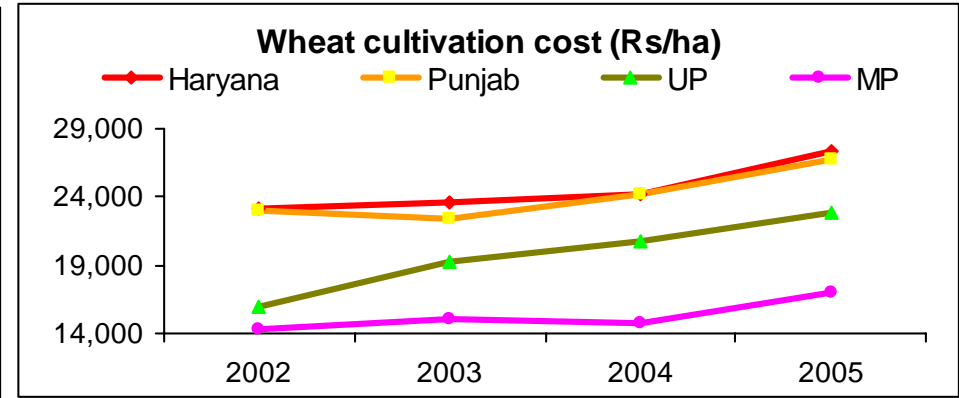
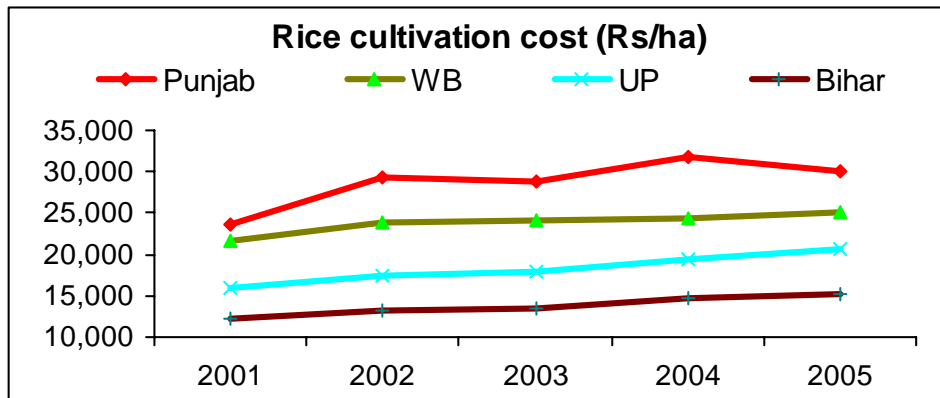


7. Profitability is still poor, for many reasons...



- The state of the two main food crops in India demonstrates the farmer's poor profitability: for rice, MSP doesn't even cover cost in states like Haryana, Tamil Nadu, West Bengal and Madhya Pradesh; wheat is somewhat better, but still delivers only marginal profit in states like UP
- The reasons are related to sharp increases in farming costs and inadequate linkages with open markets where prices are typically higher

8. ...one of these is rising labour costs



- A key reason for rising costs is the increase in wage rates – a direct fall out of falling farm labour availability
- This trend will continue due to Government efforts (e.g. NREGA) and other measures to reduce employment dependence on farming

9. ...another is sub-optimal cropping systems

	Less remunerative system	Net return (Rs/ha)	High profitable system	Net return (Rs/ha)
Kahikuchi, Assam	Rice-wheat	16,749	Rice-toria	22,333
Chhattisgarh	Rice-wheat	30,291	Rice-potato	67,496
Ambala, Haryana	Soyabean-wheat	29,851	Rice-wheat	36,399
	Sorghum-wheat	13,602	Maize-wheat	22,188
Nasik, Maharashtra	Rice-wheat	33,378	Rice-groundnut	46,504
Wardha, Maharashtra	Soyabean-wheat	25,008	Soyabean-gram	32,327
Faridkot, Punjab	Rice-wheat	50,388	Rice-mustard	66,887
Ludhiana, Punjab	Rice-mustard	52,537	Rice-wheat	63,352

If farmers shift away from the decades-old rice-wheat cropping pattern, they can raise returns significantly – this realisation is now driving shifts in cropping patterns

