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Economic Reforms and the External Sector

Bibek Debroy

In the wake of globalisation, competitiveness of nations is often measured in terms of share of world exports. India's performance on this front has been depressing what with its share in world exports having declined from 2.5 per cent in 1947 to 0.5 per cent in 1997. On the other hand, it has been difficult to slash imports, thus resulting in balance of trade deficit, year after year. This paper makes a diagnosis of problems associated with India's poor performance in external trade. Noting that exports appeared to react positively to policy changes with perceptible improvements since 1993-94, only to again drop since 1996-97, the paper attempts to identify the factors responsible for such trends. After an overview of the pre-1997 scenario, the paper closely examines the economic reforms since 1991 from the external trade perspective. While emphasising the need to continue with the reforms relating to tariffs, export-import restrictions, foreign exchange etc., the author also makes several innovative and useful suggestions. The author concludes by stressing that performance of the external sector can not improve if sufficient reforms are brought about in the domestic economy to remove the supply-side cosntraints on account of quality, infrastructure, technology, high costs etc.

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Introduction

Since independence, India's track record in the external sector has been depressing. Sustained (over a period of at least three years) export growth rates of between 15-20 per cent in dollar terms have taken place during only three periods since 1949-50: 1972-73 to 1976-77, 1987-88 to 1989-90 and 1993-94 to 1995-96. In addition, in the fifty years since independence, India's share in world exports has witnessed a decline from 2.5 per cent in 1947 to 1.9 per cent in 1950, 1.0 per cent in 1960, 0.6 per cent in 1970 and 0.4 per cent in 1980. Just before economic reforms started, India's share in world exports hovered at around 0.5 per cent, and since 1993, inched back to around 0.6 per cent, before dropping again to 0.5 per cent. The point thus is that the Indian export effort has been insignificant compared to what other countries have been able to achieve. If competitiveness can be measured as share of world exports, there has been steady erosion in India's international competitiveness since independence.

If competitiveness can be measured as share of world exports, there has been steady erosion in India's international competitiveness since independence.

While the export growth rate has been less than satisfactory, it has been difficult to slash imports, as these are essential imports required for investments and stepping up rates of economic growth.[1] Thus, India has generally faced a balance of trade deficit and one of the problems has been one of financing

1. The scope for further growth based on import substitution petered out in the second half of the 1970s. India managed to tide over the oil price shocks without serious problems. The response to the second oil price shock of 1979-80 was somewhat different from the response to the first oil price shock of 1973-74, since by the time of the second shock, domestic oil production had increased. See Ahluwalia (1986).

this deficit.[2] The coverage ratio (exports/imports) has fluctuated quite a bit, but has improved since 1991-92. Pre-empting a bit, exports did seem to respond to the policy changes introduced after 1991, at least from 1993-94. There were three main reasons for this time lag. First, the former rupee payment area accounted for almost 20 per cent of India's exports and because of reasons that were extraneous to the reform attempt, exports to the rupee payment area collapsed and became less than half of what they used to be.[3] Second, the years 1991-92 and 1992-93 were aberrations as there was an enormous amount of import compression in the system in those years. This affected industrial production and export production. Third, there was the usual J-curve kind of time lag.[4]

If exports react to favourable policy changes, why has the export performance flagged since 1996-97? There are several reasons and it is impossible to separate out the importance of these various factors. First, the export growth rate slowed down in dollar terms (not that much in SDR terms) and this reflects exchange rate movements. Second, as the base level of exports increases, it becomes difficult to sustain 20 per cent dollar rates of growth. Third, global recession affected exports. Fourth, specific problems such as the use of azo dyes (affecting garments), child labour (affecting carpets) and food and sanitation requirements (affecting marine products) had adverse effects.[5] Fifth, as the trade intensity of the economy goes up, infrastructural problems become constraints that bite.[6] Sixth, the temporary imposition of a minimum alternate tax (MAT) on exports in 1996-97 had a negative impact. Seventh, there were problems with the cost and availability of export credit. Eighth, court intervention on environmental grounds adversely affected exports of marine products and leather and leather manufactures. Ninth, the real appreciation in the value of the rupee made India's exports uncompetitive in price terms.[7] Tenth, there were sector-specific problems like exports of gems and jewellery (which really means polished diamonds) being affected by imports of inferior quality roughs. Eleventh, the pulls of the domestic market led to exports of some agricultural products being prohibited. Because of such factors, it is unrealistic to expect export growth rates of more than 10 to 12 per cent in dollar terms in the near future.

To go back in time, there was some liberalization in the 1980.[8] This also involved some limited import liberalization. The reforms in 1991 were triggered by a severe Balance of Payments (Bop) crisis. It is tempting to argue that the Bop crisis was caused by the import liberalization of the 1980s and such arguments have indeed been advanced. But this is not a contention that is entirely supported by facts. In the first place, till July 1991, there was not much of actual import liberalization. While quantitative restrictions and procedural formalities were eased somewhat, tariffs were not brought down and for the decade as a whole, the incidence of customs tariffs actually increased (Ahluwalia, 1992). Particularly in the case of imports that competed with domestic industry and consumer goods, there was very little of actual import liberalization in the 1980s (Jalan, 1991; Kelkar and Kumar, 1990). Secondly, quite a bit of the increase in the value of imports was due to higher prices paid for imports.[9] But it is indeed true that the ad hoc industrial liberalization of the 1980s fostered a policy regime where the prime movers of industrial growth were sectors like petrochemicals, chemicals and allied industries. The tax and trade policy structure thus created incentives for import intensive industrialization in specific sectors and there is some limited evidence of

2. Since independence, India has had marginal balance of trade surpluses in only two years, viz., 1972-73 and 1976-77. In every other year, there has been a balance of trade deficit.

3. This also had a clear sectoral dimension, such as for exports of tea, coffee, cashew and some consumer goods. It also had implications for a free trade zone (FTZ) like Kandla, from which, 90 per cent lof exports used to be directed towards the former Soviet Union.

4. Another minor point should be mentioned. Export incentives like the CCS (cash compensatory support) were not transparent and were not always passed on by the Indian exporter in the form of a lower price to the foreign importer. However, the devaluation of 1991 was transparent and its benefits had to be passed on.

5. Mauritius joined the European Union in banning seafood imports from India.

6. For example, exports of non-basmati rice clogged up ports and ships could not be loaded or unloaded for three months. The resultant demurrage charges were considerable.

7. Since India's exports are in the low value segments, they are relatively price sensitive. With a lack of product differentiation, price increases cannot be passed on. Nor have they been absorbed through productivity increases. The price elasticity of demand for India's exports has been a debated issue in the context of devaluation or depreciation. Subject to various econometric problems, empirical studies do show that India's exports are fairly elastic. For a relatively recent estimation, see Virmani (1991).

8. This was ad hoc and piecemeal and not very systematic. This spate of liberalization is usually identified with the Rajiv Gandhi government that came to power in 1984-85. However, reforms had started before Rajiv Gandhi came to power, although the momentum accelerated under Rajiv Gandhi. Since real GDP (gross domestic product) growth rates went up to 5.5 per cent during the 1980s, it was tempting to correlate increased growth with liberalization.

9. It is of course possible that import liberalization may have exerted pressure on the bop. For instance, some of the pressure may be evident not on the balance of trade account, but through payments made under other bop headings.

import intensity having increased in these sectors in the 1980s.

The Pre-1991 Scenario

The period before 1991 is generally identified as an era where, barring a few exceptional periods, there was a neglect of exports. This started in the 1950s and the early 1960s, with the Second Five Year Plan (1956-61) associated with the initiation of an inward-looking strategy of development with import substituting industrialization as the core of the strategy (Balasubramanyam and Basu, 1990). Self-reliance was adopted as a goal and trade policy often hampered exports instead of promoting them (Singh, 1964; Bhagwati and Desai, 1970). Although export incentives were introduced prior to 1966, vigorous export promotion is identified with the period that followed the 1966 devaluation of the rupee.[10]

More specifically, the approach and policy towards exports can be divided into several distinct phases (Jalan, 1992). This essentially follows the Bhagwati (1978) and Krueger (1978) typology, which distinguishes between five phases in the process of liberalization (Bhagwati and Srinivasan, 1975). In Phase I, quantitative restrictions are imposed and intensified. In Phase II, quantitative restrictions continue, but some price measures are adopted to offset some of the undesirable effects. In Phase III, attempts are made to systematize the changes of Phase II. Phase IV is associated with increased foreign exchange earnings and relaxation of quantitative restrictions, while Phase V is a regime of complete liberalization. Till the Second Five-Year Plan, the Indian trade regime clearly belonged to Phase I. This early phase was one of extreme export pessimism, coupled with a belief in the writings of Prebisch, Singer and Nurkse. Phase II began with the Third Five Year Plan (1961-66). Although quantitative restrictions continued, more attention was paid to exports through the setting up of export support services like export promotion councils, state trading houses and export houses and the introduction of various export subsidization schemes. In some sense, the economy moved to Phase III during 1966-68, after the 1966 devaluation.[11] But instead of moving forward towards Phase IV, the period 1968 to 1970 witnessed a movement back to Phase II, which lasted till at least the second half of the 1980s.

Although the 1990-91 crisis was precipitated by some short-term factors, it reflected an economic crisis that was more long-term in nature. One of the best statements of the neoclassical critique of import substitution and inward orientation is available in Little, Scitovsky and Scott (1970) and the argument readily generalizes to India.[12] Import substitution leads to high levels of effective protection. The currency becomes over-valued and exports are discouraged. The protection involves very high domestic resource costs. There are often lower rates of protection on intermediate and capital goods and higher levels of protection on final consumption goods. This encourages relatively capital intensive and intermediate input intensive techniques of production. Since these are imported, the dependence on imports is not reduced. The import substitution that is achieved is almost exclusively in the final consumption goods sector. High capital intensity leads to under utilization of capacity and slow growth in industrial employment. Despite low capacity utilization, high protection ensures that profitability in industry is high. High levels of protection for manufacturing industry distort incentives against agriculture and introduce a bias against agricultural production. Income distribution is distorted in favour of industry. Trade intervention encourages resource misallocation. There are variations in the levels of protection across sectors and across industries. Excessive government intervention leads to corruption, uncertainty and delays. The inefficiencies that are generated in the system make it difficult to enter international markets without a complex battery of export incentives. Meanwhile, the protected and profitable domestic market offers little incentive to turn towards an extremely competitive export market. There is policy-induced bias in favour of producing for the domestic market rather than for the export market. In addition, trade distortions often support inefficient investment decisions.

The protected and profitable domestic market offers little incentive to turn towards an extremely competitive export market. There is policy-induced bias in favour of producing for the domestic market rather than for the export market.

10. This was the second devaluation since independence. The first was in 1949 and the third in 1991.

11. The export incentive schemes were rationalized, export subsidies reduced and export duties imposed. Thus, the net devaluation was less than half the nominal devaluation. See Wolf (1982).

12. Srinivasan (1998) is a recent re-articulation of these arguments. Also see, Bhagwati (1998), Desai (1998) on the export implications of alternatives to the Mahalanobis model and Sen (1998) for a discussion of Manmohan Singh's 1964 analysis of India's export trends.

Specifically, in the Indian context, import substitution led to the setting up of industry at home and this industry clamoured for protection. Accordingly, industry was protected from all external competition in two ways. First, there were very high tariff rates and before the reforms started, peak tariff rates were 300 per cent plus. Second, there was a complicated import-licensing regime. Before reforms started, imports were divided into four categories – OGL (open general licence, which means that an import licence was not required), prohibited or banned, restricted (as import licence was required) and canalized (imports could only take place through designated state trading organisations). The import-licensing regime was so arbitrary and non-transparent that it became almost impossible to import anything, apart from distorting effective rates of protection (ERP) across sectors. Industry was thus protected from all manner of external competition. In addition, Indian industry was protected from all manners of domestic competition through an industrial licensing policy.[13] Thus, it faced a protected and profitable domestic market that was oligopolistic or monopolistic and had no incentive to lower costs, improve efficiency or upgrade technology. However, this also led to a policy-induced anti-export bias, because the world market was competitive. As crutches to inefficient Indian industry to go out and export, one therefore had to offer a complicated spectrum of export incentives such as the CCS (cash compensatory support) scheme and 'rep' (replenishment licences). But despite these export incentives, the bias in favour of producing for the domestic market was not eliminated.[14]

The import-licensing regime was so arbitrary and non-transparent that it became almost impossible to import anything, apart from distorting effective rates of protection (ERP) across sectors.

As the above diagnosis indicates, one cannot expect to introduce reforms in the external sector, leave the domestic economy unchanged, and presume that India's exports will take off. However, since the focus of this paper is on the external sector, we will concentrate on the external sector reforms alone. These have involved five different strands – reductions in tariffs, reform of the import-licensing regime, unification of export subsidies, changes in the exchange rate regime and a more open policy towards foreign direct investments (FDI).

One cannot expect to introduce reforms in the external sector, leave the domestic economy unchanged, and presume that India's exports will take off.

Before passing on to the next section, one should make the obvious point that this diagnosis about what was wrong was not suddenly thrust down on India in 1991 by the International Monetary Found (IMF) or the World Bank. This diagnosis had been articulated by a large number of Indian economists, some of who have been quoted. In addition, this diagnosis found support in the reports of a large number of government committees. The following is a list of government committees set up since 1947 to examine various aspects of India's export performance.[15]

(i) The Gorwala Committee. (Govt. of India, 1949)

(ii) The D'Souza Committee. (Govt. of India, 1957)

(iii) The Ramaswamy Mudaliar Committee. (Govt. of India, 1961)

(iv) The Sondhi Committee. (Govt. of India, 1974)

(v) The Alexander Committee. (Govt. of India, 1977)

(vi) The Tandon Committee. (Govt. of India, 1980)

(vii) The Second Tandon Committee. (Govt. of India, 1981)

(viii) The Kapur Committee. (Govt. of India, 1984a)

(ix) The Abid Hussain Committee. (Govt. of India, 1984b)

A few brief quotes will illustrate the point.

