Roots of Agrarian Crisis in Interwar India

Retrieving a Narrative

Agricultural growth declined in interwar India, intensifying poverty and weakening prospects for industrialisation. Historical scholarship explains poor agricultural growth mainly in terms of adverse institutions, a hypothesis that fails to account for the much better growth rates in pre-war India. A contemporary discourse suggesting the presence of environmental constraints on investment in agriculture, and sustainability of extensive growth, supplies a better account of economic history. It can also connect the past with the present, when sustainability concerns have returned.

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I
Introduction

This paper deals with an episode from Indian economic history that sheds a great deal of light on the long-term dynamics of agricultural growth in the south Asia region. A historical perspective in this case adds value to the understanding of present-day patterns of development.

Let me begin with a set of stylised facts well known to economic historians. According to the best estimates available, India's national income increased between 1870 and 1914 at a rate of 1-2 per cent per year, and per capita income at the rate of 0.5-1 per cent per year. Simon Kuznets' calculations showed that the growth rate of national income ranged between 1.5 and 3.1 per cent per year (except US, Japan and Canada) among the industrialising countries in the late 19th century.[1] Pre-war India was not far behind this standard. What made these other countries special was that growth was sustained there for a much longer period of time than in India. In interwar India, by contrast, rate of growth of per capita income declined to near zero.

There was, thus, a shift in the trajectory of economic growth about the second decade of the 20th century. The source of the crisis was agriculture.[2] Both the earlier growth and the interwar stagnation derived largely from trends in agricultural incomes (see the figure).[3] Growth in manufacturing income was considerably above average in the second period and compensated for the effects of the agricultural stagnation to some extent. But manufacturing was too small a sector to make a significant difference to average incomes. The shift in the trajectory of agricultural growth was a landmark in many ways. Arguably, continued agricultural growth would have supplied a firmer foundation for Indian industrialisation by supplying cheap food, material, taxable income, saving, export earnings, and markets. This whole package was weak in the region in the best of times, and weakening in interwar India. Further, the change in the growth trajectory put the well-being of the poor progressively at risk. From 1930 onward, stagnation in real agricultural wages set in and remained unbroken until the mid-1970s, even as the number of agricultural labourers increased several times. Poverty, in short, intensified in scale if not in intensity.[4]

The proximate cause of the stagnation was shortage of land. The growth phase was made possible by extension of land area, and the stagnation was an effect of exhaustion of land area.[5] The proximate cause of intensification of poverty was population growth in a context of stagnant total rural production.

But the world had seen land scarcity and demographic transitions before. These episodes do not necessarily derail economic growth. There is, indeed, nothing inevitable about sustainability of agricultural growth. In world history, an initial burst of agricultural growth followed by a slow down has happened time and again, and been modelled and explored from many angles. Models of growth that stress the role of natural resources in history, such as the North-Thomas interpretation of European economic history, the "staples" theory, or the "vent-for-surplus" theory, build on such dynamics.[6] And yet, theories of long-term economic growth, which focus a great deal on innovation, whether via endogenous learning or induced learning, also suggest that such instability can be overcome. Historical scholarship on modern Japan has discussed the successful overcoming of the agrarian barrier, which in turn aided industrialisation, by providing food, material, and saving.[7] In the 1970s, this example was generalised into a model of agrarian growth in monsoon-dependent Asia, where the accent fell on resource management and efficiency, especially increasing control over biological inputs and water.[8] The induced innovation model, again influenced by the east Asian experience, also suggests that resource barriers can be overcome.[9] The lesson from these models is that the productivity of land can potentially respond to land scarcity without outside aid. Land yield, however, was stagnant in the south Asia region throughout history until the very recent green revolutions, and agricultural investments remained too small to make a large impact on productivity.

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This phase of a relatively slow change in land yield continued to the late 1960s. It would not be far off-the-mark to say that agricultural and general economic growth in the south Asia region derived largely from surplus land in the late 19th century and from land yield in the late 20th century, but that between these two regimes, there was a long interregnum when both area and yield grew too slowly relative to population growth. In this interregnum, which came to an end with the green revolution in a few regions and the breakout of violent rural unrest in a few others, we have an account of the deepening, if not the genesis, of Indian rural poverty in the modern times.[10]

In current scholarship, the presence or absence of growth has been addressed from the perspectives of institutions and incentives, but the available hypotheses do not completely explain the simultaneous presence of growth and stagnation in colonial India. These perspectives have emphasised various forms of obstacles to investment in agriculture. But why growth-promoting agents prevailed over the growth-depressing ones in the late 19th century, and fail to do so in the mid-20th, is a question that does not have a clear answer in current scholarship.

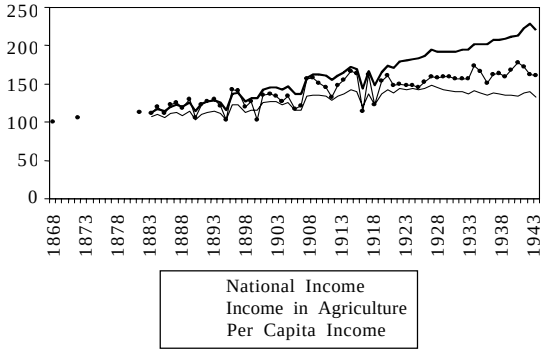
If historical scholarship is not particularly helpful with finding an answer, can one be found in contemporary observations? Indeed, long before institutional paradigms took shape, scientists and economists in interwar India had fashioned another discourse on the sources of and constraints on agricultural growth in India. In this narrative, I discover two significant suggestions. First, agrarian expansion carried costs, especially unevaluated or social costs in the shape of ecological degradation. And second, investment decisions were constrained by environmental conditions. More particularly, possibilities of agricultural growth in the region were constrained by the relatively high private costs of extraction of water for irrigation. Both these propositions remain as valid today as they were 75 years ago. And the second proposition, suggesting that the quality of natural resource endowment constrained production possibilities in agriculture, though obvious to the point of being a truism, has played a surprisingly weak role, if any, in the historiography of economic change in India. I shall call this perspective the sustainability thesis.

The paper begins with a somewhat longer tour of the historiography of agricultural growth in the region, and follows it with two sections elaborating the sustainability thesis. The concluding section returns to the relevance of the narrative for economic historians of the region.