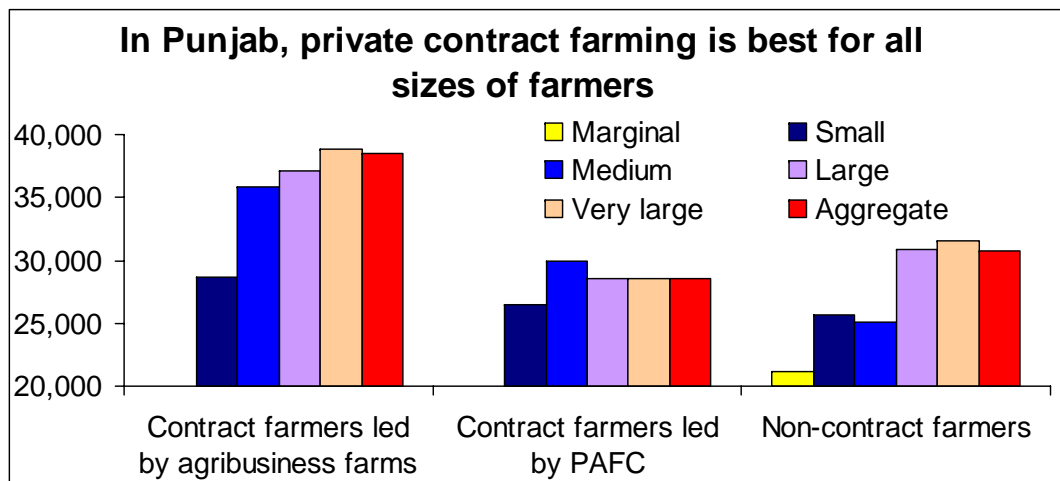
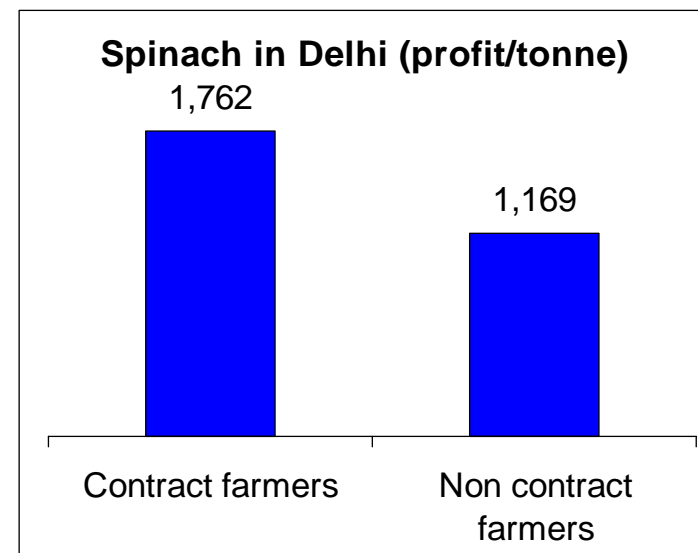
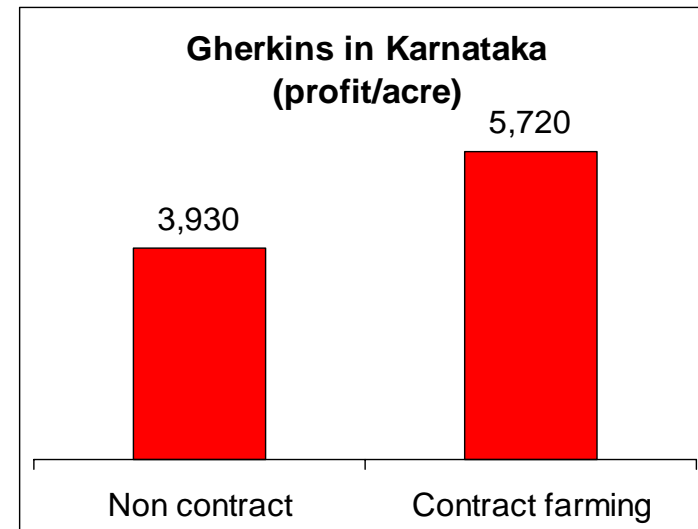
Cropping patterns are improving