The Gorwala Committee (Govt. of India, 1949) argued that, "It is somewhat paradoxical that while the

13. Other distortions were additional clearances required by companies listed under the Monopolies and Restrictive Trade Practices (MRTP) Act, reservations for the public sector and small-scale sector and a government procurement system that had purchase and price preferences in favour of the public sector, the small scale sector and indigenous production.

14. Apart from the costs, the system of export incentives also led to bureaucratic delays and inefficiencies. As such, they need the most effective means of promoting exports. See Bhagwati and Desai (1998), Bhagwati and Srinivasan (1975), Bagchi (1981) and Lal (1979).

15. Obviously, there were also government committees that argued against reforms.

Government has been aiming at export drive, an elaborate machinery to exercise control over the majority of exports exists. The present export control notification has been inherited from the days of the war when there was a need to restrict the volume of exports for a variety of reasons, many of which no longer hold good. The argument that if free export of any commodity is allowed, its internal prices or supply would be adversely affected always needs the most critical scrutiny. The price level of Indian goods, in general, is such today that far from exports leading to an increase in the domestic price, it is the high price which is hampering exports. The fear that there may be a shortage is frequently ill-founded. The impact of a large demand often stimulates production which may prove sufficient both for internal and overseas consumption."

The D'Souza Committee (Govt. of India, 1957) argued that, "Canalization of exports through a single agency, though a useful device, should be considered as an exceptional measure to be taken only in special circumstances."

The first Tandon Committee (Govt. of India, 1980) argued that, "Import control and the resulting non-availability of the high cost and poor quality of domestically available substitutes, put exporters at a disadvantage in the highly competitive international markets. Export profitability is lowered by undue bias towards import substitution in trade policy, higher relative lrates of inflation compared to inflatiion abroad and an inappropriate exchange rate. An effective export strategy must counter all these biases. It must ensure that over time, the bias towards import substitution is progressively reduced and in the interim, these disadvantages must be compensated."

The sense of *déjà vu* is very strong.

Reviewing the Reforms

Let us now turn to tariffs. How high were tariffs in India before the reforms started? It is diffiicult to give a simple answer. Various post-1991 issues of *Economic Survey* state that tariffs were 300 per cent plus. The Alexander Committee (Govt. of India, 1977) quotes a nominal tariff rate of 450 per cent for the mid-1970s. Part of the problem is due to the discrepancy, thanks to exemptions, between official duty rates and collection rates. In the post-reform era, the government set up a committee known as the Chelliah Committee to examine the issue of tax reform. The Chelliah Committee's interim report (Bhagwati and Srinivasan, 1993) stated, "In 1980-81, the import-weighted average rate of nominal tariff (with quantifiable exemptions) was 38 per cent. In 1989-90, it rose to 87 per cent. The collection rate of duty increased in this period from about 20 per cent to about 44 per cent." Roy (1996) quotes World Bank figures for a maximum tariff of 400 per cent, an average (import-weighted) tariff rate of 87 per cent and a collection rate of 42 per cent in 1990. Since the reforms started, the peak customs duty has been brought down to 40 per cent. However, since this is the basic customs duty and there are several other duties tagged on to it, the effective duty rate is around 30 per cent. This is still extremely high by global standards.

Tariff reform does not only involve a reduction in duties. There also has to be a reduction in the number of rates, the removal of exemptions and a switch from specific to ad-valorem rates. If there are complaints about the post-1991 rationalization of tariffs, those complaints concern the continued multiplicity of rates. This multiplicity continues to make lobbying possible.[16]

One should also mention that under the Uruguay Round agreement, the number of tariff lines India has agreed to bind, has increased from around 5 per cent to around 64 per cent (Singh, 1996). All agricultural products have bound tariffs and the percentage of bound tariff lines for industrial products is 72.7 per cent. However, because tariffs have been brought down, the current tariff levels are generally lower than the bound levels agreed at the Uruguay Round. And barring textiles and garments and agriculture, the reduction commitments also generally fall short of the tariff reductions brought about unilaterally.

Having talked about tariffs, let us move on to quantitative restrictions. As was mentioned earlier, before the 1980s, imports were restricted primarily through quantitative restrictions rather than through tariffs. As was also mentioned, imports were divided into four categories – OGL, restricted, prohibited and canalized. Canalization primarily characterized crude materials and basic manufactures, while licensing restrictions cut across the board. Prohibited items were mostly animal and vegetable oils and fats and we will come back to this point later.

The import licensing regime is set out in the export

16. Joshi and Little (1995) is one example of arguments against multiplicity. Before the reforms, a single commodity often attracted multiple tariff rates because of end-use specific duties through duty exemption notifications. The grant of duty exemptions depended on origin of imports, the type of manufacturing process, type of end product, whether the intermediate good manufactured was used to produce specific final goods and type of industry. This widened the scope of rent seeking. See Goswami and Mohan (1996).

import (exim) policy. Before 1991, changes in exim policy were often announced annually, sometimes even every six months. There was some attempt, towards the end of the 1980s, to impart stability to exim policy by announcing these changes for longer periods of time. When reforms started in 1991, a three-year exim policy for 1990-93 existed. Since this had become irrelevant, it was replaced by a five-year exim policy announced on 1 April 1992. This lasted till 31 March 1997. The present five-year exim policy was announced on 1 April 1997 and is expected to last till 31 March 2002. The broad thrust of exim policy changes since the reforms has been to move an increasing number of items to the OGL. Thus, barring a small number of items that will have to be on the prohibited list, everything else should be on OGL. Apart from the new phenomenon of external pressure, this is perceived to be necessary because of two reasons. First, if imports are to be discouraged, that is more efficiently done through tariffs. Second, import licensing regimes tend to be completely arbitrary and non-transparent and encourage lobbying and rent seeking behaviour. Thus, in consonance with this spirit of reforms, items have been decanalized and moved to OGL. Restricted items have also been moved to the OGL list.

If imports are to be discouraged, that is more efficiently done through tariffs. Import licensing regimes tend to be completely arbitrary and non-transparent and encourage lobbying and rent seeking behaviour.

Since October 1992, there has also existed a system of special irnport licences (SILs). These are a bit like the old replenishment licences and can be used to import items that continue to be on the restricted list, naturally, subject to the payment of usual customs duties. SILs are granted to specific categories of exporters and need not be used to carry out own imports. They can also be hawked on the market at a premium and thus represent an indirect export subsidy to exporters.[17] In addition to the restricted list, there is thus an SIL list, which is a list of items that can be imported through special import licences. In some instances, items from the restricted list have not been directly moved to the OGL, but have instead been moved to the SIL list, the idea being one of eventual transition to the OGL.

17. The premium fluctuates, but is now around 6 per cent. It came down sharply after gold was recently moved to the OGL.

In October 1995, the Commerce Ministry issued a classification of export and import items based on the 8-digit harmonized classification system. This describes around 10,500 import and export items. Prior to 1 April 1997, the Commerce Ministry's computations were that 3000 of these items were on the restricted list, a drop from around 8000 when the reforms started. The new exim policy was expected to announce a time frame (over five years) for phasing out these quantitative restrictions. In other words, on an average, around 600 items would have to be phased out every year. When the 1 April 1997 exim policy was announced, there was no announcement of a time frame. The only announcement, concerned items that were being liberalized (through movements to OGL or the SIL list) in 1997-98.[18] Thanks to these changes, the Commerce Ministry now estimates that around 2700 items are on the restricted list.

Clearly, some liberalization is better than none. But having said this, the liberalization seems to be completely arbitrary. If *ghee* can be in the SIL list, why do butter and dairy spreads have to be in the restricted list? If cornflakes are on OGL, why does Bulgar wheat have to be in the restricted list? If truffles are on OGL, why must mushrooms figure in the SIL list? Prepared or preserved pineapples are on OGL, but prepared or preserved oranges and pears are in the SIL list. Chilly sauce can be imported through SILs, but soya sauce is on OGL. Shaving cream can be imported through SILs, but after-shave preparations are in the restricted list. Plastic and wooden furniture is in the SIL list, but the import of bamboo furniture is restricted. Rabbit meat is in the SIL list, but frogs' legs are in the restricted list. Golf balls are on OGL, cricket balls are in the SIL list and the import of rugby balls is restricted.[19]

Moreover, liberalization does not mean the restricted list alone. There are prohibited and canalized items as well. On prohibited items, not much can be done. The existing prohibited items are prohibited either because of religious reasons or under *the Wildlife Protection Act* (e.g., beef or tallow, fat and oils of animal origin). Therefore, even when quantitative restrictions are completely phased out, these prohibitions will presumably continue. However, this logic does not hold for canalization. Not only has the new exim policy not decanalized, it has actually moved cloves, cinnamon

18. 150 items moved from the restricted list to the SIL list, 60 items moved from the SIL list to the OGL

19. What is of course significant is the fact that imports of consumer goods and items reserved for the small-scale sector have been opened up. These are the traditional red herrings for justifying quantitative restrictions.

and cassia from the restricted list to the canalized list.[20] Nor have quantitative restrictions on exports been touched. Prohibition, licensing restrictions and canalization continue to affect many exports, especially agricultural items.[21]

If one scans the list of import items that are on the restricted list, they belong to five major product groups – consumer goods, urea, petroleum products, textiles and garments and agriculture. Trade liberalization of urea and petroleum products is difficult without domestic deregulation and liberalization taking place first.[22] On consumer goods, there is resistance from the Left, as they are unnecessarily perceived to be elitist. In addition, there are lobbies of domestic producers of consumer goods. Similarly, there are analogous lobbies for textiles. Finally, on agriculture, there are perceptions that the objective of self-sufficiency in foodgrains will be lost if agricultural imports are opened up. This is a misconception. For example, India's tariff bindings on selected agricultural products and the tariff equivalents of existing quantitative restrictions show that, in general, India has agreed to bind tariffs at 100 per cent for most unprocessed agricultural products, at 150 per cent for processed agricultural products and at 300 per cent for edible oils. For most products, the tariff bindings are more than adequate to grant protection that is more than the tariff equivalents.

Is Indian agriculture price competitive by global standards? One way to evaluate this is by computing nominal protection coefficients (NPCs), which are nothing but the ratios of international prices to domestic prices. Gary Pursell and Ashok Gulati worked out NPC figures (Gulati and Pursell, 1995; Gulati and Sharma, 1991; Gulati and Sharma, 1994).

Essentially, Pursell and Gulati found that if one leaves out products like oilseeds and sugarcane, Indian agriculture has negative protection. Stated differently, for other agricultural products, India is price competitive. The reason for this is simple enough. Indian agriculture receives lower than market-determined prices for its output. In this sense, there is a negative subsidy or an indirect tax. Indian agriculture also pays lower than market-determined prices for its inputs. In this sence, it has a positive subsidy. What happens on balance, if one moves to market determined prices on both counts? The NPC computations show that the increase in output prices will more than compensate for the increase in input prices and therefore, Indian farmers will benefit.[23] The Pursell-Gulati kind of exercise also has critiques, primarily on methodological grounds.[24] But, the results are robust enough for one to argue that, barring products like oilseeds and sugarcane, Indian agriculture is globally competitive.

Let us now move on to the exchange rate. Before 1991, the exchange rate used to be an administered one, with the value of the rupee announced by the Central Bank. This led to an exchange rate that was over-valued. Over-valuation made exports artificially price uncompetitive and made imports artificially cheap.[25] Since 1991, the exchange rate regime has gone through several transitions. While retaining the administered exchange rate system, in July 1991, there was a devaluation of around 21 per cent against major convertible currencies in two cumulative doses.[26] The country then transited to an explicit dual exchange rate mechanism in March 1992. This was followed by a unified floating rate in March 1993. Since March 1993, the value of the rupee has been determined in the market, although the market is one that is yet restricted to dealers recognized by the Reserve Bank of India (RBI). Moreover, the market is not yet deep or broad enough, and thus, the ex-

20. In a similar reverse transition, battery scrap, sodium metal, Australian lupin seeds, passive night vision goggles and fire and burglar alarms have been moved from OGL to the restricted list.

21. Among agro-related canalized export items are niger seeds and onions. Among agro-related canalized imports are cereals, oilseeds, animal or vegetable fats and oils and residue and waste from the food industry. Cereal imports are canalized through the Food Corporation of India (FCI) and the import of cereal seeds is generally on the restricted list.

22. Some such measures, involving transition to market determined prices and away from an administered price structure, have now been announced.

23. This is the reason why aggregate measurement of support (ams) computations, without allowing for greenbox policies, are below the benchmark of 10 per cent, for both product-specific and non-product-specific support. Gulati and Sharma (1994) find a total AMS of minus 27.24 per cent. Figures on product-specific AMS mirror this finding. The product-specific AMS was calculated for 22 agricultural products and for 17 of these, the AMS was negative. In the remaining 5 cases, the AMS was below the 10 per cent benchmark.

24. Apart from identifying the right variety with which global comparisons can be made, there are problems of deciding which is the relevant domestic price. Moreover, the fact of pervasive state intervention distorts the picture.

25. Just before the reforms began, the official exchange rate was 21 rupees to a dollar. In the illegal or *hawala* market, a dollar was available for 25 rupees. The exchange rate depreciated during 1975-79 and 1985-89 and both periods had high rates of growth in exports. The currency appreciated during 1976-85 and exports stagnated. To suppress the resultant balance of trade deficit, one therefore needed import licensing and multiple (effective) exchange rates.

26. As was mentioned earlier, India's exports do tend to face price elastic demand. The devaluation is estimated to have added around 2.5 per cent to the inflation rate.

change rate is extremely susceptible to sales or purchases by the RBI. Subsequently, the government announced in March 1994 its decision to move to current account convertibility, which, however, was implemented w.e.f. August, 1994, and more recently, there has been an announcement about capital account convertibility.