II
Historiography

The episode of a decline in agricultural growth raises two types of question. The first set is historical. Why did agriculture stop growing from the second decade of the 20th century? Why were land yields so low and so stagnant in the region? The second set of questions is analytical. The stylised fact we need to explain is not entirely why agriculture stopped growing. Rather, a process of extensive growth had failed to transform itself into a process of intensive growth, based on new knowledge, techniques, processes, and a more productive combination of traditional inputs. If this is true, it is also true that agricultural policy after independence succeeded in enabling just such a transformation. Why did extensive growth fail to become intensive growth in the 1920s? Were there obstacles to land improvement? How is

Figure: Real Income, 1868-1946 (1868 = 100)



Source: A Heston, 'National Income' in Dharma Kumar (ed), *The Cambridge Economic History of India*, Vol 2 c, 1757-1970, Cambridge, 1983.

it that these obstacles proved binding in the 1920s, and could be overcome in the 1960s? Merely a blanket reference to new inputs or new policies do not answer these questions. The point is to know what obstacles policies were trying to meet.

Just as there are two ways of raising questions, there are two ways of answering them, one historical and another analytical. We can suggest, for example, that a temporally specific conjunction of circumstances led to the agrarian crisis in interwar India. Alternatively, we can believe that the obstacles to land improvement were rooted in the agrarian milieu. British Indian policy failed to meet the challenge. State policy after 1950, and especially after 1970, did meet the challenge. It is this latter perspective that the paper will illustrate and side with.

In mainstream historiography, the answer we do get is of the former kind. A large literature exists essentially projecting the colonial rural economy as an ailing enterprise, ailing because of the two new forces unleashed in the 19th century, colonialism and globalisation. The argument turns on interplay between class and capital markets. If a Marxist, one might veer more towards class, if a neoclassical, one veers more towards imperfect capital market, but the essence of the argument changes little.

A section of the colonial bureaucracy and nationalist opinion believed that the systems of payment of rent and tax, and the risks of selling at the world market, had pushed the Indian peasantry toward a debt trap. This line of argument was later generalised in a neo-Marxist scholarship suggesting that the distribution of assets that came into being in rural India during colonial rule was an adverse one. In the 1970s debate on "modes of production in Indian agriculture", several authors stress the particular forms of surplus expropriation possible in a colonial setting, and the broad alliance between merchants and landlords that this system was founded on. "[T]he forms of capital which found the colonial economic environment particularly congenial", writes Patnaik, "were landlord, trader and usurer capital". The resultant accumulation process was "marked by a relative absence of transformation of the productive base".[11] Habib offers a similar interpretation: "[T]he phenomenal growth of usury was an inseparable aspect of the transformation of the Indian agrarian economy brought about by colonialism itself".[12]

If the accent in some of these writings falls on the inequity of these institutions, a related literature stresses their inefficiency. The "semi-feudalism" thesis and its application to colonial Bengal connects usury with under-investment, and explains the incapacity of the rural economy to generate investment by the power

of rent- and interest-earning classes.[13] In this system, alternative modes of extraction of surplus made investment in profit-oriented activities unnecessary. Usurious capital did not need such investment. To put it more simply, controllers of land could find ways to increase their share of the cake (marketed surplus), which made attempts to increase the size of the cake unnecessary, and most likely, dangerous too.

Against the backdrop of 1920s rural India, class-cum-capital explanations run into four difficulties.

First, the stagnation in land yield was a long-standing feature, and not particularly sensitive to new property relations. According to rough estimates, paddy yields changed little between 1750 and 1920. A temporally specific explanation for what was a lasting syndrome does not help.

Second, it remains unexplained why the colonial economic system, which was seen, to cite Hamza Alavi, as "an extended reproduction of capital which was generated in the colony but accumulated in the metropolis", invested so little in agriculture, the principal resource base for this accumulation process to succeed.[14] Why metropolitan capital or the colonial state would slowly strangle the goose that laid golden eggs remains a puzzle.

Third, there was hardly a moneylender class distinct from a rich cultivator class. Those who followed the profession of lending money alone were generally against taking over land titles, which would be a can of worms for most outsiders. Class identity could change quickly in response to alternative opportunities. Most economic historians who have investigated the question of actual extent of land transfers suggest that outright transfers occurred on a limited scale.[15] Such low percentages as we do get are not strong enough basis to build a story on.

Fourth, class-based explanations of under-investment are poorly able to explain a shift in the trajectory of agricultural growth. Why was class not an obstacle to growth in pre-war India? Why was class an obstacle in interwar India? In important writings in the field, this puzzling problem has been explained away with a twist of words. Mundle writes, for example: "We see in [the] closing decades of colonialism the bitter fruits of an intensified surplus extraction mechanism which had already come into place by the latter half of the 19th century".[16] However, no concrete evidence of increasing intensity of surplus extraction is available. Sugata Bose's suggestion, that the main form in which surplus was extracted in Bengal changed in the 20th century from rent to interest is hardly more tractable.[17]

In the presence of growth in the 19th century, class-based theories of stagnation would have the awkward implication that the dominant class might permit investment in land extension and not permit investment in land-improvement. Why would the idle rich in rural India permit any land expansion at all if their class character or available modes of surplus extraction made such moves unnecessary, indeed dangerous to their own survival? Would not all such moves to extend the land frontier potentially empower the direct cultivator, the small peasant, the tenant, and the labourer? Did class structure change so much in rural India at 1920 to alter the course of economic growth? To the contrary, the origins of the supposedly malign inequality went back almost a century to the early 19th century property rights reforms. The same class structure had allowed growth in the pre-war 50 years. On the other hand, if it is allowed that the earlier land-intensive growth was driven by profitability, the absence of land-saving growth could just as well be explained by poor profitability. A class-based model of under-investment, then, becomes redundant. Usury might well give better return in rural India than land-saving investment, but the real question is what factors depressed returns to land-saving investment.[18]

One exception in recent scholarship is B R Tomlinson, who addresses the trajectory shift in agricultural growth.[19] Tomlinson's views are not spelt out as fully as one would wish. However, the drift of the argument is clear enough. The trajectory shift is attributed to "the specific institutional inadequacies and market failures of the last 20 years of British rule". It is suggested that there were institutional obstacles to economic growth such as imperfect or missing capital markets, which a pre-war phase of expansion in world market eased somewhat and the interwar collapse of exports exposed. There are two distinct elements here: institutions and the world market. The precise relationship between the two is not fully spelt out, however. And therefore, why institutional obstacles did not function as a growth-depressing agent in the 19th century and why they became binding in the interwar period, is a part of the story that remains undeveloped. The accent on export does not give a complete picture of the interwar stagnation. The domestic market for grain was potentially a large one, but to meet this market, investments were needed to cheapen supplies.