	Change in acreage between 2000 and 2007 ('000 ha)								
	Rice	Wheat	Fruits	Vegetables	Cotton	Pulses	Maize	Sugarcane	Total acreage change
AP	-243	-2.0	405.0	16.9	-29.7	-122.7	192.0	46.6	72.5
Karnataka	-138.4	-21.0	-47.9	42.7	-176.8	-66.7	279.1	-151.1	-288.9
Tamil Nadu	17.99	0	49.3	76.0	-47.9	-157.9	203.5	70.7	144.69
Kerala	-80.5	0	85.6	67.7	-3.8	-9.9	0	1.6	120.3
South – change	-443.9	-23.0	492.0	203.3	-258.2	-357.2	674.6	-34.7	48.59
% change	-5.4%	-8.2%	39.4	18.8%	-14.8%	-3.4%	52.7%	-3.6%	
Assam	-375.3	-10.3	42.7	155.2	-1.7	-111.5	-1.2	-1.0	-299.1
Bihar	-261.3	269.2	18.2	61.8	0	-117.2	119.5	23.5	78.0
Chhattisgarh	-39.6	63.2	98.2	242.6	-0.1	281.5	73.3	3.0	845.7
Jharkhand	153	-4.0	16.7	128.3	0	173.7	140.1	-0.1	596.8
Orissa	66	-8.8	52.1	5.8	19.6	205.7	135.7	3.2	590.1
UP	11.9	-293.3	-4.0	113.1	-5.3	59.3	116.2	308.6	320.2
West Bengal	384.8	-26.0	64.3	67.6	-1.2	-54.5	13.9	-4.6	381.3
East – change	-60.5	-10	293.7	774.4	11.3	437.0	597.5	332.6	2513.0
% change	-0.2%	-0.1%	24.3%	25.9%	xx	9.2%	33.2%	16.1%	

A significant shift towards high value crops (2000-2007)

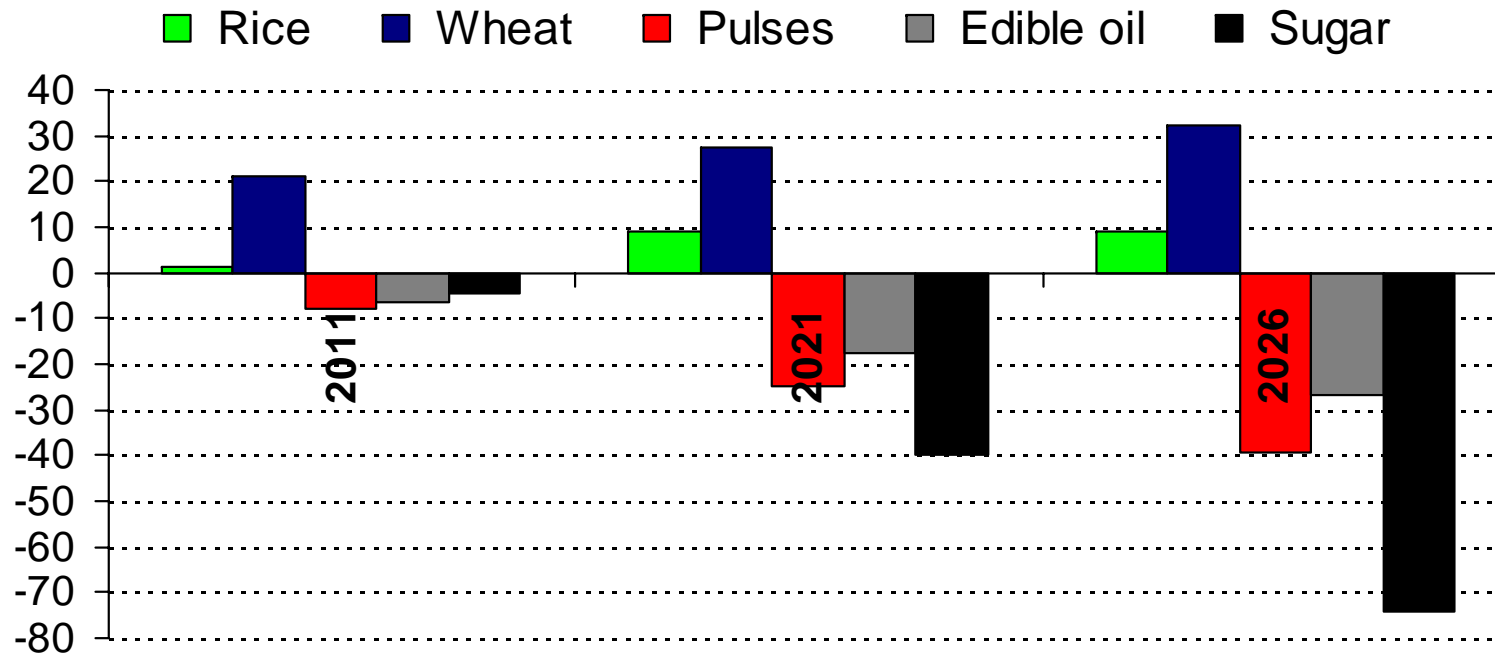
10. Contract farming can raise profitability