One can detect four possible reasons behind the recent move towards capital account convertibility. Two of these are valid reasons. The remaining two are inappropriate reasons, and amount to doing the right thing for the wrong reasons. The two valid arguments are the following. First, capital account convertibility fits in with the general thrust of reforms and liberalization. It is the right thing to do and no further justification is necessary. The only question that remains is when should the transition be made?

In his second Budget Speech, Mr. Chidambaram mentioned two aspects of exchange control regulations that continue to plague the Indian economy. The first is the Foreign Exchange Regulation Act (FERA), in its 1973 incarnation, being more Draconian than the 1947 version of FERA. The preamble to the 1973 version of FERA states that this legislation is necessary "for the conservation of the foreign exchange resources of the country and the proper utilization thereof in the interests of the economic development of the country". That is, FERA belongs to an era when foreign exchange was a scarce resource and its use needed to be carefully controlled. There was a foreign exchange constraint and the reforms since 1991 have solved that problem. Why then does one need a statute like the 1973 FERA?

During the Second World War, foreign exchange was used to import food and war equipment. Therefore, several rules were issued under *the Defence of India Act, 1939*. All such exchange controls were meant to be temporary. But they survived the war. Foreign exchange was still scarce. So a *Foreign Exchange Regulation Act* (FERA) was enacted in 1947. This was meant to last for ten years. However, ten years of economic development did not ease the foreign exchange constraint; it only made things worse. Thus, FERA permanently entered the statute books in 1957. The preamble to the 1947 version of FERA said that this was "an Act to regulate certain payments, dealings in foreign exchange and securities and the import and export of currency and bullion.[27] This version of FERA only had 52 sections. However, the 1970s were a decade of tightening up.[28] Therefore, one had the 1973 version of FERA, with 81 sections instead of 52. And this version was far more Draconian.[29]

The above-cited Budget Speech announced the setting up of a Reserve Bank of India Committee to draft a Foreign Exchange Management Act (FEMA), following the guidelines laid down by the Sodhani Committee (an RBI committee) in 1993. The new government has approved the transition to FEMA. The very fact that the number of sections has come down from 81 in the 1973 FERA to 21 in the new FEMA is symptomatic of liberalization. Since the draft FEMA is not yet a public document, one should not comment on its provisions, except to point out that in some ways it represents a return to the 1947 version of FERA. It also removes clauses that concern non-bailability and cognizability of foreign exchange violations.[30]

Related to FEMA is the second aspect of exchange control regulations mentioned by Mr. Chidambaram in his Budget Speech. This is a time frame and a road map for capital account covertibility, to be provided by another committee set up by the RBI. This is the Tarapore Committee, whose report has now been submitted. There are two valid reasons for moving towards capital account convertibility. The *per se* logic of reforming is one. In addition, once one has complete current account convertibility, capital account convertibility follows as a matter of course. It is sometimes impossible to distinguish between

27. Thus, the 1947 version did not mention the proper utilization of scarce foreign exchange resources.

28. In 1971, a study team reported on "Leakage of Foreign Exchange through Invoice Manipulation". In 1972, the 47th Report of the Law Commission was on "Trial and Punishment of Social and Economic Offences".

29. A couple of examples will illustrate the point. Section 18 governs exported goods and exporters perennially complain about Section 18. Escorts exported goods for which the foreign buyer made 95 per cent of the payment. Escorts did not bother about the remaining 5 per cent because the money spent on arbitration would have been far more than the worth of the 5 per cent. The case went to Delhi High Court before it was eventually ruled that Escorts had not violated FERA (*Escorts Ltd. versus FERA Appellate Board, 1988*). Another company exported perishable goods and the foreign buyer refused to accept the consignment. Since it was not economical to re-import the goods to India, the company auctioned them off abroad. No legal action was taken against the foreign buyer and the RBI was not contacted for any permission or advice. Therefore, there was a violation of FERA (*Blisson India Corporation versus Director of Enforcement, 1989*). One can convincingly argue that the requirement of converting foreign exchange earnings into rupees can now be dispensed with.

30. An expected money laundering bill will however include such provisions, reflecting an altered mindset about white collar crimes.

current account and capital account transactions and capital account transactions can always be disguised as current account transaction. The Enforcement Directorate uses this argument to clamp down on both types of transactions. But that is not the point. The point is that below a certain threshold, there should be no controls, regardless of the nature of the transaction. And above that threshold, one can have controls, regardless of the nature of the transaction. The current account/capital account distinction is artificial, unnecessary and dysfunctional.

Unfortunately, there are also two inappropriate reasons for moving towards capital account convertibility. Indian economic reforms can be broken up into a domestic sector component and an external sector component, although the distinction is somewhat artificial as one impinges on the other. With the exception of industrial delicensing and some tinkering with the financial sector, very few reforms have taken place in the domestic economy.[31] Reforms have primarily been introduced in the external sector and that is also where there is some kind of time frame for further reforms. However, there is also a perception that reforms have begun to slow down and to reverse this perception, one looks for further reforms. These are not possible in the domestic economy and one goes back to the external sector to see if something can be found there. But peak tariffs have already been brought down and there is a time frame for further reductions. Quantitative restrictions on imports are being eased. If one looks for something that is significant, all that is left is an announcement about capital account convertibility.

There is yet another unfortunate reason for moving towards capital account convertibility and that concerns the balance of payments. The simple point is that the current account deficit was around 1.3 per cent of gross domestic product (GDP) in 1996-97 and around 1.5 per cent in 1997-98. Despite some concerns about bop following nuclear tests and sanctions, this can be spliced with the phenomenon of a sizeable capital account surplus and the net capital account surplus is much more than the current account deficit. Therefore, without RBI intervention in the foreign exchange market, the rupee would have appreciated in nominal terms.[32] Even with RBI intervention, the real exchange rate has appreciated, as the differential between the rate of inflation in India and that in the rest of the world has been quite high.

One should not of course get bogged down in the semantics. There is a superficial impression that in one of his budget speeches (1993), Dr. Manmohan Singh announced that the rupee was going to be convertible on the trade account. In a subsequent budget speech (1994), he announced that the rupee was going to be convertible on the current account. There is a neat and smooth transition from trade account convertibility to current account convertibility and thence to capital account convertibility. All that had happened in the 1994 budget speech was that India had accepted the Article VIII obligations of the IMF. But this did not mean that the changes would be implemented overnight. There are four different reasons why India is still short of complete current account convertibility. First, authorized dealers (ADs) or banks clear current account transactions only up to a certain threshold, not beyond. Second, there continues to be a dividend-balancing requirement for foreign direct investments in consumer goods. Third, interest on some non-resident Indian (NRI) deposits cannot yet be freely repatriated in foreign exchange. Fourth, debt servicing to the former Soviet Union cannot be freely paid in foreign exchange. Admittedly, these restrictions are progressively being eased. Similarly, on capital account convertibility, the semantics is not important. There are no restrictions on capital inflows and some categories of capital inflows qualify for free repatriation (for foreign direct and institutional investors).

The Tarapore Committee recommended a phased transition to capital account convertibility in three phases—1997-98, 1998-99 and 1999-2000. Before complete capital account convertibility, certain macroeconomic conditions have been stated as prerequisites. First, the gross fiscal deficit must be brought down from 4.5 per cent of GDP to 3.5 per cent. Second, the average effective cash reserve ratio (CRR) must be reduced from 9.3 per cent to 3 per cent. Third, gross non-performing assets (NPAs) of public sector banks must be reduced from 13.7 per cent to 5 per cent. Fourth, the inflation rate must be brought down to between 3 and 5 per cent. Fourth, the debt service ratio as a percentage of current ac-

31. This is naturally related to the political economy of the reforms process and the existence of lobbies and vested interests. Generalizing somewhat, anti-reform lobbies can be found in inefficient industry, large farmers, organized labour and the bureacracy. Pre-reform lobbies can be found in efficient industry, small farmers, unorganized labour and the consuming class.

32. Such RBI intervention is naturally associated with an increase in the inflation rate or with an increase in interest rates, if the RBI tries to sterilize inflows by selling government paper. Since May 1998, this has however no longer been a compelling argument, bolstered by the East Asian currency crisis and expectations about a rupee depreciation.

count receipts must be brought down to 20 per cent. Fifth, the RBI must withdraw from primary government borrowing programmes and the government must set up its own public debt office. Sixth, interest rates must be completely deregulated. Seventh, there must be a consolidated sinking fund and disinvestment proceeds (from public sector undertakings) and RBI dividends must go into this sinking fund. Eighth, there must be a moratorium on the creation of weak banks. Ninth, there must be transparent and globally comparable procedures for financial accounting.

This is an agenda for complete financial sector reform and three questions arise. First, are these criteria necessarily desirable, such as the example of the inflation rate, knowing well that there is a trade-off between inflation and growth. Alternatively, is the composition of the fiscal deficit also not important? Second, assuming that the criteria are desirable, can the preconditions be achieved in three years? The answer is clearly in the negative. Third, how are these preconditions to be interpreted? Does one wait for all of them to happen before one moves towards capital account convertibility? Interpreted thus, nothing is going to happen for the next ten years. Thankfully, this is not how the government has interpreted the preconditions. On capital account liberalization, there are five clear segments for which reforms are needed—corporate sector, banks, non-banking financial institutions, individuals and financial markets. On some of these, such as for non-resident individuals and the corporate sector, liberalization is possible without waiting for all the preconditions to be met and this has indeed begun to happen.

How does the Indian scenario relate to the East Asian currency crisis? Several symptoms of the currency crisis are familiar syndromes in India as well (Rakshit, 1997). The Indian financial system is riddled with non-performing assets (NPAs). Competition has been driving down spreads for banks. Thanks to adverse selection, credit rationing has also not been unfamiliar. Due to moral-hazard type problems, credit has also been extended to high risk sectors, though not significantly to real estate. As has been mentioned earlier, exports have begun to stagnate and there is downward pressure on the rupee. However, there are no imminent signs of the currency crisis replicating itself in India. India's short-term debt is too low and so is the current account deficit to GDP ratio. The currency crisis ought to have been generally interpreted as an argument for introducing financial sector reforms. Unfortunately, it has more often been construed as an argument for postponing reforms and a vindication of India's slow approach.

Conclusions

If India's exports are to grow, the growth must primarily come from textiles and garments, leather goods, gems and jewellery, software, selected engineering goods, pharmaceuticals, marine products, agro-industrial products and processed minerals, toys and sports goods. Broadly speaking, the Indian export basket can be divided into two groups—agro items and manufactured products. In both categories, severe supply side constraints exist. In agro items, exportable surpluses are simply not available. In the short run, exports can be pushed up only through the means of diverting items from the domestic market and this results in domestic inflation (the existing onion crisis is a good example). In the long run, exportable surpluses can be generated only if reforms are introduced in the agricultural sector. For manufactured products, supply side constraints manifest themselves through inferior quality, outdated technology and high costs.

And common to both categories are constraints like infrastructural and procedural problems. Infrastructural problems concern power, port facilities, railways, inland container depots and other means of transportation. Exports suffer from inadequacy of power, wagons, mechanization at ports and air cargo complexes or inadequate mechanization of the containerization process.[33] Given the scarcity of resources, it is unrealistic to expect that the government will be able to solve these problems on its own. But there is certainly scope for greater private sector participation in the development of infrastructure. Unfortunately, the problem with privatization has been that the policy on private sector involvement in the development of infrastructure was not always very clear in the first few years of the reform process and the essential ingredients are falling into place only now. Among systemic improvements that can be brought about through privatization are the development of inland container depots, privatization through bonded warehousing and development of container facilities and the relaxation of cabotage restrictions which require that all cargo movements between Indian ports have to be on national carriers. There is also a problem with rigid labour markets and unionization, as this inhibits such private sector involvement.

Roy (1996) quotes a 1989 World Bank study which shows that trade logistics costs in India are inordinately high. These costs are direct costs of hinterland movement, including port and clearing charges, costs of

33. It is estimated that containerization costs in India are three to four times the containerization costs in the United States and Japan.

inventory, insurance and documentation and such costs are as high as 40 per cent of the delivered cost of commodities to foreign markets. Since the reforms, there has been some improvement for export procedures, but not so much for import procedures and many imports are export-related imports.[34] One needs to introduce a simple export clearance form with a single signature and legislation that gives effect to an internationally accepted combined transport document. Transition to computerization and electronic data interchanges (EDI) will also reduce discretionary abuses in customs clearances. This will also help control corruption, which is endemic.

Many supply-side reforms can only be solved with reforms in the domestic economy, not otherwise. It is because such problems cannot be solved until well into the twenty-first century that one talks of 10 to 12 per cent dollar rates of growth in exports, rather than twenty per cent. And if one does not introduce reforms in the domestic economy, one will not even get 10 to 12 per cent.

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34. Some of the improvement is automatic. Export procedures concern export clearances, as well as special procedures for collecting export incentives. To the extent export incentives have been slashed, such procedures have also been eliminated.

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Economic Reforms and Labour

C.S. Venkata Ratnam

While India may symbolise unity in diversity, the diversity in Indian industrial valations system has grown in a hydra-headed fashion. The labour institutions, laws, policies and practices are so diverse that arguably India seems to lack a single rational systems of industrial relations and even within a state, sectoral differences are striking. Hence any generalisation about both economic reforms and labour needs to be cautionary looked into. This paper attempts to take stock of the economic reforms in India and the gamut of labour issues related to it. Noting that though the labour laws appear to be very stringent on paper, downsizing and retrenchment is rampant, taking various forms, the author points out that most of the laws pertain to the organised sector which has only about 8 per cent of the total workforce. Politicisation of economic reforms has led to labour distriust about the positive side of reforms. Parties criticise 'new economic policies' while in opposition and opt for reforms when in power. Such inconsistencies have serious impact on the fate of the reform process. The paper stresses that economic development should be the means and human development, the goal. As regards labour, legislation needs to be aligned with the overall shift in economic and industrialization policies. The paper also underscanned the need to pay urgent attention to the evention of a timely, adequate and reliable data base on labour upon which policy planning may be based.

