

# Policy Watch

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## Slow Agricultural Growth and Agrarian Crisis

A. Vaidyanathan



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Politics and Public Policy

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# Slow Agricultural Growth and Agrarian Crisis

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## ABSTRACT

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India's agricultural growth in the past two decades has been slower than the rest of the economy. This has led to resentment among the rural population that the bulk of the benefits of development have gone to the urban areas and that public development policy is more concerned with promoting urban interests at the cost of ignoring the concerns of rural areas.

This resentment is widespread, strong and grows to crisis proportions whenever there are severe natural calamities as witnessed in the last few years. This paper is an effort to explore the deeper issues underlying the past experience and future prospects of growth of agriculture and the rural economy. It also examines how this growth has impacted (and is likely to impact) various sections of the rural population.

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## I. INTRODUCTION

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The state of the country's agriculture and of its agrarian economy has been and continues to be the subject of discussion and debate. The following are the major concerns highlighted in the literature about the trends in the performance of the sector, their adverse socio-economic impact and the needed remedial measures.

- The fact that despite massive investments and technological improvements, there is no significant change in the trend rate of output growth, which has been more or less steady at around 2.5 per cent per annum over the last six decades.
- The realised growth has consistently fallen short of the four per cent per annum targeted in successive Five Year Plans.
- Agricultural output has throughout grown at a slower rate than the rest of the economy. This differential has progressively widened, and has become particularly marked during the last two decades. The gross domestic product (GDP) per worker in agriculture not only remains much lower than in the rest of the economy, but has also grown much slower. The widening differential in this respect is an important reason for widening disparities between incomes of those dependent on agricultural and non-agricultural activities.
- Within agriculture, growth is very uneven across crops and regions; there is also a widening gap between irrigated and rain-fed tracts. Landless and marginal holdings are proliferating rapidly both in absolute terms and as a proportion of rural population. They, as well as those with larger holdings, complain that high input costs and low output prices have made farming precarious even in normal times. Their vulnerability is aggravated by the loss of incomes, inability to repay debts in the face of periodic droughts and fall in market prices.
- Despite sustained agricultural growth, diversification of employment and rising real wage rates, rural-urban disparity in per capita consumption is growing. High incidence of unemployment, poverty and low food intake in the rural population remain a source of great concern. At the same time, access to and cost of health care and higher education is heavily skewed in favour of the better off; and many of those with better education are less interested in remaining in rural areas even as those who choose to remain report very high levels of unemployment.

Cumulatively, these have led to resentment among the rural population that the bulk of the benefits of development have gone to the urban areas and that public development policy is more concerned with protecting or promoting urban interests at the cost of ignoring or overriding the concerns of rural areas. The attempts to assuage these grievances through ad-hoc sops (subsidies, freebies) and various kinds of ill-thought-out and poorly implemented special employment and social security programmes. This resentment is widespread, strong and grows to crisis proportions in the wake of severe natural calamities of the scale and scope witnessed in the last few years.

This paper is an effort to explore the deeper and more basic issues relating the past experience and future prospects of growth of agriculture and the rural economy and how it has impacted (and likely to impact) on various sections of the rural population.

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## II. CAUSES OF SLOW GROWTH

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The widely cited argument that inadequate investment is responsible for the relatively slow growth of agriculture and related activities over the last several decades is both wrong and misleading<sup>1</sup>. The total volume of investment is in fact large and growing: In real terms, gross capital formation in this sector has more than quadrupled during the last three decades. More importantly, the contribution of total investment to augmenting the sector's production potential, however, depends very much on its composition and efficiency. One has to distinguish between those (especially irrigation) that directly augment production potential; those (notably investments in machinery) that displace labour without significantly augmenting to production capacity; and those for various other supporting facilities and infrastructure.

In absolute terms, all three components are growing, the first two account for the bulk of total capital formation. Public investment is mostly for expansion of water supply for irrigation and improving its efficacy. A large part of private investment also goes into irrigation using groundwater. (An increasing part goes into purchase of farm machinery which are mostly labour saving and do not add much to production potential). The volume of water available for agriculture from these investments, however, does not increase in the same proportion as investment. In the case of public sector, newer projects - besides being more difficult and costly - are prone to cost-increases due to inflation and inordinate delays in completing projects.

The phenomenal growth of private investment in wells and tube wells has no doubt contributed to a huge increase in the volume of groundwater available for irrigation in a form that permits a far more flexible and efficient management of water. However, here again the effective increase in the volume of water extracted is likely to be much less than the volume of investment would suggest. This is because more and more private investment goes into deepening of wells and installation of more powerful pumps to extract water from falling groundwater levels. There is general agreement on this stylised picture, but very little hard data to assess their impact in terms of the actual volume of surface and groundwater that are utilised for agricultural and non-agricultural purposes.

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<sup>1</sup> The subsequent discussion draws heavily on data and analyses presented in my 2012-book titled *India's Agricultural Development: Role of technology, incentives and institutions* (Oxford University press). Given the serious gaps and inadequacies (in terms of scope, coverage and reliability) in available data, the analyses and conclusions are tentative and open to challenge and refinement.

A detailed review of these deficiencies along with a detailed proposal for restructuring the current system of agricultural statistics is available in GOI, Department of Agriculture and Cooperation, *Report of the Expert Committee on Agricultural Statistics*, 2011.

The serious lacunae in the mechanisms for collecting and collating reliable and validated data on these basic data have been vividly documented in a recent report on the state of water related data prepared by an expert group of the Planning Commission<sup>2</sup>. More comprehensive but un-validated data on source-wise area irrigated is available from different sources (land use statistics, agricultural censuses and sample surveys). But as these differ in terms of scope, coverage, concepts, and periodicity, and all are prone to errors of omission and commission, it is difficult to get at the ‘true’ picture. It is appalling that major issues of water resource development strategy and policy have been and continue to be debated by scholars and decided by politicians without an analytical framework founded on reliable data on these basic aspects.

A more meaningful way to understand the dynamics of agricultural growth is to focus on the trends in volume of key output augmenting inputs (namely land, water, bio-nutrients) and the efficacy with which the available technology for their management is utilised. The extent of land being cultivated has long reached its limit and has remained more or less constant at around 140 million hectares (mill. ha.). The intensity at which this land is cropped has, however, increased progressively from 165 mill. ha., in 1970 to nearly 200 mill. ha., in 2011. This increase is made possible by the expansion of total irrigated land 31 mill. ha., to 66 mill. ha., over this period. This and the increase in the proportion of groundwater irrigated land has played a central and critical role in the growth of crop output: Besides increasing the intensity of cropping, it has (a) brought about significant shifts in crop pattern to relatively high-value water-intensive crops like paddy and sugarcane as well as several important commercial crops (including oilseeds, fibres and horticulture); made farmers adopt (b) high yielding varieties that require irrigation; and (c) more intensive use of fertilisers. These effects operate in synergy in the case of irrigated crops in such a way that is expected to increase the yield response per unit of nutrient considerably more than on rain-fed crops.