In short, in both these cases, class and institutions, we need to know the precise reasons why investments to produce extensive growth could be allowed by these supposed obstacles and investments to produce intensive growth could not be allowed by the same obstacles. In both cases we need to know why a simpler alternative, that extensive growth gave relatively high return on investment and intensive growth gave relatively low return or was too costly to implement, is unacceptable as an alternative theory.

The class view of agrarian crises had antecedents in the interwar period. At 1947, there were, not one, but three distinct strands of interpretation about the Indian agricultural problem, using arguments focusing on class, scale, and ecology respectively.

In the most general statement, "the imposition of English notions of property" in 19th century India was argued to have strengthened a substantial class of landowners who earned an income from rent and interest, at the expense of the profit- and the wage-earner.[20] Part of this story was a criticism of the zamindari land tenure of eastern India alleging that the rural power structure was tilted against the tiller of the soil, increasingly a tenant without secure property rights and overburdened with consumption debts. Subinfeudation and proliferation of insecure tenancy were problems that plagued ryotwari areas too. Gilbert Slater was not alone in believing that the land tenure system was the root of the agrarian crisis in south India, though he did not quite elaborate on the point.[21]

Early 20th century observers of rural economic life often expressed views about the agrarian crisis that were consistent with the semi-feudalism framework. In this framework, the moneylender is seen to possess superior property rights on lands tilled by a landless peasant. The moneylender, thus, earns income from interest on consumption loan and from crop-share. If the owner invested in land, crop-share might increase, but the demand for consumption loan would fall. Fearing this loss of interest income, the moneylender would be reluctant to make productive investment. This thesis is applied in the context of Bengal agriculture, seen as overburdened by intermediaries. Consider,

however, the following statement made in a different regional context:

"A great deal of the poverty and indebtedness of the villagers arises from the fact that many villages are held by malguzars who have no interest whatsoever in agriculture and only regard their villages and tenants as potential sources of income to be made from loans made to them".[22]

The fact that this statement was made in the context of the central provinces, not a standard example of the zamindari settlement, suggests the relevance of the semi-feudalism thesis to virtually any situation in which ownership of superior right and financial capital joined together. That being said, class characters changed rapidly in the presence of profit opportunities. If returns to investment in land could be shown to increase, the syndrome disappeared. This is exactly what happened in the central provinces. In the more commercialised districts the malguzars did not fall into this pattern at all, but worked in close collaboration of the agricultural department and introduced a variety of innovations. When the so-called moneylender smelled money in land improvement, s/he undertook land improvement instead of persisting with exploitation.

The class-based view was clearly the political winner at 1947. Influenced by critiques such as the above, land reforms were almost universally adopted soon after 1947 as the nucleus in a strategy to revitalise agriculture. This accent on land reforms, however, lived uneasily with a parallel discourse on what the economists Dantwala and Donde called "the uneconomic cultivator".[23] Through inheritance practices and subdivision of holdings, many ordinary peasant households had, by the middle of the 20th century, been reduced to holding sizes that were below the minimum economic scale. This concern too began to take shape in academic circle from early in the interwar period, especially in dry regions like Bombay Deccan.[24] Land redistribution was likely to add to the numbers of such uneconomic cultivators, for at 1950 there was just not enough land above the minimum economic scale available for redistribution. Industrialisation, it was hoped, would ease the burden somewhat. In the most perceptive of the writings on the sub-marginal farmer, the suggested remedy was non-farm employment.[25]

The possible contradiction between equity and efficiency, between land redistribution and loss of scale-economies, was bridged in two ways. First, the concept of the cooperative represented a way to achieve scale economies despite the existence of large number of farms individually sub-marginal. Tying up the cooperative movement with credit disbursal to the "uneconomic" peasant, a step that Dantwala sharply criticised, was a potential bridge between equity and efficiency.[26] Second, the idea that land reforms would strengthen the incentive system by removing absentee interests also seemed to resolve the contradiction between redistribution and scale economies. A substantial empirical support to the small peasant bias in policy became available in the 1960s in the controversial finding that small farms were more efficient than large farms.[27] The marginal farmer now became the economically correct choice. How successful these steps were in meeting the growth challenge is an issue I need not go into.

The message of this critique is that, ultimately we need to consider why the private return to investment in intensive agriculture might be low in colonial India, irrespective of class and colonialism. A group of scientists and economists addressed just this question. The scientists included men like R G Allan cited above, who were associated with the Imperial Council of Agricultural Research, and wrote occasional essays in the *Indian Journal of Farming*. Almost the entire senior cadre submitted extensive written and oral evidence to the Royal Commission on Agriculture in India (1926-27). The economists included scholars like Gilbert Slater, who occupied newly introduced chairs in "rural economics" in major provincial universities, and whose main outlet was the Allahabad-based *Indian Journal of Economics* (1917).

Some of these economists were clearly looking beyond India, and found the remarkable improvement in land yield in contemporary Japan to carry a lesson. The lesson was, significant increase in land-yield was possible by combining water, manure and traditional seeds in combination. India was well below the frontier. This was so because there were structural factors that suppressed private return to land improvement. They believed that resources such as soil and livestock were of comparatively poor quality in India, water was scarce, and that missing markets and inadequate knowledge about use of fertilisers, seeds and equipment held back improvements.

It was not the contention of these writers that stagnation was universal and total. A great deal of movements had taken place through the pre-war expansion that had had a positive impact on productivity. In the cotton tracts, deeper ploughing had become an established practice. A larger number of inversion ploughs and iron-share ploughs were in operation than before. In wheat areas, new seeds were used, and while plough techniques changed little, broadcasting of seeds had more or less universally given way to line sowing. A significant expansion in wells had taken place. Neither were farmers against change, nor was it the case that agriculture was changeless. Nor was there enough evidence that the elite systematically blocked innovations.

The lessons of the sustainability thesis, rather, were threefold. First, growth carried costs in a fragile agrarian environment. Second, class was not the obstacle to growth, land quality was. And third, agrarian markets were prone to failure. Many today, across ideological boundaries, would subscribe to a similar critique of present-day agricultural growth, despite the vast differences in productivity conditions. I shall return to this point in the concluding section.

The rest of the paper deals with some of these themes in greater detail.

III
Resources under Stress

Land Degradation in Northern India

At the most general level, there was an overarching ecological point. The balance between agriculture and soil fertility had been upset in the course of the commercialisation and land extension in pre-war India, leading to a series of subsidiary crises. Parts of the Gangetic plains and the Ganges delta had been home to settled agriculture for well over two millennia, and at the limits of natural productive powers when the great opportunity of exporting grain to the industrialising west reached it in the 1850s. This extension could only occur at a cost. In the next century, land degraded in some regions due to extension in inferior lands. In Bengal at least, ecological stress was well documented.