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Introduction

A great deal of diversity exists in India in regard to both economic reforms and labour. Some may contend economic reforms began in the 1980s, but no one would dispute that they got a shot in the arm around eight years ago in 1991. Reforms are occurring in some areas, but not in others. The contrast between banking and insurance or surface and airways transport brings this out. Similarly privatisation is occurring speedily and overtly in some states, though at the central level it is through the covert route of deregulation and opening of sectors hitherto reserved for public sector to private sector (including multinationals).

As for labour, the dualism is exacerbated with government paying its employees more for less work while in industry, trade and services a sizeable section is losing their livelihood to make their enterprises viable, competitive and profitable. The labour institutions, laws and policies and practices are so diverse that arguably India seems to lack a single national system of industrial relations and within a state also the sectoral differences are striking.

The regional and sectoral differences in unionism are even more pronounced (Venkata Ratnam and Verma, 1997; Shyam Sundar, 1998), In a country of over 900 million, only six million are union members. While politically affiliated unions dominate in West Bengal, enterprise-based, independent, unaffiliated unionism is the main feature of Mumbai. Within eastern states, unions are declining in Bihar and growing in Orissa. In some western states (Gujarat, for instance), high wage unions co-exist with 'foot-path' unions formed by briefless lawyers holding brief for unions registered with the support of seven dismissed and disgruntled workers to fight contingent litigation. Within the state of Tamil Nadu, while multiple unionism is rampant in Coimbatore, one-union, one enterprise is a common feature in Chennai. In the city of Bangalore, public sector is riddled with multiple unions and low employee turnover while the modern, high-tech, and information technology in-

dustries are almost union-free but saddled with very high employee turnover!

Among employers and their organisations, there are some who consider that globalisation has gone too far while others consider that what is being done is too little and too late. In pre-independent India, Bombay and Calcutta were home to 'foreign business clubs'. In post-liberalisation era they have turned more *swadeshi!* The 'Bombay Club' is concerned about MNCs causing de-industrialisation. On participative management, we have a long tradition of talking, not practicing.

While the labour laws may appear too stringent, one may find 'success' stories by managers of how they reduced manpower to 10 per cent of what it was seven years ago. In the field of collective bargaining, one may find trade unions in several public sector undertakings getting something conceding nothing while several in the private sector may have got something conceding anything and everything.

If one divides the map of India vertically into two halves and looks west of Kanpur or Lucknow, the job situation is not alarming but stirs hope. If the same person sets his/her sights east of Kanpur or Lucknow, the situation is grim and one of despair.

Thus while India may symbolise unity in diversity, the diversity in Indian industrial relations system has grown in a hydra-headed fashion. Therefore, whatever one says, the opposite could also be true. Hence any generalisations about both economic reforms and labour need to be considered with a sack of salt. Given the absence of an adequate, timely and reliable statistical data base, the conclusions may often be based on subjective, not objective reality.

While India may symbolise unity in diversity, the diversity in Indian industrial relations system has grown in a hydra-headed fashion.

Declining Labour Intensity

The common belief is that in India capital is scarce and labour is plentiful. Since the 1980s Indian industry has become more capital intensive and less labour intensive. The databases published by the National Productivity Council of India in the various issues of its Productivity journal confirm this. It is not a question of wisdom, but a lack of choice which would have made Indian industry employ capital, which is scarce and costly, more lavishly and use labour, which is plentiful and cheap, as if it is rare and hence precious. The result is capital productivity has been sliding and labour productivity, inspite of—not necessarily because of—labour, has been increasing! The World Bank (Fallon and Lucas, 1991) says that job protection laws (1975 emergency amendments to the Industrial Disputes Act) were the cause of jobless growth in India. The ILO feels it is a cause, not the cause. Labour market in our urban industrial centres is not rigid, but as flexible as it is in Kualalumpur where the right to hire and fire, reward, transfer, promote or assign work have been recognised as employers' prerogatives under the national industrial relations legislation. But, then, India is so large, complex and diverse that a person who looks at labour mobility in two adjoining villages in Bihar finds labour market is too rigid. Within the state itself, labour can not move from one village to another. Still, even during the worst period of violence in Punjab, agricultural labour from eastern U.P. and Bihar could freely move all the way to Punjab in search of livelihood.

Within the organised industry, to understand the impact of structural and other changes on labour the following should be considered:

Production and labour management system are closely linked: Technology is a unifying factor converging labour management system. Multinational companies in India have been transmission belts of western policies and practices. Consider the case of information technology industries. The human resource/industrial relations practices of such firms in Bangalore are not much different from their counterparts in North America or Europe. In the post-reform era, whether it is in the field of non-unionism (information technology industries in private sector), cost cutting competitiveness (several pharmaceutical companies) or employee-stockholding (Infosys and Global Trust Bank, for instance), some Indian companies could be ahead of similar players in the west and some Indian subsidiary operations (ITC and Hindustan Lever, for instance) beat their parent companies abroad.

Product life cycle: Like humans passing through four stages (birth, adolescence/adulthood, middle age and old age/death), companies and their products also pass through four stages (start up/introduction, growth, maturity and closure/decline in demand). the sales of a company or product will be low in the start up/introduction phase, grow in the growth phase, plateau in the maturity stage and begin to drop in the decline phase. If companies are able to introduce/adapt to new materials, new products and new technologies in time, they can continue to remain for ever in the growth phase. Remington Rand chose to remain in typewriter

business and had to face liquidation. Gestetner duplicating company, on the other hand had adapted its products with the changes in the technology and therefore remained vibrant and growing to this day. workers in Remington Rand had to pay a price. But Workers in Gestetner did not suffer. Workers in industries/firms which have matured or in decline phase suffer most. Companies like Sundaram Fasteners have developed systems to beat world class standards in quality, cost and timely deliveries and able to bag global tenders for supply of spares. Others languish when they fail to bridge the gap between current and desired levels of performance.

Forces of competitiveness: Michael Porter (1980) who studied competitiveness of industries and nations avers that there are five forces of competitiveness: entry/exit barriers, competitive rivalry, power of substitutes, power of suppliers and power of buyers. When there is no competition, labour and management prospered at the cost of customers. When the Japanese and the Korean products entered the Television market, many of the domestic Television brands had suffered extinction. So did workers in those companies. When a substitute for jute was found, jute industry suffered. When the textile mills did not modernise or diversify, they suffered. While most other textile mills in Ahmedabad were either closed or are in the brink of liquidation, Arvind Mills in the same city continues to do well.

When there is no competition, labour and management prosper at the cost of customers.

Elasticity of demand for labour: Alfred Marshal's four laws of elasticity of demand for labour merit consideration so that labour and management could adjust their approaches accordingly, avoid counterproductive assertion of adversarial stances and limit negative impact: (1) Technological possibility of substituting other inputs; (2) Elasticity of demand for product of labour; (3) Proportion of costs spent on labour; and, (4) Elasticity of supply of other inputs. The combined impacts of the four determinants of labour demand make the demand for some categories of labour (such as airline pilots and others with rare skills) far less elastic than the demand for other categories of labour (such as unskilled workers in most industries). The latter category of workers suffer most due to structural changes. Trade unions' impact on wages will be higher in the former category and less or marginal in the latter category. Where labour and management learn to cooperate with each other and prepare themselves to external and internal changes, it is possible to maximise opportunities, minimise weaknesses and reduce adverse impacts, if any, due to structural and other changes. However, due to the impact of product life cycle and other external environmental effects, in companies where the realisation to respond to changes comes too late and becomes too little, the choices/options to respond to environmental threats will be limited and hence the ability to meet the challenges will be weak.

Employers focus on product markets and unions harp on labour markets. The labour market impact is a function of the interaction between product market and labour market forces. In quite a few situations industry and product market characteristics strengthen the employers and weaken or make unions vulnerable. In some others both will be left with limited choices/options and become defenceless, vulnerable or endangered. For instance, in companies like Hindustan Lever, Proctor and Gamble, Philips, Bata, etc., where employers have opportunities for parallel production, outsourcing etc., unions power would be weak relative to employers due to industry and product market characteristics. In contrast, consider the case of J.K. Synthetics, Kota (Rajasthan) which became sick. In this case the employer does not have options like parallel production or outsourcing. The input costs are rising and output prices are falling. Both the employer and the union faced squeeze in margins and wages respectively. Both needed to make sacrifices and enter into "do or die" suicide pacts. Here, given the rivalry and competition among and within the unions, the unions are damned if they cooperate with the management. They are also damned if they do not cooperate. Such dilemmas lead to delay due to dithering behaviour. a stitch in time could have saved nine. In the absence of timely and proactive responses from both employers and union, decay and decline become imminent.

Economic Reforms and Labour as a Redundant Resource

India adopted a policy of self-reliance and protectionism during the first four decades of economic planning with avowed tilt towards socialist pattern of society. As a result, the public, private and even foreign firms resorted to cost plus pricing strategies. Given the low levels of literacy and skills and the availability of large number of people, the government and the industry chose to employ more people at low wages. In many sectors, even though we employ more people, unit labour costs continue to be competitive. Where workers received low wages and employers incur high unit labour costs, cost plus pricing formula ensured that only the consumer pays.

With liberalisation and the policies towards the integration of the domestic economy with international economy, competitive considerations became compelling, resulting in steep cuts in costs.

But with liberalisation and the policies towards the integration of the domestic economy with international economy, competitive considerations became compelling, resulting in steep cuts in costs. While employers had little control over most other input costs which were raising any way, several companies chose to effect cost reduction through job reductions while a few others (mainly loss-making public enterprises) chose a trade off between jobs and wages. Low wages do not guarantee low unit labour costs because in the organised sector the former is usually associated with low skills, non-productive use of labour and low productivity. Mere consideration of unit labour costs can be misleading. Being a relative index, it depends on how other inputs are used. Most firms still seem to prefer the cost cutting route and ignore/neglect quality and value addition as superior, alternative options. This is evident from a discerning examination of the composition of India's exports.

Low wages do not guarantee low unit labour costs because in the organised sector the former is usually associated with low skills, non-productive use of labour and low productivity.

The exception, however, is in industries which have competitive advantage in labour and skill-intensive industries which are also relatively less dependent on inefficient domestic input producers, poor infrastructure and domestic demand. There has been a compound annual growth rate of 12 per cent (between 1990-91 and 1995-96) in diamond, 27 per cent in garments (between 1989-90 and 1995-96) and 47 per cent in software (between 1990-91 and 1996-97).

Institutional constraints (labour law, etc.) are considered 'the reason' or 'a reason' for employers considering labour as a difficult and disposable commodity (Philadelphia declaration holds that labour is not commodity). Ironically the stringent job regulations did not deter private employers from cutting jobs when they had a well-knit plan. The public sector and the government had to contend with stiff opposition from the politically aligned national centres of trade unions.

For instance, the Fifth Central Pay Commission, which submitted its report in 1997, suggested that over the next 10 years the government should reduce 30 per cent of jobs, at the rate of 3 per cent per year, through natural attrition and voluntary separation schemes. The World Bank estimated that in Railways the redundancy is as high as 33 per cent (World Bank, 1995). Yet the civil service and railways employees unions could secure 35 per cent increase in pay and benefits without any conditions about job reductions. When retrenchment was difficult, companies began to offer voluntary separation packages which offered three to ten times the normal retrenchment compensation. For instance the private sector steel giant, Tata Iron and Steel Company (TISCO) in Jamshedpur which once prided in recruiting almost all able bodied and willing males in its neighbouring villages, announced a voluntary retirement plan to reduce its workforce of about 71,000 (including township and mines) to one-third or a mere 23,000 or so. The public sector steel giant, Steel Authority of India has already reduced its workforce from 2,30,000 in 1986 to 1,80,000 in 1997 and plans to downsize by about one-third or over 60,000. Both the companies have introduced voluntary separation schemes that promise to pay workers, amounts equalling their last drawn pay for the next 10 to 12 years without work if they choose to leave the company now. Tatas have additionally promised to pay a lumpsum of Rs. 2 lakhs towards housing assistance and access to company's schools and hospitals till their normal age of retirement.

A few public sector companies signed collective agreements that envisaged a 20 per cent job cut during the five year period of the agreement. Air India and Indian Airlines have plans to shed their redundant workforce (Rao, 1998). The employee–air craft ratio in Air India and Indian Airlines is reported to be 660 and 400 respectively against the industry average of 175 to 225. Still about Rs. 1350 million or 20 per cent of wage bill is on account of "productivity linked incentives"! More recently, the Government has announced a plan to "voluntarily retire" 11,000 workers in nine sick public enterprises at a cost of about Rs. 5500k million (Statesman, 1998). Several private sector companies have successfully implemented "compulsory" voluntary retirement programmes. Some multinational companies have succeeded in reducing workforce to the extent of 25 per cent (BOC Ltd.) to 90 per cent (Sandoz)! The Bengal Chambers report on productivity growth in West Bengal illustrates how 26 companies have achieved significant productivity improvement through, among others, phenomenal workforce reductions. Typically, in

several green field sites, as compared to their old manufacturing sites, firms employ half the workforce, achieve double the output and pay 60 to 80 per cent wages.

Several estimates in various other sectors put the extent of redundancy at over 30 per cent or about 3 million out of 28 engaged in the organised sector. One section defends the case for flexibility (for workforce adjustment through "down" or "right" sizing) with arguments about less than 8 per cent organised sector holding the entire economy to ransom at the expense of the 92 per cent in the informal/unorganised sector workforce. The other section seek to counter the arguments as sheer propaganda and assert that when 92 per cent of the labour market is flexible why cannot they (the employers) leave the remaining 8 per cent as it is. The stakes in the organised sector being very high, the high-voltage debates generate more heat and less (or no) light.