- India's experience with contract farming has been universally positive in raising profitability – this is being helped by the emergence of organised food retail
- However, there are issues around renegeing of contracts and political opposition that need to be addressed



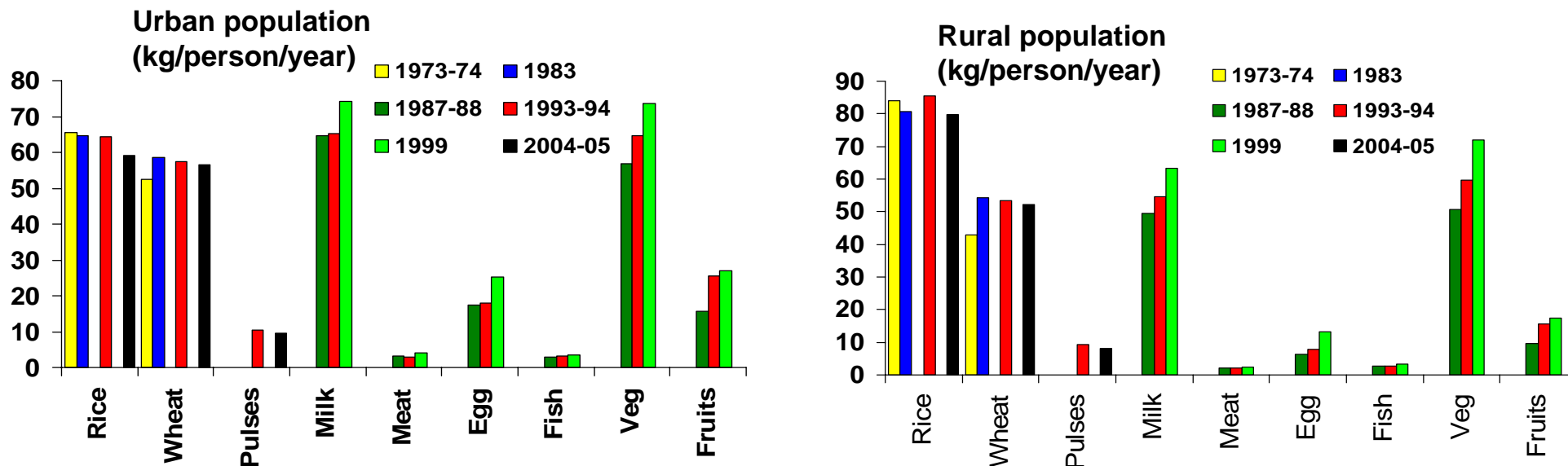
11. Contrary to popular belief, 'cereal' sufficiency has been achieved

Demand-supply gap projections (mn tonnes)



The demand-supply gap is no longer foreseen in cereals but in pulses and cash crops – a fact that is belatedly being recognised by Government policies

But changing consumption patterns will put supply pressures on other crops



A clear change in consumption pattern is visible in both urban and rural India – declining/stagnant consumption of cereals accompanied by increasing consumption of higher value foods – milk, meat, vegetables and fruits

Increasing incomes will drive greater consumption of high value food and cash crops – this is creating economic opportunities for farmers and businesses that did not exist in the aftermath of the Green Revolution

12. Bio-fuels is one such ‘opportunity’

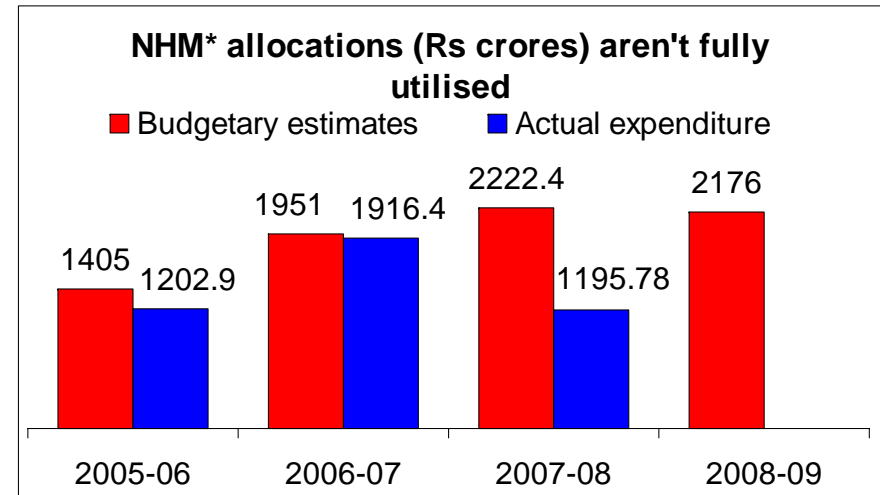
- Indian bio-diesel acreage (Jatropha) could rise to 5.6 mn hectares by 2012 and 13 mn ha by 2018
 - Of this, the Government expects up to 3 mn ha to come from currently cultivated area (i.e. diversion from one crop to another)
 - The balance is expected to come from rejuvenation of fallow land and diversion from non-agricultural sources