Deltaic Bengal became fertile and retained fertility through a natural process, change of course of the rivers. In the monsoons, numerous small channels carried excess river water into depressions, turning them into tanks. As the tanks were drained again,

the dried up tank-beds provided excellent fields for rabi crop. In some tracts, particularly in western Bengal, the 19th century had begun to see a restraint on this twofold process, with the result that the soil surrounding the rivers had begun to deteriorate. In turn, the steady deterioration of the water-courses owed to some extent to the continuous process of deforestation and land reclamation that the western districts of Bengal had seen throughout the 19th century. An example of the man-made crisis was the Damodar river, which deteriorated into a narrow and fixed channel on reaching lower Bengal. In Jessore and Nadia, many agricultural tracts were said to be "dying", and the reason was that the tanks neither had enough water nor did they dry in time. In turn, this was a result of the silting up of the rivers, and the silting of the channels that carried river water. The tanks became swamps in the dry season, and good breeding grounds for mosquitoes carrying malaria. "There is little doubt that deltaic Bengal has become populated a geological age before its time, and the legacies of fever, deterioration of rivers, etc, is [*sic*] at least partly due to this".[28]

The Royal Commission on Agriculture in India (1927) considered the question whether or not on average the fertility of the Indian soil was actually declining. The commission found no definite evidence of declining land yield. If the commission discounted the view of falling yield, it took no issue with another prevailing view among scientists and economists that land yield had remained stagnant in most parts of India through the expansion in cultivation, and that Indian yields were significantly smaller than yields of similar crops in east Asia, north Africa, Europe and North America. To take just one example, rice yield rarely exceeded 1,000 lbs/acre in India, whereas the average for late-interwar Japan was over 2,000 lbs/acre. Similar gaps existed in the case of cotton between India and Egypt, and wheat between India and US.

Among the most influential academic proponent of the degradation story was Radhakamal Mukherjee, who, with some of his colleagues, developed an account of riparian northern India. There were two main sources of degradation. First, changes in cultivation practices and crop-choices induced by profitability had affected the natural processes of restoration of fertility. "The introduction of commercial crops has upset the ancient system of rotation which served very well for fertilising the soil".[29] And second, there was over-harvest of water. Here, unlike in Bengal, cultivation depended largely on subsoil water, where rivers and tanks were not available or even where canal water was available. Groundwater exploitation, however, had reached unsustainable levels in some of the most densely populated parts of the Indo-Gangetic plains. A memorandum of the director of agriculture stated the problem:

> With the continuous multiplication of population not upon the rivers but upon the subsoil reservoirs…south of the Jumna, the groundwater supply is becoming more and more precarious, leading to an agricultural crisis…In many tracts a considerable fall has rendered useless a large number of existing masonry wells. It has greatly increased the cost of constructing new wells as well as of the labour and cost of lifting the water to the surface. The use of mechanical power to pump water from the subsoil is thus one of the most urgent measures for agricultural improvement.[30]

This so-called solution, however, was a costly one, we shall see.

In the vision of agrarian stress presented by Mukherjee and his peers, there was an association between farm size and return to cultivation and it was a positive one. The poor felt the ecological stress more acutely than the rich, worked harder to extract more from the soil, and damaged the soil the more. The association existed because "in the heavily populated areas of India, ...the cultivation unit is rarely of the optimum size and more often uneconomic".[31] Most small-sized holdings were unable to utilise water, manure, livestock and pasture optimally because there were economies of scale in the usage of these inputs. There were secondary effects too. If it was possible for a farm to employ irrigation optimally, it would also be possible to go for multiple cropping; and winter crops were usually more profitable than rainfed ones.

In the absence of direct data on land-use and yield over time, Mukherjee explored the link between intensity and fertility by testing this hypothesised association between yield and farm-size, the latter being a proxy for intensity of land-use.[32] His rather inconclusive empirical exercise seemed to establish two points. First, holding the quality of monsoon, soil quality, market-access constant, the association between profitability and farm-size was a positive one, but only showed up over relatively large differences in farm-size. Second, work-intensity per acre, which in all regions had a strong negative relationship with farm-size, could potentially compensate for economies of scale that arose from cost of water use.

In Mukherjee's account, farm size was correlated with social profiles, which reinforced the supposed association between small farms and land degradation. In western UP, the larger holdings were held by the jats, who were well-equipped with livestock, and having long-established rights, held the superior quality land. The upwardly mobile rural chamars, on the other hand, acquired land that tended to be small, scattered, inferior, and yet carried high rents. The jats knew their business better than some of the other late entrants into settled cultivation. While the peasant-cum-artisans practised non-farm activities to a greater extent, industry was hardly a source of mobility for these groups. In tanning, the centres of dynamism were the towns. A rural chamar would be better off migrating for wages, leaving the farm in the care of family. These non-agricultural classes in rural north India were under a double squeeze; they were "inferior farmers" as well as "inferior artisans" in the new system of market and property rights.

What were the feasible technical solutions to the low-yield syndrome? Let us look more closely at the principal inputs that could, in certain fixed combinations, be used to raise land yield: equipment, improved seeds, livestock, irrigation, and fertilisers.[33]

Equipment: Missing Markets

In the early 20th century, agricultural scientists advocated heavy plough and deep ploughing for dry areas. Deep ploughing required the iron rather than a wooden plough. Although partially successful in Punjab, elsewhere the diffusion of iron ploughshare remained limited. In the case of wheat and cotton, improved varieties of seeds played an important role, and were the result of the establishment of a chain of agricultural research stations by the government of India. Scientists staffed these rather than, as had been the practice with experimental farms before, bureaucrats. These stations, especially the one at Pusa, identified superior wheat strains by selecting among hundreds of indigenous varieties.[34] A third focus of propaganda was the crop storage technology. Grain storage systems were a constraint on commerce. In the ordinary warehouse storage, weevils and damp took a toll of an estimated 2½ per cent of output; when stored in mud-pits, mould destroyed an estimated 5 per cent of the stored grain.[35] Construction of silos that could withstand insects, damp,and mould, however, was a tough challenge in the Indian climate, and found no easy or affordable solution until the advent of refrigeration much later.

The diffusion of new equipment or seeds posed a persistent economic problem, missing markets. Agricultural research stations and departments vigorously advocated the iron plough, but at 1928, not more than a few thousands out of several million ploughs in India was fitted with the iron share. Agency was clearly a constraint. The government's own propaganda machinery was inadequate or ineffective given the enormity of the task. And neither an equipment market nor a seed market on a large scale existed.