Rough estimates—based on admittedly rather patchy—data (especially on irrigated and rain-fed crop patterns and yields), suggest that most, if not all, of the increase in production has come from expansion of area and increased overall yields of irrigated crops. Rain-fed crop areas are shrinking even as their overall yields per hectare do not show any significant trends over time<sup>3</sup>.

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<sup>2</sup> GOI, Planning Commission, Report of the Working Group on Water Data Base Development and Management for the 12th plan, 2011.

<sup>3</sup> The basis of this assessment, its scope and underlying assumptions, are detailed in Vaidyanathan. A. ET. al. 1994. Impact of Irrigation on Productivity of Land. *Journal of Indian School of Political Economy*. (Vol. 6. No. 4. Oct-Dec). It covers changes between the early 1970s and late 1990s; there is no reason to believe that the picture has changed significantly since. There is clearly need for more intensive research for updating the estimates with better, more disaggregated data and improvement in assumptions for estimating area and yields of irrigated and rain fed crops.

**Trends in use of key inputs for crop production 1970 – 2011**

		1970-1	1980-1	1990-91	2000-1	2011-12
<b>Net sown area</b>	Mill ha	140	140	143	141	141
<b>Gross crop area</b>	Mill ha	165	172	186	185	196
<b>Net irrigated area</b>	Mill ha	31	39	48	55.2	66
<b>Gross irrigated area</b>	Mill ha	38	49.8	63.3	76	91.7
<b>HYV area</b>	Mill ha	n.a.	15.4	43	65	n.a.
<b>Fertilizers</b>	Mill tons	2.2	5.5	12.5	16.7	27.8

Source: Compiled by author.

Nevertheless, there is general consensus among agricultural experts, researchers and field staff that the actual impact of expanding irrigation, and yield-augmenting technology and inputs is much less than their potential. A *prima facie* indication is that over the last four decades, which have seen a two-and-half-fold increase in irrigated crop area and nearly 12-fold increases in fertiliser use, the overall index of crop production has barely trebled. While we do not have data to assess these trends for irrigated and rain-fed areas separately, it is widely recognised that yields of irrigated crops, including those using superior high-yielding seed varieties, are well below potentials demonstrated by field trials; that indiscriminate and wasteful use of irrigation water and fertilisers is widespread; that this has led to degradation of soils, overexploitation of groundwater and increasing spread and intensity of deterioration of water quality due to leaching of agro-chemicals. Also well known, though not rigorously documented and analysed, is the fact the potential yields and the gap between potential and realised yields vary across regions and between crops. Rain-fed crop yields are invariably much less than under irrigation and inter-regional variability is much higher.

These features in part reflect the diversity of agro-climatic conditions across regions, the highly uneven pace of improvement in yield-augmenting techniques for land improvement, and soil and moisture conservation (for instance through integrated watershed development) rain-fed areas, the relatively limited scope for raising yields of rain-fed crops with fertilisers and improved agronomic practices, and the highly uneven pace and progress of research to develop yield augmenting varieties, and practices suited to varied agro-climatic conditions even for different irrigated crops. The extent to which farmers adopt these practices, the level of inputs they use and the care with which they are managed is conditioned by the calculus of net returns over costs. This depends on the demand for the products, the prices of outputs and inputs, and efficiency of input use.

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### III. EVALUATING THE INCENTIVE ENVIRONMENT

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The growth of overall demand for agricultural products is a function of growth of population, level of incomes and their distribution. Both population and incomes have grown, the latter at an accelerated pace, but overall demand for farm products has grown at a much slower rate than one would expect in a low-income country. According to official national income statistics, private consumption of food and food products has grown consistently at a slower rate than aggregate private consumption (both valued at constant prices): the difference between the two has widened progressively and especially rapidly during the last two decades of accelerated overall growth<sup>4</sup>. This decline reflects the progressive urbanisation and rapid increase in the share of incomes accruing to urban population; a marked shift in patterns of tastes and preferences from food to non-food both in rural and urban areas; and also progressive increase in the consumption of various processed foods.

Prices of both agricultural and non-agricultural products have been on a rising trend, but notably there is no significant and sustained change in the trend of relative prices of agriculture and manufactures. This suggests that changing relative prices of the products of the two sectors is unlikely to be an important factor in explaining the near stagnation of overall agricultural growth at low levels. But changing composition of demand for agricultural products and their relative price and costs, taken together with the potential of yield-augmenting techniques have a significant impact on supply response of different products.

Agricultural produce prices are largely market determined. But the extent of trade relative to output as well as the geographical scope of the market, its organisation and functioning varies. Supply-demand conditions and competition between buyers and sellers are evident in all markets, but few meet the norms of a free and open competition. State intervention has a significant influence on trade and trading practices. Besides legal regulations meant to ensure fair and transparent trading environment, governments intervene in the functioning of markets directly and indirectly in numerous ways but in varying degrees.

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<sup>4</sup> NSS consumption surveys also show a decline in the share of food in total consumption expenditure and also a declining trend in the cross section elasticity of per capita food expenditure relative to per capita total consumption. These estimates, which relate to the value of expenditure at current market prices, include processing and marketing margins. The elasticities of primary farm products relative to total consumption will obviously be considerably lower. Estimates that take this aspect into account and focus on farm gate prices of agricultural products using the survey data have not been attempted.

In the case of produce markets, the government fixes minimum support prices (MSP) for a large number of crops. The aim, initially, was to protect farmers from volatility of market prices and guarantee a price that will provide a reasonable margin over costs. These are revised periodically on the basis of sample surveys of costs of production. This guarantee is, however, not uniformly effective. Where it is, as is the case of crops (like rice, wheat, sugar cane, and cotton) for which there is wide network for procurement of marketed surpluses, the fixation of minimum prices is open to pressure from cultivators in the main producing regions on the scope of costs to be covered and what is deemed to be a reasonable margin over them.