Acreage for bio-fuels: Government estimates

Year	Diesel demand (MMT)	Bio-diesel @5% (MMT)	Acreage (Mn ha)	Bio-diesel @10% (MMT)	Acreage (Mn ha)	Bio-diesel @20% (MMT)	Acreage (Mn ha)
2001-02	39.81	1.99	NA	3.98	NA	7.96	NA
2006-07	52.33	2.62	2.19	5.23	4.38	10.47	8.76
2011-12	66.90	3.35	2.79	6.69	5.58	13.38	11.19

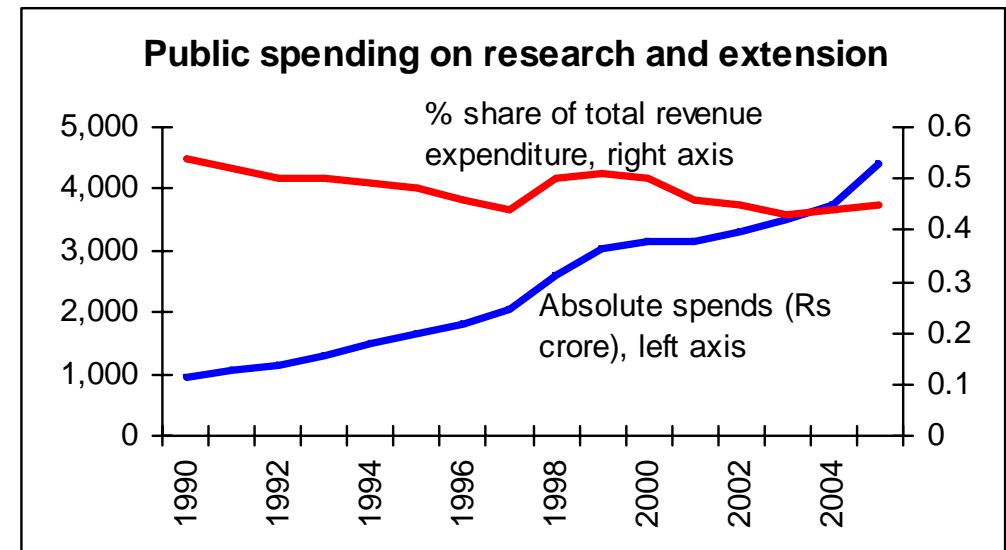
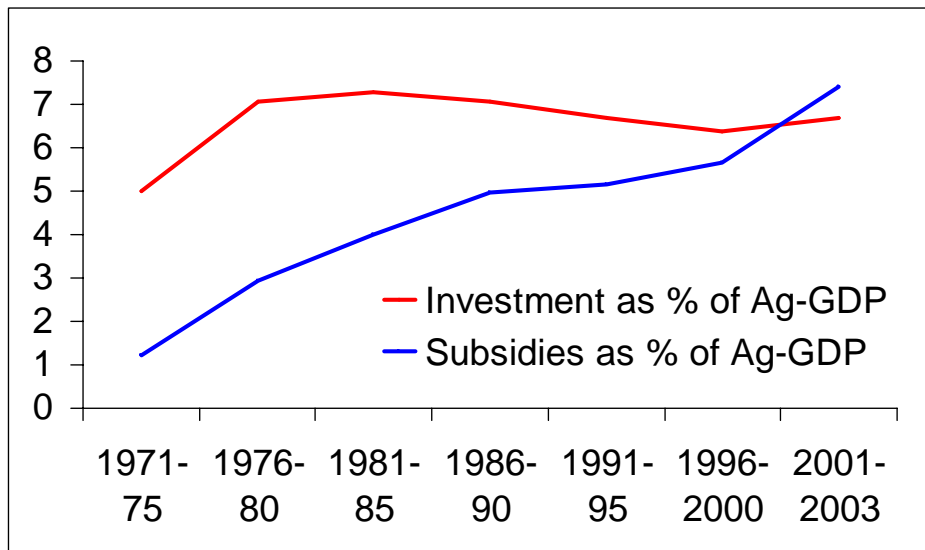
13. The Government's efforts towards pulses and non-food crops are fragmented