At 1925, several Indian firms were making implements according to designs and prototypes supplied by the agriculture department, but these firms were based in the towns and had weak network in the villages. "Progress would be much faster if the firms were in closer touch with the markets".[36] Cast iron parts could not be repaired if the parts broke. The firms making these ploughshares supplied no worthwhile after-sales service. This weakness of the private commercial network "made it necessary for the agricultural department to carry on almost the whole retails trade in agricultural implements".[37] But this was hardly a solution. "The people are extremely suspicious of anyone in the nature of a 'Babu'".[38] A landlord near Nagpur stated before the commission in 1927, that "there is an unlimited field for developing trade in agricultural implements if the initial difficulties are surmounted.." What were these difficulties? "Firstly, the villagers are scattered over long distances and it is impossible for the trade to reach them". Financing was another problem, specifically the scarcity of long-duration loans. Further, there were problems of fine-tuning designs depending on local conditions. The manufacturer-user interface was practically non-existent.[39]

Interestingly, the newly elected legislative councils were hostile to agricultural research, driven by the idea that these departments existed to provide jobs to European officers. In the Central Provinces, the council actually cut funds on research.[40] The only agency that worked was the advocacy of rich peasants, or the conversion of some of the rich peasants into seed merchants. This condition occurred in the Punjab canal colonies. Reports from central India also confirmed that demonstration farms needed to invite and ensure the presence of big landlords in order to be a success.[41]

Through the agency of capitalist landlords, a significant path-dependence could work in diffusion. Commercially developed, more capitalistic, relatively clustered agricultural zones were more likely to accept innovations, reinforcing their progressive character. The principal non-land capital in rural India was livestock, the quality of which had been likewise degraded in this view owing to the existence of open commons, and consequent overstocking.

Livestock: Open Commons and Overstocking

There was a big slack in the use of animal power in India. The main power used in driving the plough was bullock. In the 1920s, India used 67 heads of cattle per 100 acres of net sown area, whereas Holland used 38 and Egypt, where conditions were similar to that in many parts of India, used 25. Holland used, in addition, horses, but that would not have bridged the gap. Contemporary experts believed that the apparent inefficiency arose from two factors: the under-usage of buffalo in India, which was a sturdier animal and the universal source of animal power in Egypt, and the poor quality of the bullock in India on average. The Indian zebu was a sturdy animal, capable of withstanding many tropical diseases that the English shorthorns would be susceptible to, and able to survive on small rations. Yet, there is no question that the supply of fodder available from common grazing grounds, meagre in the best of times, was declining from the middle of the 19th century.[42] At an earlier age, a Malthusian process of famine mortality restored the cattle-fodder ratio, but famines became rare after 1900. Progressive peasantisation of pastoralist communities had led to the weakening of traditional knowledge concerning cattle health and maintenance of stock. It was not uncommon earlier for grazing and maintenance of herds to be hired out to professionals. Through much of the late 19th century, the peasants took over these tasks, or those who used to perform these tasks turned into peasants, and in the process knowledge weakened.

Peasants responded by overstocking, "as cattle became smaller, the cultivator increased their numbers to offset their inefficiency".[43] At 1930, there were 200 million cattle in India, and only 60 million working cattle. While a part of the remaining must have been milch animals, "the proportion of animals not capable of paying their way must be very large indeed".[44] The number of working cattle was insufficient in relation to the requirements. With a gross cultivated area of 300 million acres, one pair of bullocks had to till 10 acres of land. Even in the easiest of soils, this was a tall order. Overstocking was partly a response to open commons. In 1916, Gilbert Slater discussed the pasture problem in different parts of the south.

> Throughout most parts of south India there is little pasture except common pasture;…cows generally have to struggle for a scanty living...The tendency to overstock, which is general in all countries where pasture is held in common, is specially rampant in south Asia, where the cooperative spirit and power of organisation are especially weak.[45]

A decade later, witnesses before the Royal Commission in Agriculture confirmed the presence of a similar contest in other regions. In the Central Provinces "rice tract free grazing and cheap grass has led to a custom of judging social position by the number of head owned rather than by their individual utility"..[46] On the other hand, overstocking increased the pressure on the common lands left, reinforcing the deterioration in fodder.[47] Seemingly confirming the association between decline of pasture and bullock quality, it was generally believed at this time that bullock quality was better in the dry regions of India because these regions had more natural pasture left.

Practices of "uncontrolled breeding" further weakened the quality of the stock. "[F]or many years now the tendency has been to produce more and more to compensate for the low productive power of the existing ones".[48] The disappearance of custom sometimes played an adverse role. Indigenous systems of breeding depended for its effectiveness on customs such as protecting the "brahmani bull", a young bull dedicated to the temple when a prominent villager died. The bull had to be in sound health and roamed free to graze wherever it wished, and grew up to be a good breeding bull. However, the custom was coming to an end where expensive crops were grown and the cost of prime quality bulls had increased.[49] Finally, the virtual absence of slaughtering in the villages for meat, bones or hides, led to an accumulation of idle cattle in the villages, whereas in the urban areas where there was a market for meat, valuable milch animals were more likely to be slaughtered. One indication of a general quality problem was the small amount of milk that most Indian cattle produced on average. That this was a reversible condition was proven in experiments conducted at the Imperial Institute of Veterinary Research, Muktesar, and at the military dairy farms,

where it was found that the Indian cows and especially buffaloes responded remarkably well to controlled nutrition.

Water: High Cost and Uncertain Return

The greater part of the Indian subcontinent combines three months of monsoon rain with extreme aridity the rest of the year, which dries up much of the surface water. The rains make one sowing relatively easy (the usual practice is to have two sowings in the monsoon, of which one is a major grain), but growing another crop dependent on irrigation that requires expensive systems of harvesting and storage of water. Thus, the monsoon in a tropical region makes earning subsistence easy, but improvements in yield difficult. The average peasant "has five months hard work. If he has a share in a well he is busy for three more months". F L Brayne, the deputy commissioner of agriculture of Punjab added, "in his slack time he smokes and litigates..".[50] Elsewhere, and especially in the dry tracts, enforced idleness became a life and death issue.

The theoretical solution to the scarcity of water in the dry seasons was wells. Wells avoided the massive capital cost involved in canals and tanks. Wells avoided the evaporation and percolations losses involved with tanks. At 1900, not more than one and a half per cent of total volume of rainfall was being extracted from wells, so the subsoil reservoir was practically untouched. And yet, the risks of well construction could be prohibitive.