Over time, pressures to raise MSPs on the ground that farming is becoming uneconomical and unattractive have intensified. There are instances—of which rice, wheat, and sugarcane are good examples—where despite signs of supply exceeding demand, the government buys the excess supply and bears the costs of holding huge inventories. In some other cases, imports are sought to be restricted to protect domestic producers (rubber is a good example) or by liberal imports of cheaper substitutes (as in the case of edible oils), and in several others, high price volatility in the domestic market is sought to be managed through import and export controls.

**State intervention in input prices much wider in scope and extent:** The bulk of several key material inputs used by agriculture—surface irrigation, energy for groundwater irrigation, agro-chemicals and rural credit—is produced and/or supplied through public sector organisations. The pricing of all these inputs is decided and enforced by government ostensibly to ensure that they are affordably cheap. This has been and remains the overriding objective of policy. The political argument is that these measures have been and continue to be justified for helping the poverty-stricken farming community. The economic argument is that cheap inputs are necessary to induce adoption and spread of yield augmenting technology and inputs on a scale and at a pace needed to achieve and sustain rapid growth of agricultural output.

Whatever may have been the validity of these arguments in the initial years of planning; there is little justification for deliberately persisting with the policy. The rapid growth in the supply of yield augmenting inputs has been matched, in fact more than matched, by demand. Costs of production and distribution show spiralling growth. And yet, nominal input prices for all key material inputs have been kept unchanged and even reduced in many cases. Leakages and poor recoveries have further reduced effective rates to negligible levels in the case of canal irrigation and energy for pumping.

This policy has resulted in mounting losses which are left to be borne by the exchequer. The adverse fiscal impact of these input implicit subsidies and the fact they have significantly reduced the resources available for much needed public investment for increasing the overall growth rate is widely recognised

and commented on. But there is hardly any strong voice, even from economists, urging a reduction of subsidies which is deemed politically unfeasible. Given the importance of farmers in electorate, attempts to raise the issue in public forums evokes fierce and on occasion violent, reactions from the farm lobby and practically all sections of the political class.

Surprisingly, the huge perverse impact of the cheap input policy on incentives for efficient and prudent use of water and fertilisers hardly gets any attention. Low input prices in the context of rising product prices obviously stimulate larger demand for water which, over time, has progressively outstripped utilisable supplies. Increasing competition between different uses and users for access to this resource and attendant conflicts have intensified in a manner that works to the disadvantage of small and marginal cultivators. Over-exploitation of groundwater extraction beyond the levels of renewable recharge is reflected in falling water tables and massive investments (for deepening of wells and use of more powerful pumps) yielding only marginal increase in volume of water. Excessive use of water and agro-chemicals are not just wasteful but the main source of degradation of land, chemical pollution of water and ecological damage which portend serious long term damage to sustainable growth and further intensification of the already difficult and complex task of balancing the interests of economic growth and of ensuring a healthy environment.

There is ample evidence that farmers' decisions on allocation of land, water and related resources for different crops are highly sensitive to shifts in their relative net returns and changes therein. It is, therefore, difficult to understand the reluctance of even professional economists to highlight the hugely beneficial effects of raising input prices more in line with costs both for farmers (by raising the output per unit of inputs) and for the long-term interests of mitigating the adverse trends under the current regime and promote more prudent management of critical natural resources and a healthier environment.

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## IV. IMPACT OF INSTITUTIONS

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**W**e cannot, of course, under-rate the difficulty of making radical changes in a democratic polity. Nor can we assume that raising input prices will by itself induce farmers to change their attitudes and practices for more prudent and efficient use of resources. Their attitudes and practices are conditioned by the availability and quality of physical infrastructure (irrigation, transmission networks, roads, storage facilities); and the functioning of institutions that provide common support services (research, extension, marketing and credit). Except for groundwater extraction, marketing of both inputs and outputs and to a limited extent in research and extension, most of these facilities and services are provided by government departments or state-sponsored institutions. All, however, function within the legal, regulatory and policy framework defined by government.

The scale, scope and reach of operations of all support facilities have recorded impressive growth.

- Vast improvement in access of rural communities to transport facilities, connectivity and communications
- Creation of a national network of public sector agricultural research stations for improving varieties, cultivation techniques and agronomic management to increasing productivity of various crops in different agro-climatic regions
- A nation-wide public extension service to conduct field trials to demonstrate the efficacy of varieties and practices generated by research and to advise farmers on solutions to their location specific problems
- Manifold expansion of public irrigation and domestic water supply systems
- Massive increase in the number of wells and tube wells and area irrigated facilitated by extension of electricity distribution networks for rural areas
- Increase in the number of regulated markets with improved facilities for staple crops and major improvements in the organisation for procurement, processing and marketing of perishable produce especially milk, animal products and horticulture
- Massive expansion of banking facilities and institutional credit in rural areas through network of cooperatives, commercial bank branches and microfinance institutions

Most of these developments are the result of large-scale public investment which in turn has facilitated rapid growth of private investments in trade, transport, processing and marketing of agricultural produce. Of late, government policy is giving greater scope for private sector both in key areas of

breed improvement using bio technology as well as in seed production and distribution, extension services and in the nature of organisation and techniques of procurement, processing and merchandising of food and food products (especially perishables). Performance in these spheres presents a mixed picture of impressive quantitative expansion but, in most cases; attract widespread criticism for deficiencies in their functioning and achievements.

**Irrigation:**<sup>5</sup> Take for example irrigation which is the most critical contributor to agricultural growth. It has absorbed a massive amount of both public and private investment. Surface irrigation projects are almost entirely planned, implemented and managed by government. Under the Constitution, assessment and allocation of surface water resources between riparian States of inter-State river basins, and disputes over them, is left to be decided by tribunals appointed by the Centre. The CWC has also played an important advisory role in technical aspects of investigation and design of projects, and appraisal of techno-economic viability and environmental impact of all major and medium projects, especially of projects with inter-State implications, proposed by States for clearance by the Planning Commission. The authority for all aspects of actual implementation of projects and their continuing maintenance and management, including formulation and enforcement of rules of allocation and scheduling of water supplied through them, is vested entirely with the State governments. Programmes and policies for development and regulation of minor surface works and groundwater are left entirely to the States.