- In response to changing demand-supply dynamics, the Government has increased focus on crop-specific schemes: National Food Security Mission; National Horticulture Mission; the Integrated Scheme of Oilseeds, Pulses and Maize
- However, each of these suffers from a variety of inefficiencies
- As yet, there is no credible strategy to address these i.e. we should expect 'more of the same' as far as Government-sponsored action and implementation is concerned



Targets and achievement in pulse production			
	Production target ('000 tonnes)	Actual production	% deviation from target
2002-03	14,400	11,125	-22.7
2003-04	14,800	14,905	+0.7
2004-05	15,300	13,130	-14.2
2005-06	15,700	13,390	-14.7
2006-07	16,200	14,200	-12.3

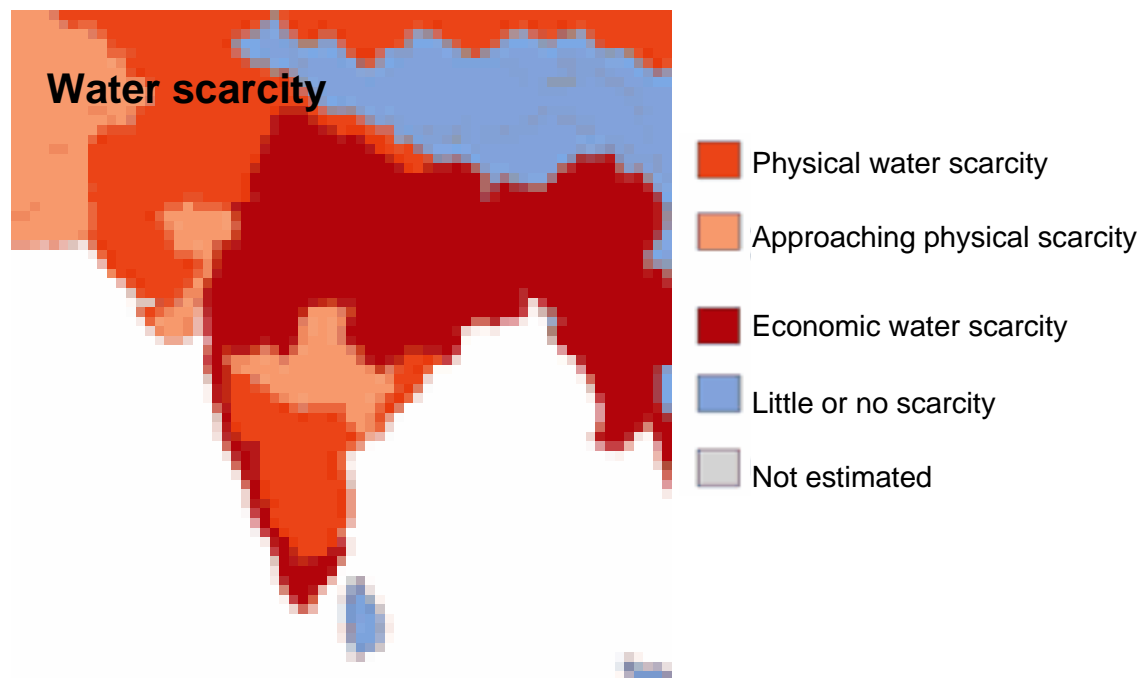
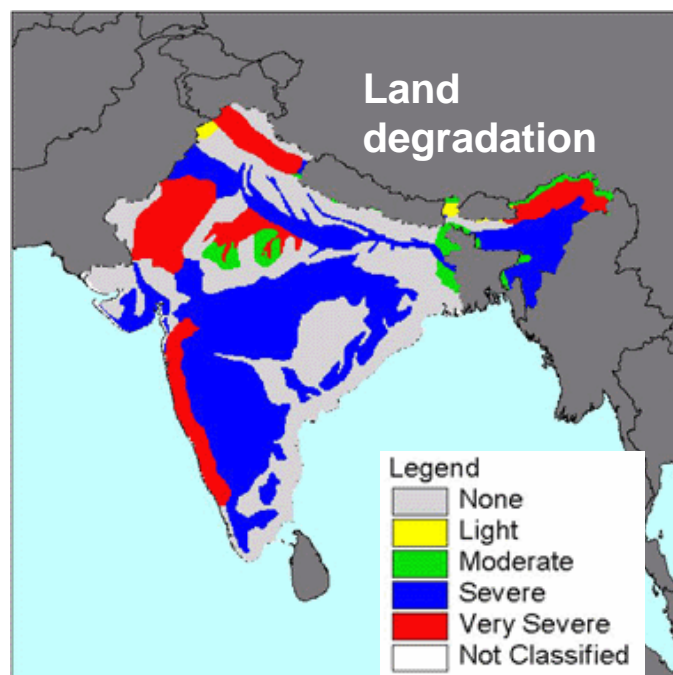
In fact, Government spending is inadequate and ineffective across the board