Well irrigation was generally a complement, and not a substitute of canal irrigation. Canals needed perennial rivers, which prospect only the Gangetic plains could offer. At 1920, the percentage of area irrigated by wells was the highest in the alluvial tracts (7.3), and smallest in the Deccan trap (2.4). The reason for this pattern was that well construction was easiest and the returns from wells most secure where subsoil water was plentiful, and the seasonal variation in the water level was moderate. In parts of the riparian Gangetic plains, this condition was fulfilled. The water table varied between 10 and 30 feet in those districts of UP that received canal water. It was easy to construct a temporary well in a year of shortage in northern India. In Punjab, the winter rains rarely failed, and the cold and moist climate of winter requires less frequent waterings. In the Deccan trap, on the other hand, the water table was 40-50 feet even in the monsoon months, and here locating a well site was not easy. The winter was drier and hotter. Nearly all wells in dry south India were permanent construction, and very wide (20-100 feet). Whereas in Punjab, the average area cultivated by a well was above 10 acres, in Madras it was three, and in Bombay it was 2.6.

There is considerable evidence that well construction was unprofitable in the dry zones in India. In "...the black soil plains and stony uplands of the Deccan trap and crystalline areas, wells are impossible or will never pay".[51] Gilbert Slater, while agreeing that "more wells could be sunk with advantage…They are not sunk owing to lack of funds with the ryots", qualified that "it would not pay to sink wells in [dry lands] and take out water according to the existing methods. If cheaper and more efficient methods are possible, then it would be worth attempting".[52] In Central Provinces, not normally a dry zone, the chief irrigation engineer declared that "the only place where wells can reasonably be adopted is in the bed of rivers".[53]

What exactly made up the cost of well construction? A perennial well needed to be very deep in south and parts of Central India. According to the table, the capital cost per acre irrigated could be Rs 100 at 1,900 in Madras. The interest plus operating cost of this well could add up to Rs 30-40 per acre. Given the prices at 1903, the decision would be justified if an additional rice crop yielded between 1,200-1,800 lbs per acre. Rice yield averaged about 1,000 lbs in most parts of India. For any other lower-valued crop, the decision would be uneconomical straightaway. The calculations for a slightly later period are even more striking. In 1927, a substantial cultivator in Central Provinces (with 600 acres) dug four wells for Rs 22,000 to irrigate 20 acres. On average a well could irrigate seven-eight acres in the dry season. But if the rains failed, the wells dried up, leaving the average to about two acres. This gives a capital cost per acre irrigated at a whopping Rs 2,750.[54] The interest costs of this amount, at several hundred rupees, not considering operating costs, would make the well a disastrous economic decision. In this case it indeed was. In Sahibabad-Daulatpur village near Delhi, in 1929 the return on 33 acres of land was Rs 1.23 per year per acre.[55] While this figure is unbelievably low, in 1938 in Madras, the return per acre of a rice crop was Rs 7.7. At 1927 prices, the figure would be only slightly larger. In 1927 in the dry zones of Madras, an average well watered about two-half acres, and cost Rs 500 to construct. Once again, the returns would not justify the estimated interest plus operating cost.[56]

Given these figures, one would wonder why any well was dug at all outside riparian north India. There is an answer. The estimated returns would increase if we assume that all labour was supplied from within the family, and all capital came from own savings. Then much of the operating and interest costs would disappear. However, the assumptions are not realistic for the larger-sized farms in dry areas, which more often took the decision to dig a well. A second consideration was that the portfolio of highly profitable crops was changing in south India late in the interwar period, and that factor may have reduced the risks of a well. A yet third answer should look at how food security was valued in famine-prone regions of India. If this value were large, low economic returns from wells might be outweighed by subsistence considerations.

Well construction was not only costly even when successful, but also involved a rather low success rate. How did one find the site to dig a well? A "water-finder" of the village was called. There is great deal of uncertainty about how effective local knowledge of subsoil water could be. The irrigation commission went into this issue and believed that in the alluvial tracts of northern India, local knowledge was good enough. But in the dry areas, local knowledge was inadequate. The problem of failed wells was compounded by the fact that in a famine year, wells tended to be dug indiscriminately.[57]

Much later, Harold Mann cited two sets of surveys that arrived at totally contradictory conclusions about the effectiveness of irrigation on yield-per-acre and peasant incomes.[58] In one set of

Table: Cost of Well Irrigation, c 1900
(Rs)

	Capital Cost Per Acre Irrigated	Operating Cost Per Acre	Crop
Punjab	30-40		
UP	30-40	7	Wheat
Gujarat		22.5	Barley
Interior Madras	100		
Central India	100		

Source: India, *Report of the Indian Irrigation Commission 1901-1903*, Part-I – General, HMSO, London, 1903, p 51.

official surveys, the effect was significant and positive, the extent of gain being much larger in dry Madras and Bombay. In another set of surveys conducted by D R Gadgil and his associates in the Gokhale Institute of Politics and Economics in villages near Pune, the returns did not justify the costs of well construction. Mann hinted at a reason for this anomaly, which deserves a longer and somewhat rephrased statement.

Early irrigation administration made a distinction between two types of works in India: those that raised income and those that reduced risks. The ones that raised income were sources of water that functioned in winter to enable a diversified basket of crops, water-intensive crops like sugar cane, and highly profitable crops such as vegetables. The ones that reduced risks were those that worked in the monsoon and dried up in winter. If the rains failed, the farmers could rely on these sources to sow the monsoon crop, but otherwise ignored them. In much of peninsular India, it was prohibitively expensive to build wells that worked throughout the year. However, if such a source existed, it raised incomes proportionately more in the dry south India than it did in the water-rich north India where it cost less to extract water in winter. On the other hand, just any well would not raise incomes. Seasonal wells had a very weak effect on incomes, and most wells in the dry areas were seasonal wells, they were no good in winter for agricultural purposes. Mann, thus, suggested that the results of the return from wells might well differ depending on what type of work was observed.

If not wells, what other systems could raise the prospects of a second or third crop? Tanks were the only technically feasible solution to storage of water. But it was poor insurance against repeated failure of crops. The irrigation commission concluded that a tank meant for drought insurance would involve so enormous a wastage of water through percolation and evaporation that it would not be an economical proposition.[59] Tank maintenance was an organisational challenge on a massive scale, and the response was often inadequate.