In reality, these checks and balances meant to ensure transparency, efficiency and equitable use of water have proved largely ineffective in the face of widespread and intense ground level demand for expanding both surface and groundwater resource as the duty of government. As a result, practically all aspects of the planning, appraisal, implementation and management of projects and their regulation has been politicised to a degree that has done grievous damage to the way these functions are managed. In the case of large surface water based projects, it has led deterioration in the quality of investigations and design, fudging of estimates of available water availability, project costs and benefits. The impact is evident in frequent and large upward revisions of costs, inordinate delays in completion of projects, increasing divergence between the magnitude of investment and additions to irrigation potential, and between potential created and area actually reported to be irrigated. The incremental cost (in real terms) of additions to storage capacity and its utilisation (measured in terms of irrigated crop area) have increased manifold over the last four decades.

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<sup>5</sup> The subsequent discussion of the institutional problems in the irrigation sector draws heavily on Planning Commission 2012 Report of Working group on water data and management for the 12<sup>th</sup> plan

**Trends in investment, potential created and utilised  
from major and medium irrigation projects**

	Unit	1968	1990	2000	2012
<b>Live storage capacity</b>	Bcm	125	162	214	253
<b>Cumulative investment</b>	Rs billion*	234	735	1012	1334
<b>Irrigation Potential</b>	Mill ha	18.1	29.9	37.1	45
<b>Utilisation</b>	Mill ha	16.7	25.5	31	35
<b>Investment/mcm of additional storage *</b>	Rs lakh		1.35	5.3	8.2
<b>Investment/ha of additional utilisation *</b>	Rs 000		5.7	49	80

\* Incremental ratio of additions 1968-90, 1990-00; 2000-2012 sources: CWC, Water related statistics 2014.

The CWC's estimates of surface and groundwater utilised for irrigation and the area irrigated are notional. There are no measured estimates of the volume of surface and groundwater actually used for irrigation. CWC itself has no independent mechanism for compiling and verifying these data. This is left entirely to be done by States. States do record the volume of water released from public canal systems and the area and crops they irrigate. They also collect data on area reported to be irrigated by groundwater but not on the volume of groundwater pumped for this purpose. The methodology and basis for these estimates and their validation leave much to be desired. The process is not subject to rigorous inspection; nor are these data made available in the public domain or reported to CWC even when they formally ask for it. Estimates of source-wise irrigated area from land use statistics compiled by States and the National Sample Survey are at variance with CWC estimates. Though this is a widely discussed issue, the reasons for these differences remain unexplored. Nor is any serious effort made either by CWC or the States to evolve and implement a uniform framework for compiling comprehensive, reliable and comparable data on water use and irrigated area

This indifference is in part due to the inability or unwillingness of CWC to exercise the authority which it has to address these issues and insists on compliance by the States. But it also reflects the fact that irrigation bureaucracies at all levels tend to take a narrow view of their task limited to construction of systems and managing water distribution, without any interest in keeping track of where, for what purpose and how efficiently water from different sources is being used. Even in this limited respect, the functioning of these institutions is marked by excessive secrecy and great reluctance to make all relevant data available in the public domain and to engage and collaborate with academia to improve the quality of data. Concerted pressure, using the Right to Information Act (RTI) and other avenues, to break this logjam is imperative.

Efficient use of this critical resource requires understanding of the complex interactions between soil, climate, water, bio-tech inputs and water management practices. This calls for close and continuing consultations between water bureaucracies, agricultural scientists at all stages of planning, projects, deciding allocation rules and adapting them in the light of changing situations. But this is conspicuously weak if not absent because of the complexity of these interactions and serious gaps in the state of knowledge about them.

In this context, deciding and enforcing operational rules for allocation of water in public irrigation systems serving numerous users growing a variety of crops under different agro-climatic conditions are inherently a daunting task. Invariably, issues relating to the area to be irrigated and the crop patterns for using the water supply from each project and appropriate rules for regulating supplies are decided at the stage of its design. Given the lacunae in current state of factual and analytical knowledge, these decisions are based on rules of thumb on technical aspects and the propensity of political executive to promise access to a wide section of potential beneficiaries.

Even at this stage the decisions are influenced by lobbying by locally powerful interests who are then able to get rules changed in their favour and/or more commonly by violating regulations without being penalised. This tendency is facilitated by pervasive laxity and permissiveness in the management of institutions responsible for making and enforcing rules for water distribution in public irrigation systems; granting approvals for construction and power connections for wells and tube wells; checking and penalising violations of cropping pattern restrictions and unauthorised use of water and electricity; and ensure proper assessment and recovery of user charges.

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## V. RESEARCH SYSTEM

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The public sector research network is expected to generate, test and propagate improvements in technology and agronomic practices for increasing production and productivity of diverse crops under varied agro-climatic conditions. While its contribution to growth of food and fibre production is widely acclaimed, the uneven scope pace and coverage of its contribution has also attracted critical comment for being biased towards irrigated areas and crops to the neglect of rain-fed areas and crops.

The most serious criticism is the lack of significant improvement in varieties and yield potential of pulses, indigenous oilseeds and numerous other minor crops. This is a cause for concern because the supply of these important components of food requirements are falling increasingly behind demand causing shortages and soaring prices. Research on evolving strategies for integrated water shed development to improve soil conditions and moisture conservation in rain-fed tracts and crop patterns adapted to different agro-ecological conditions has not made a significant impact on the efficacy of these programmes on the ground.

Even in the case of successful irrigated, high-yielding varieties, it is alleged that focus on breeding without adequate attention to developing integrated soil and moisture management and agronomic practices necessary for realising the potential on mass application. The persistent and significant though variable gaps between demonstrated potential and realised yields are known to be largely due to indiscriminate use of water, nutrients and agro chemicals. Corrective measures call for techniques and practices for more prudent and economical use of these inputs are necessary to check environmental damage and reduce costs. But this does not get the importance it deserves in the research agenda and extension.

Some four decades back, the Indian Council of Agricultural Research (ICAR) did launch pioneering and innovative coordinated research project on water management. The project which continued for over two decades and collected a rich body of data which if properly analysed could have provided better understanding and insights on water management and agronomic practices for use of water and nutrients to achieve optimum impact on yields. But the project has been wound up without in depth analysis of these data from this viewpoint. So would systematic analysis of the massive data on yield response to fertilisers from both experimental stations, demonstrations and farmers field trials. Regrettably there is little interest even in the agricultural research community or extension services to exploit this potential.

The organisation and functioning of the public sector research system has also attracted considerable criticism for working in silos rather than collaborative inter disciplinary research; inadequate interaction with the farming community; rigorous monitoring of adoption of recommended practices and their performance at the ground level; and the fact that the functioning and performance of the system and its achievements have not been subjected to independent review by peers and the users of its research.