Economic and Social Performance in the Post-Reform Period-Select Indicators

The World Employment Report, 1998-99 (ILO, 1998; p. 16) has observed that, "India's economic performance has fluctuated in the 1990s due to both economic liberalisation and weather. Although the trend growth rate has been higher than earlier, it has not been sufficient or sustained for long enough to reduce significantly the existing high levels of underemployment and to absorb new job seekers productively.

Table 1 presents India's performance on select economic and social parameters in the post-reform period. Employment in the organised sector grew. Despite impressive industrial recovery (Gupta, 1998), employment grew by hardly 0.6 per cent in 1995-96 and 0.2 per cent in 1996-97, suggesting a fast (and continuing) decline in employment intensity in the organised sector. Employment in the civil service reduced mar-

Table 1: Economic Reforms and Labour – Select Parameters

Aspect	Change during post-reform era (1990s).
Estimated employment in organised public and private sectors	Increased from 267.33 lakh in 1991 to 279.41 in 1996.
Employment in civil service	Increased from 190.57 lakhs in 1991 to 194.29 in 1996. There was marginal decline in central government employees strength which was offset by the increase in employee strength in state government, quasi government and local bodies.
Employment in central public sector	Reduced by 200,000 from 21.79 lakhs in 1991-92 to 19.78 lakhs in 1996-97.
Employment in organised private sector	Increased from 76.77 lakhs in 1991 to 85.12 lakhs in 1996.
Unemployment	The number of persons in the live registers of employment exchanges rose from 36.3 million in 1991 to 38.1 million in 1997.
Workforce reductions	30% redundancy estimated in organised sector employing about 28 million. The 243 central public sector alone shed 200,000 jobs during 1991-97 through means other than retrenchment.
Poverty	The government claims that the incidence of poverty is declining. The critics argue about the poverty of poverty estimates.
Inflation	All India Consumer Price Index nearly doubled in 7 years: It rose from 951 in 1990-91 to 1803 in 1997-98. The rate of inflation is claimed to be low during the 1990s.
Minimum wages	The range of minimum wages at minimum level ranged from Rs. 9.25 to Rs. 114.16 as on 31.3.98. In Delhi it was Rs. 68.60. Minimum wage enforcement continues to lax.
Social sectors and Human development index	The Economic Survey, 1997-98 (p. 16) acknowledges that "the shortcomings in our social sectors – such as education, health, water supply and sanitation and housing – in relation to both our own aspirations as well as performance levels achieved by other Asian countries becomes increasingly stark and unacceptable. India's rank in UNDP's Human Development Index is 138 out of 175 countries in the year 1998.
Industrial unrest: No. of strikes & Lockouts	58,62,000 workers were involved in strikes and lockouts (39,21,000 in strikes and 19,41,000 in lockouts) during 1992-97.
No. of workers laid off	410,428 workers were affected by lay-offs during 1992-97.
No. of workers retrenched	15,534 workers were retrenched during 1992-97.
No. of closures and workers affected by closures	94,429 workers were affected due to closure of units during 1992-97.

Source: Annual Report of Ministry of Labour, Government of India for the year 1997-98 (various pages) and Economic Survey submitted to the Parliament by the Finance Minister in the relevant years.

ginally in the first four years of the post-reform period, but grew subsequently. Over all, unemployment is rising and will rise in the next few years, even if the economic growth is twice as high as it had been in 1997-98. Workforce reductions loom larger as economic decision-making is dithered due to political compulsions. Estimates are confusing and conflicting, whether it is poverty or productivity. Inflation is tamed on paper, but price rise of daily wage goods continue to be stiff. Minimum wages are a mockery. Organised sector pays much more than minimum wages usually. In the unorganised sector, compliance is weak and enforcement feeble.

On social sector, India's track record is poor with the dubious distinction of being the home for the record number of illiterates in the world. Industrial unrest seems under control, but when strikes are in control, lockouts are on the rise: Worker violence is replaced by employers militancy? The number of workers affected by layoffs, closures and "voluntary" reductions may be small in relative terms but in absolute terms it is a worrisome figure. Overall, there is little room for comfort or complacence. The consolation is that since India did not go all out for quicker and rapid economic changes, unlike many other countries in Asia, it could keep social costs in check.

Statistics show that the rate of labour productivity has been consistently higher since mid-1980s. In the two years (1992-93 and 1993-94) spanning the period after the stepping up of economic reforms, for which Annual Survey of Industries Data is available, the overall gains in total factor productivity growth have been impressive at 8.9 and 10.2 per cent respectively (Gangopadhyay and Wadhwa 1998). Gains in productivity have been associated with falling unit labour costs since mid-1980s, particularly in industries such as textiles, leather, metal products and other manufacturing which are spear heading India's export growth. In these industries, rising labour productivity, capital deepening and falling labour costs were accompanied by a rise in the rate of growth of employment and wages.

The rising trend of labour productivity in India should be seen in the context of: (a) productivity improvement through capital investment and resultant mechanisation; (b) increased use of casual and contract labour; and (c) steady reduction in workforce mainly through natural attrition and voluntary separations. Johri (1995) rightly questions whether labour has become a redundant resource in India's post-reform quest for productivity and quality to gain competitiveness. Indeed, in more cases than not, companies are becoming productive and profitable at the cost of unskilled/redundant labour. Bengal Chambers (1997) study of 26 firms, including nine multinational corporations, confirm this. Kuruvilla's analysis of post-globalisation trends in human resources/industrial relations reinforce this (Kuruvilla, 1997).

To sustain productivity improvement, it is necessary to ensure that the rate of expansion of industrial and economic activity is high enough to generate more jobs than are destroyed in the short-term/transition stage itself. The recent Asian economic crisis and political instability have, however, resulted in a slow down. If this slow down continues, labour productivity improvement will be at the cost of labour. Existing jobs will have to be sacrificed to make the enterprises viable. New jobs will be fewer than those displaced. With slow growth, the trickle down of benefits will not take place. The result will be that while the rich may become rich, the converse will also be true: the poor become poorer.

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With a population that is expected to cross a billion soon, the country has only 28 million workers with a semblance of job security. Public provision of education, health, housing and social security being virtually negligible, even this relatively pampered sector is in the throes of a crisis with the prospect of job loss sans social safety net.

Table 2: Performance of National Renewal Fund 1992-98

Aspect	Total from 3.2.1992 to 31.3.98
Financial allocation	Rs. 22,227 million
Expenditure incurred	Rs. 20,830 million
Expenditure on voluntary separations	Over Rs. 18,000 (90% of total expenditure of NRF)
No. of workers who took voluntary retirement with NRF funds	109,000 workers. The number of people who took voluntary retirement with companies' own funds would be at least twice this number.
No. of Employee Assistance Centres (EAC)/Employee Resource Centres (ERC)	557 EACs in 16 states and 47 ERCs in 47 central public sector undertakings.
No. of workers surveyed by EACs	66,662
No. of workers counselled	33,791
No. of workers retrained	26,304
No. of workers redeployed	6,712

Source: Ministry of Industry, Government of India.

The discussions on alternative safety nets remained on paper and the national renewal fund (NRF) initiative became a national redundancy fund (Table 2). The NRF established in February 1992 was supposed to (a) provide compensation to employees affected by restructuring/closure of industrial units; (b) assistance to retrain and redeploy employment affected by modernisation/restructuring; and, (c) area regeneration. However, over 90 per cent of the funds was used only to "voluntarily retire" 109,000 redundant public sector employees. Of these about two-thirds were surveyed, one-third were counseled, one-fifth were retained and about one out of 18 were redeployed. Not all training was relevant or appropriate and even those who were redeployed were not redeployed in the skills for which they were trained. Studies on how those voluntarily retired fared subsequently confirm mixed results (Guha, 1997 and Gupta, 1996). There are no studies on how large-scale "voluntary" workforce reductions affected those who remained in jobs.

Table 3 presents the sorry situation with regard to human resources as a source of competitive advantage. India is second to none in terms of its skilled workforce. The problem, however, is that it is woefully inadequate to meet the country's needs. Technology increases the demand for skilled labour. ILO (1998; pp. 38-39) asserts, based on an UNIDO industrial statistics data base for the year 1997, that in India the share of employment in high skilled manufacturing industry as a percentage of total manufacturing employment increased from 30 per cent in 1980 to 34.6 per cent in 1993. In future, the study noted, it is not always that "higher" skills are required, but "different" skills definitely are. Job losses may be more due to skill gaps than due to competitive pressure on costs.

Table 3: Global Competitiveness of Indian Labour

Item	Scale*	Rank**
Country has abundant labour force	6.77	1
Average workers are unproductive	2.94	51
Hiring and firing practices are severely restricted	2.16	53
Labour regulations impede adjustment of working hours to meet change sin demand	2.16	49
Labour regulations impede adjustment of working hours to meet changes in demand	5.05	8

* All questions have scale from 1 (lowest) to 7 (highest)

** India's rank amongst 53 countries ranked in the 1998 Global Competitiveness Report.

Source: 1998 Global Competitiveness Report.

The preferred alternative, therefore, is to raise labour productivity through investment in developing skilled, flexible and adaptive workforce, in infrastructure and in research and development.

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Table 4 presents a comparison between the organised and the unorganised sectors in terms of compensation and contribution. Compensation is the total remuneration paid to the employees in the respective sectors. Contribution is measured in terms of operating surplus income generated in the respective sectors.

Between 1990-91 and 1994-95, the percentage change in compensation to workers in both the organised (168.5 per cent) and the unorganised sector (170 per cent) were more or less similar. The unorganised sector fared marginally better. Contribution, as measured by the operating surplus income, has, however, increased by 228 per cent in the organised sector and 176 per cent in the unorganised sector. Compensation to the employees in the organised sector was 2.16 times and 1.55 times the operating surplus income generated in the organised sector during 1990-91 and 1994-95 respectively. The corresponding figures for the unorganised sector was 0.27 and 0.26.

Table 4: Compensation and Contribution in the Organised and Unorganised Sectors

Aspect	Organised Sector		Unorganised Sector	
	1990-91	1994-95	1990-91	1994-95
Compensation to employees (Rs. Crores)	105198	177626	58253	99400
Operating surplus and mixed income (Rs. Crores)	48749	111250	213419	375422
Ratio of Operating surplus & mixed income to Compensation to employees (in per cent)	46.3	62.3	366.36	377.69

Source: CMIE. (1998). National Income Statistics. Mumbai. Feb. 1998 (Chapter 14: Factor incomes),

On average, 28 million employees in the organised sector received, annually, Rs. 20805 and 35500 in 1990-91

and 1994-95 respectively. Their counterparts in the unorganised sector, who approximately number about 282 million, received Rs. 9297 and Rs. 17257 respectively during the corresponding years. The compensation gap between the organised and the unorganised sector has come down during the five year period 1990-91 to 1994-95. In 1990-91 employees in the unorganised sector received 44.69 per cent of the compensation received by the employees in the organised sector. By 1994-95, it rose to 48.6 per cent.

It appears from the data shown in Table 4 that (a) compensation to the employees in the unorganised sector was less than half that for their counterparts in the organised sector; (b) the percentage increase in compensation for the employees in the unprotected employees in the unorganised sector was higher than their counterparts in the organised sector; and, (c) in terms of operating surplus income the organised sector fared much better than the unorganised sector.

The wage gap between the public and the private sectors is wide and it has increased in the post reform period. The wage gap works in favour of workers in the public sector who get about 1.5 times higher than their counterparts in the private sector. The wage gap works negatively at and above manager level in favour of the private sector managers. This was feared to have created a flight of talent from the public to the private sector. Hakeem and Ratnam (1997), however, pointout, based on a study of about 20 per cent of the central public sector undertakings, that this had not happened and there was no brain drain in the public sector.

Foreign Investment

There is so much ado about foreign investment. Actual flow during 1991-97 was less than 20 per cent of US$ 47,242 committed approved flows. A large part of it has gone into increasing the stake in existing businesses (and industries). In some cases investment has gone into adding new manufacturing capacities or modernising existing capacities. The latter type of investment often reduced the existing level of labour intensity and/or affected existing domestic businesses (for example white goods industry). The net effect of what little foreign investment that flew into the country had been a decline, not addition, to direct employment in the concerned areas. Telecom could be a possible exception. Neither the Planning Commission nor any of the ministries in the Government of India have worked out employment elasticities of new technologies to be able to study the impact of investment growth and employment in different sectors. There are no such studies even by academic or other research institutes in the country.

The Asian crisis has highlighted the perils of uncontrolled mobility of capital. Yet, it is wrong to consider that foreign investment is bad. Majumdar and Chibber (1998), in their study of over 1,000 firms with varying degrees of foreign ownership in India for the years 1998-1994 found that firms with over 51 per cent of foreign ownership have fared much better in exports. Ghemawat and Patibandla (1998) have also shown how the reforms have enhanced India's competitiveness in labour- and skill-intensive industry; reduced the dependence of competitive industries on inefficient domestic suppliers and infrastructure; and enhanced domestic competitive conditions. Of course, not all industries were similarly placed to have similar beneficial impact.

Privatisation

Privatisation in India, so far, has been more convert than overt, particularly in the central sphere. Here also, the evil of licensing has been replaced by the devil of tendering in some cases such as the Telecom. If one were to look at negative impact of economic reforms, the experience of increased private sector competition in domestic airlines and passenger road transport in Delhi did not prove positive. The performance of non-banking private sector financial institutions and the scams in the stock markets have eroded the confidence of middle class investors in stock markets. Public sector reforms remain mostly on paper in the absence of civil service reforms. The economic reforms have thus, not been an unmixed blessing. Still, the need/rationale for economic reforms can not be questioned, even though the content/substance of economic reforms remains controversial.