Thus, in the dry seasons and dry zones, there was no technical substitute for wells. The economic challenge for providing irrigation to the winter crop was to break the dependence of the well to the level of the subsoil water. The only way this dependence could be broken was bore wells combined with a power-driven pump. A C Chatterton, the director of industries, Madras, understood this point before the rest of the officialdom did.[60] In 1903, this prescient technocrat wrote a report proposing power-driven wells, the power would come from small oil-engines. The experiments conducted following his report showed that lift irrigation might work on a relatively larger scale. There was good response from farmers initially, but "it soon became evident... that very few of the wells in the presidency could furnish enough water to justify the putting up of an engine and pump, and that, in order to bring pumping installations into more extended use, it would be necessary to deepen the existing wells".[61] In short, deep boring had to accompany power-driven pumps. Where subterranean artesian wells were discovered, in Chingleput and South Arcot, the scheme evoked great interest. Interestingly, the demand for oil engines in agriculture popularised the use of oil engines in a wide range of agro-industries including rice and oil mills. Till 1926, 7,862 borings had been done, the percentage of success being 60. 591 pumping and 398 industrial concerns had been fitted with oil-engines. The fact that the borewell experiment was a responsibility of the agriculture department, whereas the pumpset and oil engine were handed over, for bureaucratic reasons, to the fledgling industries department, made the acceptance of this package slow among farmers and faster in small-scale industry.

Elsewhere, the demand for bore wells remained restricted, but interest was growing. Use of subsoil water for agriculture was rare in Bengal. But with a crisis unfolding with surface water (see land degradation section above), the demand for more intensive use of subsoil water was growing. Boro crop farmers approached the agricultural department with demands for borewells.[62] An experiment with tube-well and pumps conducted in Rohilkhand found the running cost of irrigation for an acre of sugarcane crop to be Rs 25.14, which probably made the proposition break even if capital could be cheaply raised to finance the cost, for this was a hugely capital-intensive proposition. A nine inch strainer tube-well cost Rs 14,000 to construct, and could irrigate about 150 acres with a 30 feet lift. The ordinary bullock-powered lift cost approximately Rs 15 per acre. Both systems failed at water level deeper than 50 feet. Where the water level fluctuated betweens seasons, there was chance of a tubewell remaining underutilised in the rabi season.[63]

Given the dependence on power for its success, bore well construction and operation could not become clearly economical for the middle peasant until electric power was available. But that is another story.

The Takavi Fiasco

Some of these lessons had been understood in official circles the hard way. The two devastating famines over the Deccan plateau (1876-78 and 1898-1900), and evident market failures that discredited the view that a hands-off policy was the best one for famine relief, had led to a series of interventionist schemes. The most direct one was the relief camps and famine codes, precursors of present-day food-for-works programmes in the region. The more indirect one was subsidised unsecured loans, or takavi. These loans were governed by the Agriculturist Loans Act and Land Improvement Act, and given by the state mainly for capital-building in agriculture.[64] In principle, the scheme could be a success and takavi became widely known throughout India as a potential source of capital. At the moneylender rate of interest, on average between 15 and 25 per cent per year, well construction even in the water-rich north India was a business that only the richest could afford. At the takavi rate of interest, 7½ per cent, the risks of well construction came down significantly. Takavi was also often taken for working capital needs, as a substitute for moneylender or grain dealers' loans, to substitute seeds for example and occasionally to pay rent and revenue.

And yet, in the best villages of northern India, not more than one in 60 peasants actually applied for loans.[65] Evidences of the Provincial Banking Enquiry Committees of 1929-30, which dealt with takavi extensively, are replete with stories of the difficulties in the way of takavi. The main problem was of course corruption. In United Provinces, only 20 per cent of the loan amount sanctioned actually reached the cultivator, according to one report. In the sanctioning of the loan, the report of the patwari was crucial, and the patwari went by the ability to pay bribes, "leaving aside the needy".[66] The loan was sanctioned in the collector's office some distance away from the village. The dealings of the peasant with the town officers were mediated by "professional miscreants", in the words of one social activist:

> A story runs that a cultivator got Rs 5 sanctioned for seed. The poor fellow had to pay one rupee to the patwari and one to the tahsildar. With the remaining three, he dared to go to the collector and

requested him to accept two for the kind act of granting the taqavi, the remaining one to suffice for the expenses of his return journey.[67]

Fertiliser: Complementarity Problem

More water offers the farmer more choices about what crops to grow. But more water alone does not raise average yields. To raise yields, fertilisers and water needed to be used together. Why were "the cropping values of Indian soils maintained at a low but stable level of fertility", the Royal Commission asked? The answer was a simple one. Relative to other densely populated agricultural regions, chiefly east Asia, peasants in India used too little organic manure to restore or increase bacterial activity and consequently the nitrogen content of the soil, normally depleted due to repeated cultivation. On the other hand, the natural processes that enabled cropped lands to "recuperate" or regain nitrogen, the commission speculated, might have been somewhat stronger in India than in temperate climates. Whereas nature thus ensured equilibrium, the low intensity of manure usage made it a low-level equilibrium.

The "manurial problem" was a serious one in India, in the view of the proponents of the sustainability thesis. Nitrogen supplements in the form of oilseeds, grains, animal hides and bones were exported. Cowdung was used mainly as fuel. Fish manure, green manure and nightsoil usage was rare, even unheard of. According to this view, it was in the sphere of biochemical inputs that Indian agriculture had most to learn from other densely populated, especially paddy-oriented, agricultural systems.

Mukherjee argued that in learning how to raise yield, east Asian practices deserved to be studied closely, for here was a region that was already dealing successfully with increasing pressure of population on land. As we have seen, contemporary prescription for the yield problem in the dry areas concentrated on the plough. For regions that received sufficient rainfall, the prescription focused on the intensity of use of manure or commercial fertilisers. Raising manure intensity without stable supply of water can damage the soil. However, even where there was stable supply of water such as the Indo-Gangetic plains, Indian lands received too little manure. In monsoon Asia, failure or success of adaptation to population density rested on indigenous fertilisers, in this view.

As a general practice, there was almost exclusive dependence on cattle dung and urine in fertilising the fields. It was only in the case of rice and sugar cane in north India that nitrogenous manures, such as oil cakes and green manures, were used. The former supplied phosphates and potash as well as nitrogen, and the latter mainly nitrogen, but in such small quantities that this stimulation was of a low order. There was practically no market in purchased manures. Mukherjee cited the east Asian experience with using vegetable refuse, dung, nightsoil, and waste fabrics.[68] In India by contrast, nightsoil usage was unknown, cow manure was burnt as fuel, vegetable matter was destroyed, and bones of cattle were allowed to decay in piles. Why was waste management weak in India? Slater considered inadequate knowledge to be the answer.[69] Did farmers really not understand the value of dung, oil-cakes, or bone-meal? In the interwar period, the extent of use of bone-meal in commercialised tracts (potato farms near Calcutta, for example) was increasing. Oil-cakes were used as cattle-feed because of the scarcity of fodder. The increased use of dung as fuel was related with the scarcity of the commons and firewood.