### **Production and distribution of inputs**

Governments and public enterprises play an important direct role in the production, distribution and pricing of key material and financial inputs as well as in processing and marketing of produce and indirectly through regulation of private players in these activities. The management of these activities and their performance are again an area of serious concern. But decisions on these interventions and the manner in which they are implemented with scant regard for their impact on efficient, sustainable and equitable growth.

For instance, inefficiency and rising costs of public sector production of seeds, fertilisers and energy are well known. Farmers have been insulated from this by supplying them at highly subsidised prices at the cost of inducing wasteful and imprudent use of resources. The manner in which price support policies are decided and implemented is biased in favour of some crops and regions. In many cases a high proportion of farmers are not even aware of MSPs. In most crops, inadequacy of accessible centres where produce can be sold makes them ineffective. Even when such arrangements are available, when MSPs are set at higher than market prices for political reasons, public sector agencies end up purchasing and storing excess supplies and in some cases (notably rice, wheat, sugar and cotton) disposed at a huge loss.

Trade in most farm produce occurs through the private sector network operating in numerous and widely dispersed markets. The more important of them have good physical facilities, built by public investment. Law requires that all trading must be done at them observing regulations (on open auctions, grading, weighing, handling charges and settlements) meant to ensure fair trading practices. But enforcement is notoriously weak. In reality most trade is done outside of these markets and/or in violation of these regulations. Even when the state and its organisations play an important role in procurement and marketing of produce, complaints of widespread leakage, waste, unfair and corrupt practices remain unattended.

The massive expansion of institutional finance at subsidised rates of interest through cooperatives and commercial banks also suffers from much the same flaws. Total lending by rural credit

cooperatives has grown from Rs.79 billion in the 1993-4 to over Rs. 2,000 billion in 2010. The resources are provided entirely by NABARD, the geographical reach and the number of loans has not increased significantly. The bulk of the increase is for activities which support or are allied to agriculture. Direct credit to farmers has grown much slower: its share coming down from 80 per cent to around a fourth. They cater mostly to the middle and larger farmers. Their performance has been and continues to be abysmally poor in terms of recovery rates, non-performing assets and losses. The disposition and management of funds is controlled by locally powerful people belonging to ruling political parties. Loan approvals and recovery of dues are universally lax; accountability mechanisms – inspection, audit and review by meetings of the general body – are dysfunctional. The scale of their funding continues to grow despite persistently dismal performance and periodic crisis. There is no political constituency for their reform. A recent attempt to implement one with the concurrence of the central and State governments was given a burial in short order by the decision to waive all outstanding farm loans<sup>6</sup>.

Commercially bank loans to agriculture have grown much faster because they are mandated to lend a specified proportion of their resources to this sector. What section of the farmers they cater to and for what purposes they are used is difficult to assess on the basis of reported figures without a proper audit. Since these loans carry a lower rate of interest than the rate charged on normal loans, there is a strong incentive for rural households with sufficient land and other collateral to borrow ostensibly for agriculture and then use it for other purposes including on lending at the much, much higher open market rate<sup>7</sup>.

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<sup>6</sup> See Government of India, Ministry of Finance, 2004: *Report of the Task force on Rehabilitation of Rural Cooperative Credit Structure*. The cynical manner in which the implementation of this reform was thwarted and an assessment of the future of cooperatives was addressed in Vaidyanathan, A. 2013, *The future of cooperation in India*, EPW.

<sup>7</sup> For a detailed critique of the working of the governments' agricultural credit policy see Vaidyanathan, A. 2013, 'Agricultural credit: Policies, Performance and Corruption' in Samuel Paul (Ed), *Fighting Corruption: The Way Forward* (Academic Foundation, Bangalore)

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## VI. ROLE OF STATE GOVERNMENTS

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It should be obvious that policies for development and management of support facilities and the manner in which they are managed impede healthy and balanced growth of the sector. But these deficiencies have a much deeper root in the way the constitutional division of responsibilities has been implemented. Under the constitution agriculture is a State subject, which means that State governments have complete autonomy and responsibility for planning and implementing programmes for this sector. However, from early on the centre has, through the Planning Commission, played an active role in shaping strategy, policies and programmes for this sector and an increasingly important role in funding them through numerous centrally sponsored programmes. Irrigation projects had to be cleared by the Commission. But, as noted earlier, this authority got progressively diluted in the face of resistance and defiance from States on grounds of State autonomy. The creation and sustenance of the national research system and the design of the extension system was also done by centre with the consensus of States. The funding of State-level agricultural research and education came to be increasingly dependent on the Centre.

Faced with the shortage of resources and many other competing priorities for politically expedient subsidies and freebies, and given the importance of agriculture for national growth, they began accepting tied central assistance and funding for centrally sponsored programmes. This was done, despite complaints of rigid uniform conditions regarding the scope and content imposed by the centre, because they provided substantial resources to the States. This meant, in effect, that they abrogated both the autonomy and the responsibility for devising strategies appropriate to the resources, potentials and opportunities specific to their regions. They failed to insist on flexibility and even create indigenous capacity and expertise to meaningful programmes tailored to their conditions.

### **Impact on economy**

Rapid growth of agricultural production is expected and considered essential to increase food supply and improve nutritional status of the population. As a matter of fact, over the last 2-3 decades of relatively slow growth of food output, when realised agricultural growth has been stagnating, the average per capita food intake in terms nutrients has also not shown any significant improvement. Average per capita calorie intake shows a mild rising trend but remains at around 2,300 pc pd; so does the intake of fat; but protein intake is practically constant (based on FAO food balance estimates). This does not, however, mean that slow growth of intake is due to slow growth of supply. The demand

has also been growing much slower than expected in the context of accelerated growth in total and per capita real incomes. This happened due to several factors:

NSS surveys of household consumption show

1. a consistent trend reduction in the overall elasticity of expenditure on food relative to per capita consumption in both rural and urban areas;
2. population and per capita consumption in urban areas have been growing much faster than
3. in rural areas;
4. the share of food in total expenditure and its elasticity relative to per capita consumption is also lower in urban areas;
5. the inequality in the distribution of population relative to per capita total consumption has also increased more so in urban areas.

The combined effect of these explains the progressive fall in the overall consumption elasticity of food demand. While the extent of this trend is difficult to predict on the basis of available data, the fact that there is no sustained or significant trend in the relative prices of agriculture and manufactures would suggest the growth of demand is more less matched by the trend growth in supply. At any rate the slow growth of agriculture has not impeded faster and accelerating growth of non-agricultural sectors in the last two decades.