Public Policy and their Effects on Labour

Labour policies should cover the entire labour force. So far, it focussed mainly on the organised sector. The Working Group Report on Labour for the Ninth Five Year Plan promises to focus on the unorganised/informal sector. There ought to be link between economic system/policy, industrialisation strategy and industrial relations policies. Comprehensive labour law reforms seem to be considered inauspicious because thrice in the past the government of the day fell soon after the introduction of a bill attempting comprehensive reforms of the archaic Labour laws. Thick laws and thin implementation often make laws a mockery and provide incentives for lawlessness. The coverage/applicability of most laws is linked to a certain threshold number. When applicability is linked to a threshold salary limit, most workers in the organised sector are not covered as they draw more salary than the one stipulated. When the applicability is linked to number employed, employers

have started reducing the numbers both in the existing and in the green field sites. In several cases, not all those employed are shown in the rosters, with many being employed on fictitious names that change every six to seven months or were informally engaged without a proper record of employment (If there is no proof of hiring, there could be no proof of firing).

Since labour is in the concurrent list of the Constitution, some state governments are taking new initiatives to woo investment (Venkata Ratnam, 1997). Orissa and West Bengal have introduced secret ballot for recognition of bargaining agent. The results have not been satisfactory because most secret ballots in these states have resulted in anti-establishment vote and litigation. Kerala has offered some sops to employers by way of policy support against industrial action and labour militancy. Rajasthan announced significant reduction in labour inspection requirements and Uttar Pradesh ordered that factory inspectors should seek prior approval of a senior ranking official in the Ministry of Labour before inspection. Minimum wages vary widely in different states and influence cross-border migration of both labour and capital. While labour seeks to move in one direction, capital is flowing in the reverse direction. If the diversity in labour policy, labour legislation and labour inspection increases among Indian states, the result will be competitive labour policies where labour interest may take the backseat for a while. The state policies thus may encourage economic growth first and social development and labour rights later.

Judicial Activism

Judicial activism, public interest litigation and consumer courts have had bath positive and negative impact on labour. Several judgements of various high courts and the Supreme Court in recent years impacted the trade union activities: (a) Maharashtra High Court levied a fine of Rs. One lakh each on some trade union leaders who were found to be engaged in arson and damage to company property in the case of industrial action in Bajaj factory. (b) Restrictions on union protest meetings in front of the office premises (banks, etc.) (c) "No work no pay" to apply to trade union leaders even if they were drawing pay for trade union work (Blue Star case). (d) Strike has to be not only legal, but also justified. (e) Ban on bandhs—a form of form of protest which disrupts civic life. The decision of Kerala High Court was upheld by the Supreme Court. (f) When there are striking workers and willing workers, necessarily there will be a law and order situation, so policy protection should be given to uphold the right of non-striking workers (TCM Ltd. Vs. District Collector and others, Kerala High Court, 1998).

Some judgements provide for legal measures where none exist in the form of legislation either at state or central level: (a) Determination of bargaining agent through secret ballot and prescription of method of conduct of secret ballot (The Supreme Court judgement in the case of Food Corporation of India). (b) Abolition of child labour system. The Ministry of Labour was ordered by the Supreme Court to conduct a survey and report within a certain time frame. The employers were asked to release the child labour for being sent to schools and pay Rs. 25,000 to each child labourer thus freed to meet the expenses of their education and maintenance. (c) Closure of firms in residential areas and aqua firms near coastal area. The Supreme Court has ordered the employers to pay upto six years' wages as compensation to employees who lose job in the process. (d) Prohibition of mining activities in forest areas so as to protect the environment. In such cases, however, the Supreme Court did not provide for any additional relief to the affected workers.

Consumer courts have been affirming the supremacy of consumer rights over labour rights. The judgements of consumer courts are restraining the trade unions from resorting to industrial action if it disrupted provision of essential/public services and asking workers and their trade unions to compensate for the loss suffered by the unions. Telecom unions in Orissa and Mathadi workers' union in Maharasthtra were asked to pay damages.

Trade unions view with relief some of the judgements in recent years. They include the following: (a) Several judgements ordering the regularisation of contract and casual labour. (b) Some judgements questioning the content of service conditions and standing orders concerning the principle of abandonment of employment, etc. (c) Maharashtra High Court judgement that introduction of voluntary retirement scheme requires prior approval of the appropriate government under the "notice of change" provisions in the Industrial Disputes Act.

Major Portents

Organized labour is beginning to distrust political parties as he latter seem to oppose "new economic policies" while in opposition and follow them then they are in power. Governments seem to have unlimited capacity to do what they do not say and say what they do not do. Desperate times often need desperate solutions. Governments acting under the pressure of debt and exchange crises are unable to sustain the avowed promises they make due to political compulsions. They can deny adherence to unpopular policies until the time

they approach the World Bank and the IMF. Once they approach the Brettonwood twins, it is no longer a secret.

Organised labour is not able to impede economic changes, particularly when dissatisfaction with public provision of public services/utilities is higher than the distrust they may have of the market forces. Economic reforms are carried out on a negative vote despite the lack of a consensus and concern about the social and economic consequences. They are damned if they do not undertake the reforms", and they are damned if they undertake them. When one is unsure, it is wise to tread cautiously—slowly, but steadily. Consistency and predictability in policies and actions are essential. Political instability and lack of popular mandate weakens the resolve—whatever direction it is—of the government. The resultant vacillation is reflected, often in pendulum politics, policies and programmes that keep swinging from right to left, left to right and so on without resting to some point.

The big question is will the government continue to "make haste slow". The Union Budget 1998-99 and the subsequent announcements of the Union Ministers for Finance and Industry seem to point out, as Hind Mazdoor Sabha (HMS Bulletin, June-July 1998) commented editorially, "Hard times are ahead for workers" in view of, among others, the following:

- Decline in budgetary support to public sector enterprises
- No provision for modernization/revival of national textile and jute mills
- Proposed closure of nine non-viable, loss making units through voluntary retirement scheme
- Up to 75% Reduction of government equity in profitable, non-strategic public sector enterprises
- 10% new accretion of provident funds to be invested in select private sector securities.

The positive point is the insertion of Section 80 JJAA providing tax incentive to employers with over 100 employees who engage new regular labour. It provides for 30 per cent aggregate wages of new workers to be deducted from the profits of the company.

Challenges Ahead

Economic reforms based on Washington consensus—prescriptions of the IMF and the World Bank—is increasingly being questioned. We need to explore more fully the Third Way, which not only India but also others (Tony Blair of U.K. for instance) have been advocating.

As regards labour, labour legislation needs to be aligned with the emerging policy shift in economic and industrialisation policies. Otherwise, the mismatch between the two can hurt both the economy and the labour. Workforce reduction in the organised sector continues unabated. Any further delay in putting in place a credible system of compensation and social security for the affected workforce can cause untold misery and result in social crisis and political unrest. The key issue is to deal with the huge problem of redundant/obsolete workforce with minimal social cost.

Economic development should be the means and human development must be the goal. Further neglect of the growing problem of unemployment, poverty and inflation and the alarming situation in respect of public provision of basic education (including employable skills training) and health for all will have counterproductive outcomes socially, politically and economically. The Asian Development Bank (ADB, 1998, pp. 187-219) asserts that without an initial skills base, no amount of new high-technology imports will lead to sustained development. Along with investment in human resources which provides the social infrastructure, the role of investment in physical infrastructure to provide energy, roads, transportation and modern telecommunication system should not be ignored (UNDP, 1998).

The conflicting demands on public policy towards social and labour issues require delicate balancing act. Flexible conditions in labour market can be created only when the transitional problems of change are taken care of. Public policy should aim at creating more jobs than are displaced within the short term. Mere emphasis on retraining and redeployment will not solve the problem. Skills retaining and social safety net efforts need to be reviewed. Simultaneously, local level initiatives for job creation should explore the linkages between hinterland resources and opportunities.

The database on labour in India is time-barred, inadequate, and unreliable. Empirical studies are rare in India. As a result assessments are impressionistic, anecdotal or based on experiences and limited to case studies which are not necessarily representative. This raises questions about the objectivity and occasionally even doubts of paralysis of analysis due to poverty of poverty data, unemployability of unemployment data and counterproductive information base on productivity etc. Much of the labour on labour statistics just produces pain but does not deliver. For a systematic and objective assessment of the link between the intent,

content and outcomes of public policy changes, we need to pay urgent attention to the creation of a timely, adequate and reliable database. In the absence of such a databased, debates on policy outcomes would become dysfunctional and obstruct political consensus and labour and social issues.

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Indian Iron and Steel Industry: Transition Under Globalisation

Abid Haleem & R.A. Khan

This paper deals with the various issues being faced by the Indian iron and steel Industry in the post liberalised environment. In the past the protected domestic steel industry has been unable to generate requisite domestic demand. The growth of Indian steel industry has been very slow in comparison to Asian and other developing countries. That have been made to find out why India has fared so poorly. The present scenario has been studied and various issues have been identified and evaluated. These issues are privatisation, international participation, technology, product type and quality, customer services, finance, pricing, ecological awareness, waste management and trade. Some major demerits of globalization have also been discussed. There is an urgent need for developing an comprehensive strategic plan for the Indian steel industry so that it can survive in the post liberalised India and make its presence global.

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Introduction

The Indian Steel Industry (8th largest producer in the world) has to face global competition and has also to meet the changing domestic demand in the post liberalised economic scenario. At a time when the industry has necessarily to go through a process of radical restructuring, it is desirable to take stock of the present of the industry, which meets about 90 per cent of the country's total requirements of steel, with imports limited to a number of sophisticated products only.

The three integrated steel plants located at Bhilai, Durgapur and Rourkela were set up in 1950's in record time, based on up-to-date technologies, and most notably without any cost overruns. The Government administered prices, which subsidised the customer in short term and stimulated demand. However, the social objective of making steel available to the government and other customers at artificially low prices had become the undoing of the Indian steel industry. During the following two decades, after the oil crises which led to the steep increase in energy cost and other inputs, the industry lost its technological edge and cost effectiveness. Subsidy stalled the creation of new capacities. As what was, produced, was being sold, no genuine effort was made to improve quality. The industry was almost fully controlled by the government (except TISCO) which provided investment for its growth and maintenance. This investment was insufficient to make desired level of investment in technology and other contexts.

After the oil crises which led to the steep increase in energy cost and other inputs, the steel industry lost its technological edge and cost effectiveness.

Government-owned iron and steel industry failed to generate new steel demand and today per capita steel consumption in India is about 23.9 kg. of crude steel per person per year, whereas the Asian average is 103.7 and the world average is 133.1 kg. (IISI, 1997).

Liberalisation is changing the national economic scenario. Indian iron and steel industry is being forced to change for its survival. The most attractive opportunity available to the iron and steel industry is the vast potential that exists for stimulating demand in the country. India has one of the biggest iron ore reserves, coal reserves, and qualified manpower. Thus, the competitive environment ushered with liberalisation of the economy is bound to affect the future course of iron and steel sector. This trend towards globalization of the steel industry is characterised by large scale privatisation, greater international participation, effective management of technology, and increased emphasis on market orientation in terms of product quality, customer standards and price (Dastur, 1993). In this paper we would try to evaluate key issues faced by the Indian steel industry in the post liberalised economic environment. This may assist the policy planners in understanding, evaluating, analysing, and evolving steel issues.

The most attractive opportunity available to the iron and steel industry is the vast potential that exists for stimulating demand in the country.

Private Participation

The pace of global liberalisation has made a large effect over the world steel industry both in output and structure. In 1987 Britain resorted to privatisation of its steel plants. This was followed by more privatisation of steel plants in Argentina, Brazil, Mexico, Europe, and South East Asia etc. In India, a beginning has been made with liberalisation of the steel sector, by removing controls on pricing and licensing. An interesting comparison of Indian steel production with that of Peoples Republic of China is depicted in Table 1.

In 1984, Chinese steel industry made a profit of $3.8 billion. In China (and in S. Korea too) the industrial reforms took place much earlier, i.e., in nineteen eighties. Steel intensity of GDP (Kg crude steel consumption per US $ at 1990 prices) for India is 0.0635 whereas People's Republic of China and Malaysia are 0.2065 and 0.1095 respectively. This indicates towards the opportunity available with the private sector has in the coming years.

Table 1: Crude Steel Production India and China a Comparison

Year	Crude Steel Production (million metric tonnes)	
	China	India
1950	0.61	1.44
1955	2.85	1.67
1960	18.66	3.42
1965	12.23	6.14
1970	17.79	6.54
1975	23.90	7.14
1980	37.12	9.81
1985	46.80	12.03
1990	63.84	14.92
1992	80.20	17.16
1993	88.70	18.50
1996	100.60	23.75
1997	107.30	23.75

Source: International Iron and Steel Institute, World Steel in Figures, IISI, Brussels (various years).

International Participation

With the liberalisation of economy, the Indian steel industry has to increase its international participation. Many small steel producers (green field and brownfield producers) may have to sell their plants to domestic or global majors as they may not have requisite technology and money. Global trade in steel is expected to be closely tied up with international joint ventures. Mergers and acquisitions through joint ventures and technology alliances are being adopted as means to obtain economies of scale.

Technology Management

To remain competitive, it is necessary to identify the right type of technology. The old and outdated technologies will have to be phased out and efficient and cost effective technologies will have to be adopted. It is the technological change that will be the driving force for this industry in the coming decade. The priorities in technology selection would depend upon (Haleem, 1996):

- Energy efficiency

- Technological compatibility with local inputs,
- Ecological friendliness,
- Quality competitiveness, and
- Cost effectiveness.
- Financial Viability.
- Government regulation.

According to a study conducted by Centre for Monitoring Indian Economy (CMIE), it is estimated that Rs. 41,000 crores will be invested in the Indian steel sector in between 1992-2002, and half of it will be in the private sector.