What should be the response to the manure problem? Stray voices advocated banning export of manures like bone-meal.[70] Brayne, the deputy commissioner in central provinces, felt that the "first and the greatest essential in India" is to stop the burning of dung cakes.[71] The key point, however, was that better manuring made sense only in a context of more water and better seeds. Official views expressed during the Royal Commission repeatedly underscored the interdependence between seeds, water and manure.[72] The proponents of a new strategy did understand that stifling the market was not the correct response, but they lived in an environment in which calling for a large-scale initiative would have been futile.

Conclusion

In the foregoing I outlined an early discourse on the agrarian crisis in interwar India, which, in my reading of it, makes two important points. First, the quality of resources, especially water and land, was poor in large part of the south Asia region, and desperately so in the dry zones. Second, this factor accounted for the high private costs of investment in intensive growth, and also involved high social costs resulting from extensive growth, in the form of degradation of land, livestock, and commons. Together, these two points explain the trajectory shift in agricultural growth early in the interwar period when land ran out. The accent on "sustainability" of agricultural growth is certainly not a new discovery. Historians have highlighted the ecological costs of agrarian expansion in the south Asia region before.[73] Ecological degradation due to deforestation, soil erosion and "chemicalisation" of soil is the subject also of a large literature on post-green revolution India.[74] That being said, whereas in much of the current scholarship on the subject, environmental change is seen as an effect of economic change, in this body of material I also discover the further suggestion that investment decisions were constrained by environmental conditions. This reverse causality is a powerful but underutilised tool for the historian.

When exactly did the interwar crisis end and why? Was independence the key break, or the new technology of the green revolution? The interwar stasis was clearly over by the late 1950s, when area, land-productivity, and cropping intensity were growing at much better rates than before, thanks to impressive growth in irrigated land made possible by a string of river valley projects. And yet, in one important respect, the 1950s and the 1960s were not very different from the interwar period. Rural real wages remained stagnant almost throughout India during 1950-70, despite rising productivity of land and therefore rising labour demand. The explanation lies in the rate of increase in rural population, which, at 1.94 per cent per annum, equalled the rate at which net irrigated land expanded, 1.97 per cent. The average growth rates of yield and irrigated area were not much higher in the post-green revolution period (1970-2000) than in 1950-70. Yield of certain commercial crops such as cotton and tobacco accelerated, but the major grains improved at rates that do not differ much between the two time-spans. And yet, the last quarter of the 20th century saw faster increase in real wages and faster decline in rural poverty. The answer, again, lies in the balance between labour demand and labour supply. Rural population in this period grew at 1.76 per cent, while net irrigated land at 2.15 per cent. If this was the difference, the fundamental similarity between the two phases of agricultural growth was that both were sustained by heavy fiscal commitment, construction of canals in the third quarter of the 20th century, and in the last quarter, input subsidies to facilitate adoption of new seeds and the more "democratic"

groundwater-based irrigation development. In this sense, whether the break occurred in 1950 or in 1970 is an irrelevant issue. Agricultural policy that worked in the region *at any time* has been invariably supported by huge commitment of public money, going into water particularly, whether before or after the green revolution. And this is so because the fundamental obstacle to agricultural growth in the region is neither political nor technological, but environmental, namely, poor quality of natural resources.

This thesis has three significant implications for interpretation of present-day economic growth in the region.

First, agricultural growth must depend critically on fiscal support, not because of "kulak power", to borrow an expression from Indian Leninists, but because of poor quality of land. The agrarian crisis underscored that agricultural growth would require steps to meet the resource-endowment obstacle, steps to reduce the private costs of investment in biological inputs. Agricultural policy in post-independence India succeeded precisely by means of a fiscal drive that reduced the costs of private investment. True, in 1920, the HYVs of the 1960s generation had not come into being. But that is not relevant here. In the 1920s, traditional seeds were well below their productive potential because the package of seeds-water-manure was missing in most cases. The knowledge that this package was the key to growth is an old one, and makes the older discourse relevant to understanding more recent successes of policy. It is conceivable that given a concerted fiscal effort reducing private costs, an indigenous green revolution would have occurred much earlier.

Second, the fact that agricultural growth must depend on fiscal support introduces a fundamental contradiction in the growth process of the Indian economy. Agricultural growth, being intensive in public resources, can be sustained only by drawing resources away from other potential uses of public money such as health, education, or infrastructure, in short everything that the non-agricultural sector needs badly to sustain its own growth. What does this contradiction mean? Economic historians have long known that industrialisation requires rapid agricultural growth. This truism about a basic complementarity fails when agriculture and industry must compete for resources, when their interests conflict.[75] Large part of water-scarce India presents just such a scenario of conflict. Economists in more recent times have often alleged "urban bias" or rural bias in Indian development policy, noting correctly that there is indeed a contradiction. What tends to be missed out in this discourse is the point that these biases are imposed by environmental conditions, and are part of the set of constraints and not the set of available choices.

Third, the sustainability discourse underlines the costs of growth, again a contemporary concern. Since the 1990s, concern with groundwater depletion and pesticide usage has emerged to the fore. While livestock quality has greatly improved and idle stock fallen in the last 50 years thanks to systematic breeding, dairying, and the growth of a meat market, the problem of fodder supply has possibly worsened.[76] These current concerns are a reminder that the *costs* of agricultural growth the region has valuated and handled rather poorly, which is one of the key points of the antecedent literature on sustainability.

Indeed, looked at in this way, the parallels in the development experience between the early 19th century and the early 21st century seem striking. In the earlier phase, manufacturing and services did far better than agriculture. This lesson seems to be repeating a 100 years later, with a boom in the non-agricultural economy taking place against the backdrop of a spate of farmers' suicides. The essential similarity rests on the fact that agricultural growth is too resource demanding in the region given the almost pervasive scarcity of water. The process carries risks and the potential for failure. EPW

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Notes

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75 The notion of a potential conflict between agriculture and industry goes back to the 18th century. In the older version the conflict arises because of open economy effects working through specialisation and drawing labour away from industry to land or the reverse. I am talking about a conflict in allocation of funds for development. In modern scholarship on industrialisation, the two sectors are generally seen as complementary.
76 On the current discourse on sustainability see the two conference numbers of the *Indian Journal of Agricultural Economics*, 'Livestock Economy', 50(3), 1995, pp 255-316, and 'Technology and Environmental Management in Agriculture', 52(3), 1997, pp 473-529.