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## VII. IMPACT ON RURAL ECONOMY

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**S**low growth of agriculture, which has been the largest and, for long, the mainstay of the rural economy (over 80 per cent of the workforce in early 1980s was employed in this sector) also means a slow pace of increase in incomes of those dependent on agriculture. Even as the size of labour force continued to increase (from around 240 million in the late Eighties to over 300 million at present), growth of employment opportunities in this sector has not kept pace: employment in agriculture is currently estimated to be a little under 200 million. This decline is partly the result of slow growth of output but more importantly of increased availability of family labour in the proliferating small and marginal holdings, and rapid spread of labour saving machinery for agricultural operations.

The expected adverse impact of excess labour supply in terms of greater un- and under-employment, however, did not materialise because of an unprecedented diversification of rural economy that generated a rapid growth of non-farm employment and a progressive increase in real wage rates. Non-agricultural employment itself has become more diversified across all major sectors. That this has occurred despite slow growth of agriculture probably reflects the growing incomes generated in non-agricultural activities, external remittances and government subsidies.

This is accompanied by major changes in patterns of activity reflected in increased use of manufactured farm inputs including machinery, growing volume of trade in local produce, but more importantly, by changing patterns of rural demand for a variety of durable consumer goods and transport, communication equipment, the demand for their maintenance and repair services they generate, the demand for commercial transport facilities for fast growing mobility of rural population, and for education, health and personal services. It is noteworthy that there has been a dramatic increase in employment in the construction sector (which now accounts for more than 20 per cent of total employment compared to less than 4 per cent in the late 1980s). These dynamic changes in the rural economy, the relative importance of the above influences and the forces driving them deserve deeper exploration than is available in the literature.

Changes in the structure of the rural economy are reflected in the distribution of households according to the main source of income. The proportion of households whose main income is from self-employment has increased from a little over 50 per cent in 1993 to over 54 per cent currently. The share of self-employed agricultural households has remained more or less constant; that of self-employed in non-agricultural enterprises has shown a significant increase. Those dependent on wage

labour and other sources has increased from around 42 per cent to 45 per cent. Within this group the importance of non-agricultural activities as a source of income has significantly increased. Even as non-agricultural employment and incomes have grown, the agricultural sector itself is not only stagnant but livelihoods of those dependent on this sector have been under severe pressure.

#### Distribution of different types of rural households by main source of income

	1993-4	2003-4	2011-12
<b>SE agr</b>	37.8	37.2	37.6
<b>SE non-agr</b>	12.7	14.5	16.6
<b>Ag labour</b>	30.3	26.3	28.6
<b>Other labour</b>	8	10.9	13.7*
<b>Others</b>	11.2	11	3.5
<b>All</b>	100	100	100

\* including 9.6 per cent with regular employment

Source: NSS report # 563

## VIII. EMPLOYMENT AND UNEMPLOYMENT SITUATION IN INDIA 2011-12

Significant changes have taken place within the agricultural sector. The number of ownership holdings of land has increased some 40 per cent over the last two decades and is now placed at 156 million. However, with the area estimated to have shrunk by nearly 20 per cent, the average size of holdings has come down from 1ha to 0.6 ha. The number of holdings with less than 1 ha has increased much faster; from 62 million (about half the total) to nearly 110 million (nearly two thirds of the total). The average rate which comprised a little over a half of all holdings in 1991, now make up nearly two-thirds of the total. While the area owned in this category has increased (both in absolute relative terms, the average size of holdings has come down from around 0.3 ha to 0.25 ha. Households owning more than 1ha have experienced a decline in numbers, area owned and in average size of holdings.

### Changes in number and area of ownership and operational holdings 1991 – 2012

		1991-2		2002-3		2012-13	
		All	Op H	All	Op h	All	Op h
<b>All holdings</b>	Number in Millions	116	93	148	101	156	101
	Million ha	117	125	107	108	92	94.5
<b>Less than 1ha</b>	Number in Millions	62.5	59	92	70	109	69
	Million ha	19.8	24	25	24	28	26
<b>More than 1ha</b>	Number in Millions	40	34	41	33	35	36
	Million ha	97	101	84	84	62	69

Source: NSS surveys of landholdings

Changes in the pattern of operational holdings are even more striking: Their number is consistently less than the number of ownership holdings. Average size of operational holdings is larger than ownership holdings because all of those owning land do not cultivate it whether because it is being used for non-agricultural purposes or because owners prefer to lease it out. In the early 1990s, only 10 per cent of those owning some land reported not operating any land. The picture today is markedly different with non-land operating households comprising about a third of ownership holdings. The average size of operational holdings has also shrunk significantly.

The size distribution of operational holdings has also changed. Overall, even as the inequality in this distribution seems to have reduced somewhat, marginal holdings (that those less than 1ha) has increased both in terms of numbers (from 63 per cent in 1991 to over 73 per cent currently) and area (from about 16 per cent to nearly 28 per cent). Most of the increase in total operational holdings is in this group. There is not much change in these respects in the small holdings category. But the number of holdings and area has declined in all other size classes most strikingly in the large farm group.

### Size Distribution of operational holdings 1991-2 and 2012-3

	1991		2012	
	<i>million</i>	<i>mill ha</i>	<i>million</i>	<i>mill ha</i>
<b>Below .002</b>				0.03
<b>.002-.1</b>	58.7	19.5	79.7	26.2
<b>1.0 – 2.00</b>	16.6	23.4	16.5	22.2
<b>2.00 – 3.00</b>	11.2	26.5	8.7	22.2
<b>4.00-10.00</b>	5.7	33.1		18.3
<b>10.00+</b>	1.2	19	0.4	5.7
<b>Total</b>	93.5	125	108	94.5

Source: Compiled by author, based on NSSO Data.

### Role of land ownership and cultivation as income source

Ownership of land is wide spread. But it is not the only or the main source of income for all. Its importance varies both with the size of holding and, more importantly, between those who depend mainly on self-employment and those depending on wage labour for their livelihood. All size classes of holdings report multiple sources of income including self-employment in agriculture and non-agriculture, regular wage and salaried (RWS) jobs, casual labour and other miscellaneous sources. But the incidence and importance of different sources varies across different types of households. The landless and near-landless report wage labour (including regular wage employment) and self-employment as the main source of their main income. Households owning less than 1 acre (0.4 ha) have the most diversified sources of main income: wage labour being the largest, followed by self-employment in agriculture and to a smaller extent in non-agricultural activity. As one moves up the scale of holding size, the agriculture becomes the dominant as the main source. While all these classes

also report other activities as the main source, their importance is much smaller. Nearly 90 per cent of owners with more than 2 hectares report self-employment as the main source of income.