- A Rupee spent on capital formation is 3-4 times as effective as a Rupee spent on subsidies – but politics prevents reform
- Agricultural investment as a % of GDP has been falling; instead greater expenditure is being incurred on subsidies
- Although allocations for research and extension programmes have been increasing, there are inefficiencies that prevent funds from being fully utilised

14. Meanwhile, environmental degradation is emerging as a major threat

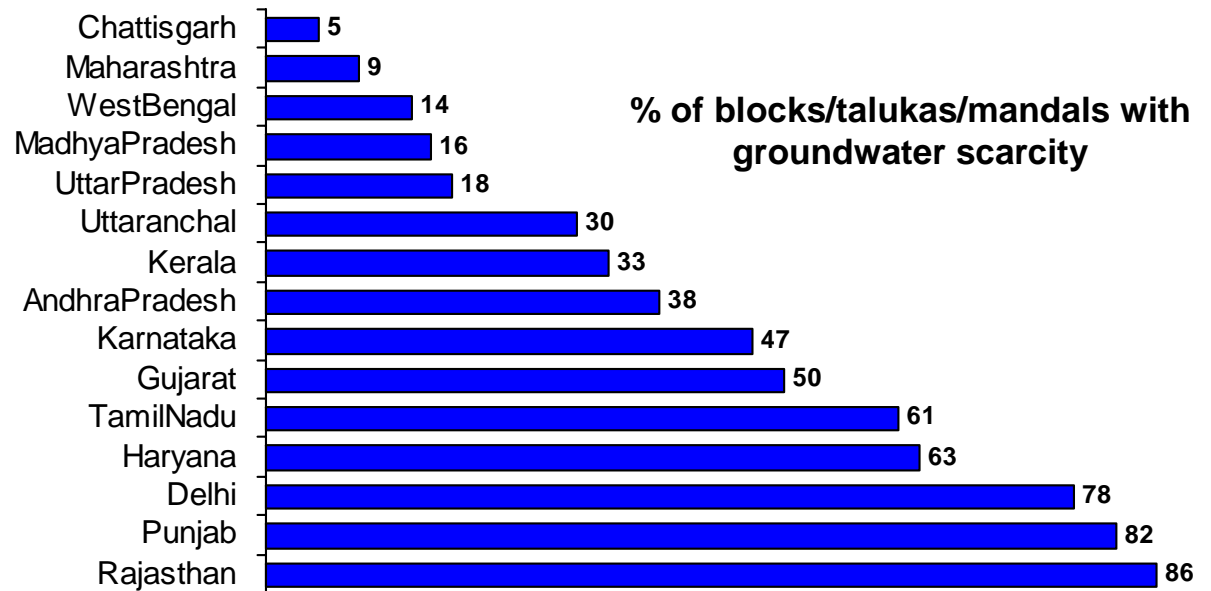
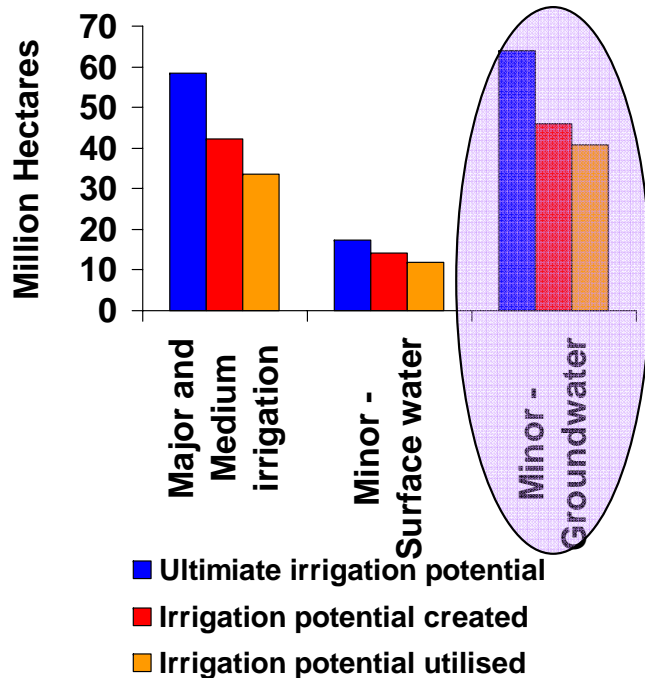
- Soil degradation is approaching worrisome levels in most parts of India; 50% of total land and 66% of cultivated land degraded – the highest amongst Asia Pacific countries
- Water scarcity projected as the single biggest factor for civil and social strife in the next decade