New steel plants are likely to bring in the latest state-of-art technology. However, with our big engineering and equipment manufacturing base it is possible to indigenise a substantial portion of the above supplies with some support from foreign technology/equipment suppliers and consultants. Table 2 provides information on where the Indian iron and steel industry stands globally in respect of technology. Thus Indian steel producers have to upgrade production processes from Open Hearth Furnaces to Basic Oxygen Furnaces or Electric Arc Furnaces. Banerjee (1993), points out that the technological obsolescence of steel plants can be singled out as the primary reason for high energy consumption in SAIL's plants. One must also keep in mind that there has been exceptionally high increase in the cost of major inputs in India (Sinha, 1993).

Table 2: Crude Steel Production Using Different Processes in Selected Countries/Groups in 1994

Country/(Group)	Processes (approximate % of production)			
	BOF	EAF	OHF	OTHERS
Former USSR	43.4	12.6	44.1	–
European Union	66.3	33.7	–	–
Eastern Europe	72.7	17.7	9.6	–
North America	58.3	41.6	–	0.1
Middle East	24.2	75.8	–	–
Asia	55.8	31.0	7.7	5.6
India	47.5	25.8	25.6	–
World Average	57.9	31.8	8.1	2.2
Asian Average	55.8	31.0	7.6	5.6

Source: IISI, Steel Statistical Yearbook 1995.
Technology Evaluation and Norms Study in Steel Sector, Government of India, Department of Scientific and Industrial Research, Sept. 1989.
BOF: Basic Oxygen Furnaces
OHF: Open Hearth Furnaces
EAF: Electric Arc Furnaces.

Product Type and Quality

India is one of the large importers of quality steel specifically cold rolled coils. It is known that quality steel production contains more value addition. Globalization would invite more players, and protection enjoyed by the domestic manufacturers would come down. Indian steel has to be qualitatively competitive. Investments have to be made along with higher technology in a particular product segment. The pursuit of quality in everything industry does viz; processes, products, services, and management should be the concern of all, from the shop floor worker to the chairman. Steel industry should try to install small/mini modern mill plants, specific in its output, targeting a certain market and making a world class product (Irani, 1992). Table 3 clearly indicates these factors.

Table 3: Crude Steel Production by Product, 1994

	Ingots (% of Total)	Cold Rolled (% of Total)	Liquid Steel in Casting (% of total)
European Union	6.1	93.2	0.7
Eastern Europe	65.8	32.7	1.5
Former USSR	70.7	24.6	4.7
North America	10.8	89.1	0.1
Middle East	–	100.0	–
Asia	27.4	70.9	1.7
India	74.9	21.6	3.4
World	26.6	73.0	1.4

Source: International Iron and Steel Institute, (1997), World Steel in Figures, IISI, Brussels.

It is known that quality steel production contains more value addition. Globalization would invite more players, and protection enjoyed by the domestic manufacturers would come down.

Customer Services

With globalization there will be more emphasis towards customer satisfaction in terms of product, quality, price, and prompt delivery. The degree of customer orientation and the scope for providing tailor-made services to the customer/consumer depends on the maturity of the steel users and market sophistication.

In the Indian steel industry, a distinct shift from production to marketing is taking place; this shift is in

terms of product quality and performance too. The world is quietly moving towards globally applicable standards for steel grades and products as also for machinery and equipment (Dastur, 1993).

Finance

Steel production requires large amount of investment and has long gestation period. However in India, financial charges are excessive with interest rates around 17 per cent while the international finances are available at 7 per cent to 10 per cent. The expert group on export of iron and steel has called upon the government to accord all priorities and facilities provided to the infrastructure sector to the steel industry too in the national interest. The removal or appropriate relaxing of the ceiling imposed on external commercial borrowings (ECB), by the export oriented units may give a fillip to this industry.

Steel Pricing

In 1994, the Indian government announced steel price decontrol and reduction in custom duties on major steel products. Thus domestic companies started competing both with themselves and with foreign suppliers. And steel industry should have long term plan and low cost strategy as a core apparatus, if a worthwhile progress is to be achieved (Jetlie, 1994). There is an urgent need for long-term steel development plan combined with national long-term plan.

In an observation made by World Steel Dynamics, the costs are of raw material, energy consumption, and labour in India in either low or at par with international standards. Contrary to popular belief, a well planned steel plant in India would be as competitive as POSCO or NUCOR. To really go global, Indian projects need relief from crippling interest burden, right from the start (Irani, 1993). Secondly, the country does not have the proper infrastructure for raw material production, output handling, and power.

The pricing of non-flat, and flat indicate a range of cross subsidisation, where considerable surplus accrues to producers in the flat range and less in the non-flat range.

Ecological Awareness

Steel production leads to a large amount of effluent production, causing environmental pollution. The steel industry in the developed countries has adopted pollution control as a policy matter. With increasing awareness among the masses, the Indian steel producers would also have to follow the same environmental norms as being followed in the developed countries. Reduction of noise, water, and air pollution means increase in the cost of production, atleast in the short run. To reduce pollution following measures are to be undertaken.

- Reduce sulphur oxides
- Reduce nitrogen oxides
- Dust control
- Improve outgoing water quality and quantity
- Reduce equipment noise
- Energy management

Waste Management

Waste is any unnecessary input or undesirable output of the system. Wastes are of different types depending upon the resource viz., material, energy, capital, manpower, services, data, and information. The global concept of waste management covers all facets of productivity improvements, resource utilisation and environmental control. In a broader perspective, waste management may be defined as the "discipline associated with the quick identification, economic reduction, storage, efficient collection, transfer and transport, optimal reuse and recycling and effective processing, and disposal of wastes in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetic, and other environmental conditions including all administrative, financial, legal, planning and engineering functions involved in the whole spectrum of solution to problem of waste". Before the implementation of any waste management program some sort of social and economic cost benefit analysis is needed. In an integrated steel plant there are large number of plant units with interdependence on each other. Each unit produces a main product, some units produce joint products and some associated waste. These products are normally used in subsequent processes or are sold in the market with or without further processing or as a last resort disposed off to nature. With the increase in production of iron and steel, and advancement of in-

Before the implementation of any waste management program some sort of social and economic cost benefit analysis is needed. In an integrated steel plant there are large number of plant units with interdependence on each other.

dustrial activity, the consciousness has slowly dawned upon mankind, that the availability of natural and other inputs are not limitless and their cost would go on increasing. Recycling of one tonne of steel scrap saves: iron ore, 1.5 tonnes; coke, 1.0 tonnes and lime stone, 0.5 tonnes and reduces: air pollution, 85 per cent; water pollution, 76 per cent and mining waste, 97 per cent.

With liberalisation, more integrated plants would ensure higher scrap recycling. Steel gets an edge over aluminium in automobile industry only because of its recyclability (International Iron and Steel Institute, 1992). Steel is the world's most recycled material whose recyclability makes it an ecologically desirable alternative from both producer's and customer's point of view.

To produce a tonne of steel, 6 tonnes of air, 3 tonnes of water, 2.5 tonnes of iron ore, coal and limestone are required to be processed. In the process they generate 9.7 tonnes of moist dust laden gases, 0.5 tonnes of effluent water and 0.4 tonnes of solid waste. Nearly all the carbon used in steel making is eventually released in the atmosphere in the form of carbon oxides. A modern steel plant typically consumes 0.8 tonnes of coal and 0.05 tonnes of injected fuel (i.e., oil, natural gas, or pulverised coal) per tonne of steel produced (Chattopadhyay, 1993).

Foreign Trade

With partial convertibility of Indian rupee, many more international steel players are expected to participate in Indian steel trading activity. Exports can become lucrative with devaluation of Indian currency and low import duties on the inputs.

With partial convertibility of Indian rupee, many more international steel players are expected to participate in Indian steel trading activity.

Import Scenario: As a result of the new trade policy, import of iron and steel items has been decanalized, and even mild steel and pig iron has been removed from negative list of imports. Duties were lowered to a maximum of 40 per cent. Reduced import duty on inputs as coke and scrap has helped manufacturers to reduce cost.

According to Professor W.T. Hogan of Fordham University of New South Wales, "India is planning to increase capacity to as much as 24 million tonnes from the current 17 million tonnes. This may be realised by end of the century. However, demand will increase so that very little of additional capacity will be available for export. India will continue to be a net importer of steel throughout the nineties".

Export Performance: Iron ore constituted approximately six per cent value of the total Indian export in 1993, and scrap steel is one of the major items imported by India. Indian steel industry's share in global market has been minyscule in the past, but now there is a distinct improvement. World steel demand is now increasing. During this period one can export. After this, the ability of the Indian producer to cut costs and deliver the desired product efficiently will decide the future of Indian exports. Table 4 provides revised projection of steel exports by ministry of steel.

Table 4: Revised Projection of Steel Export (in million tonnes)

Year	Flat Product (1)	Non Flat Product (2)	Total (1+2) (3)	Secondary Sector (4)	Manufacturing Product (5)	Total (4+5) (6)
1996-97	1.8	3.2	5.0	1.5	2.5	4.0
1997-98	1.675	1.312	2.967	–	–	–
2001-02	3.0	3.5	6.5	2.5	4.0	6.5

Source: Ministry of Steel, (1994)

Steel exports become viable, if there is an upward revision in international prices or rupee depreciates or cost of production in India gets reduced.

Product wise, India has considerable export potential in bars/rods/structure, though export of flat products does not appear to be a possibility in the near future. The export strategy of iron and steel sector has to be innovative and forward looking. Exports needs to be an integral part of the regular production planning system. A permanent presence in the international market in order to be established as a reliable supplier of quality steel is required. Regular exports cannot be accomplished by only exporting the surplus items from the domestic market (Banerjee, 1993). Instead, there is a need for export based plants, located strategically in coastal areas. These plants should use world class technology and utilise

India has considerable export potential in bars/rods/structure, though export of flat products does not appear to be a possibility in the near future.

cheap Indian inputs. Secondly, the support of policy makers is a must. The thrust of export should be on higher quality steel and it should have more value addition. Major exports have been to Indonesia, Italy, Japan, Malaysia, UK, and Nepal. There was some exports of plates to Japan and USA in 1996-97.

There are some factors that can stall iron and steel exports in the short run. First of these is, the rise in domestic demand as the country progressively lifts out of recession. Both the machine tools sector and the construction sector can exert demand for steel products. It will increasingly be upto the private players in this sector to augment capacity to meet domestic as well as export needs. Thus, if domestic market fetches good prices the producers are tempted to supply domestically. Secondly, exports might get arrested because of protectionism or economic slowdown abroad. Structural problems in the iron and steel sector are also widespread. And thirdly, while there is some point in ensuring that custom duty reduction enhances local competitiveness, simultaneous raising of excise duty appears to be contradictory.

Demerits of Globalization

Globalization may lead to the emergence of global monopolies, and in this process there is possibility of many domestic companies being swallowed up by foreign giants. Inviting foreign steel makers in the country or allowing free import of steel will definitely impart a sense of competition among the Indian steel producers. But will it always generate a healthy competition? Some of the big steel producers of USA, Japan and Europe have huge research and development facilities in their steel works. This cannot be matched in our steel plants. Indian integrated steel plants do have some facilities, but there are very small research and development facilities. With vast majority of mini steel plants this disparity is bound to produce unequal competition. But this should not deter Indian steel producers to face competition.

Secondly, unconditional foreign participation may lead to huge dividend repatriation from the country.

Thirdly, successful globalization needs macro-economic stability. In an unstable macro-economic situation, it may lead to huge loss of trade resulting from price disadvantage. (Haleem, 1996)

There may be cases of unfair trade practices, like dumping of steel products for which one has to develop a trigger mechanism.

Conclusions

The world steel industry is US $300 billion plus arena, in which there will continue to be losers and winners. If the Indian steel industry is to be a winner, it must learn to play by the new rules. The onus of globalization is now on the Indian steel producers, and the fact is if they do not take advantage now somebody else will.

There is an urgent need for developing an comprehensive strategic plan for the Indian steel Industry. This plan formulation may be based on the following issues:

- Development of a comprehensive plan for the modernisation of all existing steel plants. This plan should try to establish prescribed norms for material, labour, energy and finance.
- The effect of lowering down import and export duties and development of a trigger mechanism against dumping of iron and steel and their products.
- Development of scrap collection and recycling industry in Indian environment.
- Promotion of research and development for the development of appropriate technology. The viability of industry budgeting has to be explored.
- Effect of development of infrastructure for enhancing the long-term competitiveness of the industry.
- Low cost financing of steel plants with the help of international participation.
- Development of infrastructure would surge the demand of steel products. Liberalisation can only be successful in long term when proper infrastructure is available.

The Indian Steel Industry must adopt practices and technological discipline, that cut down internal cost, orient the product mix in tune with market demand to avoid inventory, provide total customer satisfaction with international quality product, and advise the government on the appropriate policy support it needs.

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Economic Reforms and Capacity Utilization in Indian Industry

Vijay K. Seth

The utility of capacity utilization as one of the key indicators of industrial performance stems from the fact that it is an index which is free of problems arising from varying units of measurement used in different industries and in different places. Govt. policies relating to market entry/exit, import-export regulations, incentives etc., determine to a great extent, the aggregate performance of the industrial sector. In this paper, the author explores the pattern of relationship that has been existing between the economic and industrial policies and capacity utilization in Indian industries. The author establishes that the period 1960-65 witnessed apparently high capacity utilization rates as a result of huge public investments in infrastructure, capital and intermediate goods industries as well as conducive policies, (e.g., import substitution strategy). The decline in capacity utilization rates during the late sixties and early seventies can be ascribed to fall in public investment, severe drought and wars with neighbouring countries. Poor management of public infrastructure was also a major reason. The discernible policy reorientation in the late seventies and during eighties with focus on industrial development, and in particular, consumer goods industry, led to recovery of the industrial sector. The paper points out that capacity utilization has improved after the path-breaking economic reforms got under way in 1991. However, the author concludes that while there does not exist a unique relationship between the prevalent policy regime and industrial performance, an optimal combination of policies capable of correcting some of the structural imbalances can create a favourable environment for better industrial performance.