<b>Distribution of households owning land by different types by main source of income 2011-12</b>									
<b>Size class</b>	<b>Household type</b>								
<i>Ha</i>	<i>bb</i>	<i>ba/bb</i>	<i>SE A</i>	<i>SE NA</i>	<i>RWS</i>	<i>CL a</i>	<i>CL na</i>	<i>others</i>	<i>Total</i>
<.0001	10.1	0	4.5	21.5	13.7	30.6	19	10.6	100
.001-.004	9.5	0	6.3	18.5	9.4	24.2	27	14.4	100
.005-.4	48	.18	33.6	16.3	8.3	21.6	16.6	3.6	100
.4-1	16.7	.66	69.6	8.4	5.3	9.9	5.9	0.9	100
1 to 2 ha	10.9	1.39	83.4	4.8	4	5.4	1.7	0.6	100
2-4 ha	6.3	2.6	89.2	4.1	3.9	1.3	1.1	0.1	100
4ha+	2.7	6.6	92.4	3.2	3	0.1	1.2	0.1	100
All	100	.64	34.3	15.5	9.6	21	13.5	6.1	100

It is also worth noting that sample households of all types report receiving income from multiple sources and that this mix varies across types.

<b>Proportion households of different types reporting income from different sources</b>						
<b>Hh type</b>	<b>Cultivation</b>	<b>Fishing/ other agr</b>	<b>Wage and salary</b>	<b>Non-ag enterprise</b>	<b>Others</b>	<b>All</b>
<b>SE agr</b>	95.8	27.1	24.8	9.8	21.6	179.1
<b>SE non agr</b>	38.5	15.1	25.6	88.3	17.6	185.1
<b>Agr lab</b>	42.4	14.4	93.1	6.6	13.5	170
<b>Other lab</b>	32.3	16.7	95	9.6	16	169.6
<b>Other</b>	39.8	16.4	61.4	9.5	46.8	173.9
<b>All</b>	60.5	19.5	56.5	18.3	9	176.7

Source: NSS report # 413 sources of household income in India 1993-4 includes pension, remittances, int, div, others

The picture, however, is very different when one looks at cultivation holdings. Nearly half the rural households cultivate no land. Among different main source of income, casual wage labour, regular wage and salary jobs, followed by self-employment in non-agricultural enterprise are cited as the main income source. For those cultivating less than 1 acre (0.4 ha) the main source of income is very diversified, with nearly half citing casual wage labour as the main source, followed by self-employment in non-agriculture, self-employment in agriculture and RWS. Those in the 0.4 – 1ha group also report wage employment and non-agricultural self-employment among the main sources. But thereafter

agriculture becomes the dominant source. The large majority of those cultivating more than 1 ha report agriculture as the main source of income.

<b>Distribution of households cultivating land by different types by main source of income 2011-12</b>									
<b>size class</b>	<b>household type</b>								
<b>Ha</b>	<b>hh</b>	<b>area</b>	<b>SE A</b>	<b>SE NA</b>	<b>RWS</b>	<b>CL a</b>	<b>CL na</b>	<b>others</b>	<b>total</b>
<b>&lt;.0001</b>	47.4	0	4.7	14.6	26	14.9	18.8	2.3	100
<b>.001-.004</b>	0.06	0	3.8	18.6	9.7	39	20.3	8.7	100
<b>.005=.4</b>	19.8	0.19	14.7	20.9	10.6	28.2	19.2	6.4	100
<b>.4-1</b>	14.2	0.69	61.8	10.3	6.4	11.6	7.1	2.8	100
<b>1 to 2 ha</b>	10.3	1.42	78.3	6.2	5.4	6	2.2	1.8	100
<b>2-4 ha</b>	5.4	2.66	85.8	5.3	4.7	1.6	1.4	1.3	100
<b>4ha+</b>	2.1	6.5	87	4.4	4.9	4	1.5	1.7	100
<b>All</b>	100	0.58	34.3	15.5	9.6	21	12.5	6.1	100

Source: NSS report #563

It is of interest to note that nearly half of the current ownership holdings (estimated at 156 million) do not cultivate any land. The number of cultivated holdings with more than 1 ha estimated at 26 million is marginally larger than that of ownership holdings (estimated at 24 million). The number of cultivated holdings with more than 1 ha estimated at 26 million. Almost all owners opting out of cultivation are from the marginal and small category. The bulk of the drop outs are from the marginal farm category. This not surprising because a large chunk of this group has even less land than the group average of 0.18 ha per hh. The average size of holding for those in the group who continue to cultivate the land is only 0.19 ha, again with a sizeable proportion having less than average. This process has accelerated during the last two decades of post reform, marked by rapid growth of the non-agricultural sectors. Non-cultivating hhs are a very heterogeneous category. Besides landless and land poor who have no options but to take to casual wage employment, it includes a substantial proportion reporting self-employment in non-agriculture, regular wage and salary employment, and a sizeable (higher than average) number reporting other sources (like pension, remittances, income from financial assets) as the main source of income. These require access to significant non-land resources, higher levels of educational attainment and entrepreneurial skills that are likely to be found mainly in medium and large landholding groups.

For families with marginal holdings farming is either not possible not can land alone give incomes for their meagre livelihood. They have to look to other avenues for survival. It is not surprising that only 15 per cent of even the cultivating households in this category report self-employment in agriculture as the main source of income. With such tiny area, the scope for diversification of farm activity through market gardening, livestock and poultry is limited. Since this group has a high concentration of socially disadvantaged segments, low levels of literacy and educational attainment, the opportunities for

accessing regular wage and salary employment is also severely limited. They seem to have managed to find sizeable self-employment opportunities in petty trade, craft and services. But the data clearly show that for the majority casual wage labour is the main source of income.

Agriculture is the mainstay of holdings with more than 1ha. These land owners largely belong to middle and upper castes. They cultivate most of the land, with somewhat higher than average proportion irrigation; animal husbandry is more widespread and on a larger scale; have relatively high level of education; have better access to credit, and politically powerful. However small and medium sized holdings are less advantageously placed in these respects than the larger ones.