As are falling water tables

Future sources of irrigation will depend increasingly on groundwater...

...but the level of groundwater is already in a critical condition in most states



Increasing dependence on groundwater irrigation can be a potential source of failure of future projects, due to high levels of groundwater depletion

This will have serious long term implications

Climate change impact assessment

- The impact of climate change on the environment is visibly obvious (IPCC, Working Group II, 2007)
- India's overall crop yields could fall by 30% by 2050 according to the IPCC; other impact: coastal flooding, greater drought incidence, reduced water availability
- Other studies suggest vulnerability of 5-15% in rice yields and 25-42% in wheat yields (*Parikh and Kumar, 2002*); response times of mitigation measures are 5-15 years

Climate change presents a 'real' and exogenous force that will work against productivity improvement measures locally

IV. Summary and drawings

In Summary: negative or stagnant trends

- The lack of new technologies after the effects of the Green Revolution have worn off, is becoming worrisome; very few promising seeds have been commercialised and most other innovations are still languishing due to poor extension or lack of investment
- Corrective action regarding fertiliser subsidy, inadequate seed production, market rigidities and other market-distorting policies is desperately needed – but as yet, political commitment is not visible
- Achievement of irrigation potential unlikely to surpass 50% of targeted acreage, given the large backlog of previous projects to be completed and the fact that no tangible change has been made in the strategy – hence, monsoon dependence and erratic growth will continue to plague the sector
- In general, the effectiveness of Government measures/schemes will remain erratic across the country – private participation can help but this will happen very slowly, at best (fundamental enabling measures such as land reforms, corporatisation, taxation of agriculture do not look likely at this time)
- Fundamental degradation in environmental parameters and lack of Good Agricultural Practices (GAP) are not likely to be addressed in the foreseeable future – this will create a serious long term threat

In Summary: positive trends

- Declining per capita cereal intake and rising F&V and other cash crop consumption will continue on the back of rising incomes and awareness – this will be helped by food retailing, bio-energy demand and create new opportunities for farmers and businesses
- A consistent movement of labour away from agricultural occupations will lead to rising wages; this should prompt greater mechanisation and productivity-enhancing measures
- The provision of greater finance to agriculture will continue to increase – through bank lending, the Kissan credit card scheme, and the possible introduction of trade-able deficits (for directed bank lending) as well as private-sector micro-finance programmes – this will raise farmer incomes and hence, rural demand
- There is a shift in Government priority from an overwhelming emphasis on food-grains and cereals to a more broad-based focus on profitable and sustainable farming – this will have cascading benefits for the entire agriculture-to-food value chain in the long term
- Individual states are taking the lead on issues like private participation, land reforms and other measures – this can create opportunities in the absence of a concerted push from the Centre

Implications for business: general thoughts

- Indian agriculture presents several opportunities:
 - Contract farming
 - New crop technologies – seeds, fertiliser, crop protection
 - Trading and procurement
 - R&D
 - Retail and distribution
- However, most opportunities are at nascent stages – this presents both an inherent advantage and a risk that must be explicitly realised
- A granular analysis is critical before any business or investment decision is made – generalisations are hazardous in the context of Indian agriculture
- Given the complexity of inter-relationships, it is important to be in sync with the broader economic, political and market context, before initiating a new business/activity



Research for Strategy

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