The latter have better bargaining power in both input and product markets and the determination of price support prices for major crops. They are better placed to adopt and adapt improved technologies. Much, if not most, of the benefits of subsidised supply of key inputs and public services accrues to them and have the resources to afford high cost private medical and educational facilities. And they have access to the huge volume of subsidised credit provided through financial institutions. The cumulative effect of all this gives them better access to regular employment in public sector and employment opportunities in the organised private sector as well the capacity to venture into non-agricultural enterprises requiring relatively large investments and professional skills. Larger land owners and other better off rural elite (including locally influential political and bureaucratic functionaries who benefit from leakages from public sector development and welfare schemes) are diversifying their investment in businesses both in rural and urban areas and higher education necessary to access highly paid professional jobs.

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## IX. DIFFERENTIAL IMPACT OF SLOW AGRICULTURAL GROWTH

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Given this complexity, it is obvious that there is no simple or direct relationship between slow agricultural growth and agrarian crisis in rural India in all cases. Part of the reason is a large section of landless and those with marginal and small holdings derive their main incomes from activities other than cultivation. Also because leasing in and out plays an important role in determining the distribution by size of cultivated holdings. Slow agricultural growth will not directly impact on non-cultivating households depending mostly on non-agricultural sectors.

Faster agricultural growth will have to come mostly from increased productivity in the medium and large sized farms. Whether and to what extent the impediments due to the severely limited scope for expansion of water supply for irrigation, uncertain prospects for major and yield augmenting technological change and for reforms to create strong incentives for inducing more efficient and prudent use of inputs and for improvements in the organisation and functioning of institutions that provide common service facilities is very much an open question. There are concerns that larger land holders may be losing interest in agriculture and increasingly shifting focus to take advantage of opportunities in other sectors and in urban areas and that younger, more educated among them are being groomed for urban jobs. The impact of major shifts in consumer tastes and preferences towards manufactures and services on the demand for food and farm products also needs careful watching.

The overall rate of growth of agricultural output will not make directly much of a difference to marginal and small farmers who spend mostly on agriculture and because agriculture is already a minor and one of several sources of income. But it can make a significant indirect impact to the extent that it reduces, or slows down, the growth of demand for wage employment in agriculture. They have coped with slow growth in recent times essentially by increased casual wage labour outside agriculture, some diversification into nonfarm enterprise and a rise in wage rates as a result of the rapid growth of industry and services in the last two decades.

Slow growth will have much greater direct impact on medium (2-3ha) farmers who depend mostly on agriculture. Compared with those with large farms they are relatively disadvantaged in terms of education, and access to regular employment in urban and non-agricultural sectors. They also face the prospect of demographic expansion leading to further reduction in holding size. They are likely and should be encouraged to meet this contingency by increasing educational attainment. Failing that they will move into the class small farmers and like them have to depend more on wage employment and small own non-agricultural enterprises. With nearly half the total operated area and better equipped in terms of knowledge and resources, large farmers have a crucial role in determining the pace of future

agricultural growth. If, as it is apprehended, their growing interest in exploiting opportunities in urban and non-agricultural activity results in indifference or neglect of agriculture, the growth prospects of this sector will be dampened. But this would not concern them as much as smaller farmers so long as opportunities for earnings from nonfarm enterprises and urban jobs are growing rapidly. The attitudes and behaviour of this group merits closer sustained scrutiny.

Sustained rapid growth of non-agricultural sector is therefore quite important for small as well as medium farmers. But in so far as they are forced to depend on wage employment, they are likely to get intermittent low paid manual work that yields a low income. Subsidies and transfers under several welfare schemes, the employment guarantee programme and freebies from government have also made a substantial contribution. There is evidently much scope for rationalising and expanding these programmes and improves efficiency of delivery. But the prospects of these happening being dim both for political and fiscal reasons, they cannot enable them, at any rate large sections of them, to get out of the vicious circle of social discrimination, lack of access to productive resources, low level education and skills, poor health and growing inequalities that locks them into the underclass.

Political rhetoric and public policy pronouncements recognise that a viable and lasting improvement in the conditions of the underclass calls for a universal and free education to all children, a public health delivery system that provide affordable care. It is obvious that these cannot be achieved through private enterprise and would call for expanding the scale of public funding to extend the coverage of these facilities and create institutional changes that induce efficiency and accountability in these programmes. The political constituency to advocate and press for such a programme is very weak. The ruling elite and powerful aspiring middle and upper classes are dismissive of this understanding and not just indifferent but increasingly hostile to even modest programmes that seek to address current distress.

The foregoing reading of the reasons for and the impact of laggard growth on different sections of the rural population is based on national level data. It is obviously only a broad overview of some key aspects of past performance and of the differentiated impact of continued slow growth given that the available data patchy, and neither sufficiently comprehensive nor validated, the arguments and inferences cannot claim to be definitive. That would call for more intensive and in depth analysis of available data focussing on mapping regional variations and exploring the factors that shape them. But also necessary and urgent is a major effort to improve the scope, coverage and quality of basic data.

## About the Author

**A. Vaidyanathan**, Economist, was educated in Chennai, and did his post-graduate studies in the U.S. After obtaining a Ph.D. from Cornell University, he worked for a few years (1956-62) as an Economist in the National Council of Applied Economic Research, New Delhi, before joining the Perspective Planning Division of the Planning Commission.



After a decade in the Planning Commission, and 3-4 years in the World Bank, he joined the Centre for Development Studies, Thiruvananthapuram, and served as a Professor there for eight years. He continues to be an Honorary Fellow of the Centre. He moved to the Madras Institute of Development Studies in 1984. After his retirement in 1991, he continued there as Emeritus Professor till early-2005.

Vaidyanathan's research is concerned mostly with empirical analysis and interpretation of various aspects of Indian economy and society. He has studied and written on issues concerning planning and development strategy, agricultural and bovine economy, irrigation and water management, employment, poverty and quality of socio economic data.

In addition to academic publications, he has written extensively on policy issues and is an active participant in public discussions on these matters.

In recent years, he concentrated on water-related issues. Three of his books on water have been published by Oxford University Press. Besides, he has also edited two collections on the same subject. He, along with J. Saravanan, has done a sample survey of sources and uses of household water consumption in Chennai (2004).

Vaidyanathan has served on a number of Government Committees. He was chairperson of the Committee on Irrigation Pricing set up by the Planning Commission. He served briefly as a member of the Planning Commission in New Delhi and of the Tamil Nadu State Planning Commission. He can be contacted at [a.vaidyanathan053@gmail.com](mailto:a.vaidyanathan053@gmail.com)



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