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Introduction

The process of industrialisation during post independence in India, can be divided into four sub-periods. These sub-periods are: 1950-1965, 1966-1975, 1976-1984, and 1985 onwards. The first period is described as the period of high growth rates in industrial output and productivity covering the period dominated by Nehru-Mahalanobis strategy. However, there was a marked decelaration in growth rates during 1966-75 (Raj, 1976 and Ahluwalia, 1985). This sub-period witnessed the adoption of populist policies to achieve redistribution of gains of development through policies aimed at removal of poverty. But this slackening process had been arrested in subsequent periods and the Indian industry has indeed experienced a turnaround (Raj, 1984 and 1988 and Ahluwalia, 1988 & 1991). During this period (1975-1984), populism had been replaced by pragmatism. Since 1985, a dramatic break with the past occurred when through New Economic Policy, the process of liberalisation was initiated. The process of liberalisation got further impetus after 1991, when structural adjustment programme was adopted. This led to the debate among economists regarding the impact of liberalisation on the performance of Indian industry. Several attempts have been made to study the impact of the new policy regime which sometimes is being described as "Shift in policy paradigm" (Joshi and Little, 1994 and 1998; Srivastava, 1996 and Ahluwalia & Little, 1998).

The analysis regarding the extent and determinants of capacity utilization is intimately linked with the inter-temporal trends in the growth of industrial output. Therefore, there is a need to explore whether these phases regarding trends in industrial output clearly match with inter-temporal changes in the rates of capacity utilization. While analysing the temporal changes in the rates of capacity utilization, we will also know, how far these temporal changes are related to shifts in the policy regime or with the macro-fundamentals of the economy.

The analysis regarding the extent and determinants of capacity utilization is intimately linked with the inter-temporal trends in the growth of industrial output.

Phases of Output Growth and Capacity Utilization

The acceptance of the findings regarding trends in output growth suggests that these trends can be segmented into four distinct phases (i.e. sub-periods): (a) 1950-1965, defined as the phase of higher growth rates in industrial output accompanied by higher rates of utilization of capacity; (b) 1966-1975, defined as the period of declaration or stagnation; (c) period from 1976-1984, the period of recovery; and finally (d) period since 1985 when Indian economy has adopted a new policy regime.

To observe the efficacy of these four phases of industrialisation, empirical studies generally estimate growth rates by fitting separate exponential trend lines by ordinary least squares (OLS) method to each sub-period of the time series. An estimated single regression equation using intercept and slope dummies can be utilized to yield growth rates for different periods. When this method is applied on the time series data on real gross value added for aggregate manufacturing sector for the period 1957 to 1985-86, with two dummy variables D_1 (taking the value unity for the year 1966-67 through 1975-76 and zero otherwise) and D_2 (taking value unity for years 1976-77 through 1985-86 and zero otherwise) the estimated growth rates as given in Table 1 are obtained.

Table 1: Rates of Growth of Industrial Output

Period	Rates of Growth of Output
1956-57 to 1965-66	8.72 per cent per annum
1966-67 to 1975-76	3.43 per cent per annum
1976-77 to 1985-86	6.96 per cent per annum

Source: Goldar and Seth, 1989.

These estimates clearly show the three distinct phases of industrialisation in India. This method sometimes gives estimates which suffer from anomalies because the estimated sub-period growth rates exceed or are less than the estimated growth rates for the entire period. It has been suggested that these anomalies can be eliminated by imposing certain linear restrictions (Poirier, 1976). In the case of log linear models, such an approach yields kinked exponential functions. It has been demonstrated that these estimates provide a better analytical basis than conventional estimates. Kinked exponential models can be easily estimated with standard OLS packages.

If the series is broken at two points K_1 and K_2 to create three sub periods, the unrestricted model can be written as:

$$\text{Log } Y_t = a_1 D_1 + a_2 D_2 + a_3 D_3 + (b_1 D_1 + b_2 D_2 + b_3 D_3) t + U_t$$

The two-kinked model can be derived by imposing linear restrictions in such a fashion that the sub period trend lines meet at k_1 and k_2:

$$a_1 + b_1 K_1 = a_2 + b_2 K_2$$

$$a_2 + b_2 K_1 = a_1 + b_3 K_2$$

substituting for a_2 and a_3 we obtain the two kinked exponential model $\log Y_t = a_1 + b_1 (D_1 + D_2 K_1 + D_3 K_1) + b_2 (D_2 - D_2 K_1 - D_3 K_1 + D_3 K_2) + b_3(D_{3t} - D_3 K_2) + U_t$. The growth rate in a sub-period is obtained by OLS estimates of the coefficients of the resulting composite variables.

The advantage of the kinked exponential model is that it makes use of entire information without asymmetry, for it uses information contained in the observations falling before and after the beginning and the end points in the sub periods. Based on this, a three-kinked model was used and also because we have the entire period segmented into four sub-periods. The trends (Table 2) in the growth rates of different sub periods show the appropriateness of segmenting the entire pre-independence experience of industrialisation into four distinct phases. The inter-temporal trends in the rates of utilization of capacity in Indian industry are in accordance with these phases.

Table 2: Changes in Industrial Output

Period	Rates of Growth of Output
1956-57 to 1965-66	8.59 per cent per annum
1966-67 to 1975-76	3.33 per cent per annum
1976-77 to 1985-86	5.96 per cent per annum
1985-86 to 1993-94	7.26 per cent per annum

For measuring under-utilization of capacity, the data from the Annual Survey of Industries (ASI) were used. Five different methods for estimating capacity utilization were used, namely: (A1) Wharton School Method of Capacity Utilization (Klein and Summers,

1966), (A2) Modified Wharton Method, Variant I (Klien and Preston, 1967), (A3) Modified Wharton Measures Variant II, (B1) Minimum Capital Output Ratio Method, Variant I as used by Fortune Magazine, National Industrial Conference Board and Federal Reserve Bank of U.S.A. and (B2) Minimum Capital Output Ratio Method Variant II. These measures have been described in a greater detail elsewhere (Seth, 1986a, 1986b and 1998).

It is seen that the estimated average rates of utilization of capacity for four different sub-periods using the time series of estimates (Table 3) of capacity utilization, establish that the rates of capacity utilization exactly follow the pattern as observed in different studies regarding output growth. The best rates of capacity utilization are indicated in the period 1960-65 when one uses Wharton Measure and its variants (between 82-84 per cent) and lowest rates during 1966-75. These measures suggest that the best performance of the manufacturing sector in terms of capacity utilization is observed during 1960-65, the period dominated by the Nehru-Mahalanobis strategy. On the other hand, when one computes sub-period average rates of capacity utilization with the help of minimum capital-output ratio methods, though the temporal pattern remains the same, average rates of utilization for the period 1985-93 become higher than the average rates of capacity utilization recorded in 1960-65. Thus, liberalisation has improved rates of capacity utilization, even better than the rates recorded during the period in which Nehru Mahalanobis strategy remained dominant.

Thus, liberalisation has improved rates of capacity utilization, even better than the rates recorded during the period in which Nehru Mahalanobis strategy remained dominant.

Table 3: Average Rates of Capacity Utilization in Different Sub-Periods (Aggregate Manufacturing)

Estimates/ Methods	1960 to 1965	1965 to 1975	1976 to 1984	1985 to 1993	1960 to 1993
WM	83.12	63.20	73.71	76.60	73.19
WMV1	84.42	64.34	75.61	78.97	74.77
WMV2	82.43	62.40	73.23	76.88	72.67
C-O.V1	72.92	63.31	64.70	75.08	68.46
C-O.V2	71.17	61.59	62.87	72.87	66.67

Determinants of Variants in the Output Growth and Capacity Utilization

The analysis regarding the identification of different macro-level determinants of changes in growth of output and variation in the extent of capacity utilization emerged in response to the relative stagnation which was experienced by the Indian industry during mid 1960s and early 1970s and subsequent recovery after 1976. Several explanations have been advanced by economists through inter-sectoral linkages, demand-supply constraints, market trends etc. Furthermore, wars with China (1962) and Pakistan (1965, 1971), resulting in diversion of economic priorities, caused relative stagnation and created excess capacity situation. The economic crisis created by wars was further aggravated by four successive droughts (1965-66, 1966-67 and 1971 to 1973), which resulted in shortages of wage goods, raw materials, fall in aggregate demand and changed the inter-sectoral terms of trade in favour of agricultural sector.

The economic crisis created by wars was further aggravated by four successive droughts resulted in shortages of wages goods, raw materials, fall in aggregate demand and changed the inter sectoral terms of trade in favour of agricultural sector.

Another school of thought has hypothesised that industrial stagnation and emergence of wide-spread under-utilization of capacity was a direct outcome of faulty industrialisation strategy followed during the first three plans (1951-66) accompanied by industrial licensing, controlled foreign trade regime and administered price of foreign exchange during the period. They have argued that emphasis on the strategy of import substitution, entry barriers created through license permit raj, regulations like MRTP and FERA along with very high tariff and non tariff barriers collectively led to the under-utilization of capacity. Excess capacities were created for the purposes of capacity pre emption to create entry barriers, led to the emergence of market imperfections.

Also shortages of imported raw materials, components and capital goods imposed supply constraints on the capacity utilization coupled with reduction in foreign direct investment. Not only this higher tariff walls and overpriced Indian currency reduced the size of external market which created demand side constraint on the growth of aggregate demand (Bhagwati and Desai, 1970; Bhagwati and Srinivasan, 1975 and Bhagwati,

1994). They also suggest that the post 1976 recovery in output growth and better rates of capacity utilization can be attributed to the process of decontrols and liberalisation which began thereafter (Ahluwalia 1986 and 1991; Lucas and Papanek, 1988). This has been however, questioned by many (Nayyar, 1994).

The linkages between agriculture and industry has established that a slow growth rate in agricultural production would emerge as a constraint on the growth and utilization of industrial capacity. Agricultural output becomes a constraint because (a) it determines the supply of wage goods, surplus for investment and supply of raw materials (b) it determines the aggregate demand because farmers income constitutes a significant part of household consumption. The investment in new capacity and use of existing capacity is constrained through demand from rural sector. This strategy denied the availability of ever expanding global market for capacity creation and capacity use for Indian industry. Instead it made it depends on slow growing agricultural sector (Bhagwati, 1988, p. 28). Following this logic, the relationship between industrial stagnation experienced by the Indian economy in 1966 to 1975 and lower growth rates of agricultural output have been explained (Chakravarty, 1974 and 1989; Vaidyanathan, 1977; Raj, 1976; Rudra, 1967; Mitra, 1977; Krishna, 1982 and Rangarajan, 1982).

The linkage between agriculture and industry has established that a slow growth rate in agricultural production would emerge as a constraint on the growth and utilization of industrial capacity.

The availability of wage goods and the prices at which they are available play an important role in affecting the creation of utilization of capacity. Attempts have been made to understand the role of wage goods in affecting the performance of Indian industry with the help of analysing trends in the inter sectorial terms of trade. It is a fact that from 1951-1965 Indian economy experienced relative stability in the agricultural prices due to the availability of food aid under PL 480. The relative increases in the prices of foodgrains began after mid 1960s. It is believed it occurred due to the agricultural pricing policy and buffer stocks operations of the government (Mitra, 1977 and Chakravarty, 1979). However, a clear understanding regarding the wage good constraint requires information on (a) trends of agricultural output and marketed surplus and inter-temporal movements in inter-sectorial terms of trade.

Ahluwalia (1985), observed that there is no evidence to suggest that there was slow down in production of foodgrains in India after mid sixties. Moreover, marketed surplus grew much faster than the agricultural output. Not only this, most of the indices on terms of trade reveal that there was an upward trend in terms of trade between 1956 to 1967, the period which witnessed higher rate of industrial output and capacity utilization. Interestingly, there has been a distinct downward trend after 1967 when industry was experiencing relative stagnation. Finally, it is quite evident from the measures of capacity utilization that the rates of capacity utilization were lower in capital, basic and intermediate good industries which have higher capital intensity (and therefore, less vulnerable to wage good constraints) rather than in consumer good industries which are relatively more labour intensive and also need agricultural raw materials. Hence, agricultural sector did not play a dominant role in determining the rates of capacity utilization during the period of relative stagnation (Ahluwalia, 1985).

The availability of wage goods and the prices at which they are available play an important role in affecting the creation of utilization of capacity.

The aggregate demand also plays an important role in capacity creation and utilization in the industrial sector. The aggregate demand, according to national income accounting framework, consists of (a) private consumption, (b) government consumption, (c) private and public investment and (d) balance of trade. Some economists have been debating on relative importance of domestic markets and external market, especially on the choice of strategy between, import–substitution and export-led-growth. However, it should be noted that what matters in the biography of an economy is the aggregate size of market. It is immaterial whether aggregate markets is growing through expansion in domestic market or through increases in export (Nayyar, 1994).

What matters in the biography of an economy is the aggregate size of market. It is immaterial whether aggregate markets is growing through expansion in domestic market or through increases in export.

The size of domestic market can be expanded by increasing private consumption. This might necessitates a redistribution of income in favour of poor citizens who have higher marginal propensity to consume (MPC), or through white-good-led growth which require redistribution of income in favour of middle and higher income classes. These factors are important for the utilization of existing capacities.

It has been observed in the case of India that the demand for industrial goods has remained quite narrow. Using the data collected by National Sample Survey Organisations (NSSO), it was found that in the rural economy the richest 10 per cent of the population accounted for 32.2 per cent of the consumption of industrial goods while poorest 50 per cent of the population consumed 22 per cent of the total consumption of industrial goods. The inequalities in the consumption of industrial products were more glaring in the case of urban economy, where the top ten per cent of the population purchased 39.3 per cent and bottom 50 per cent of the population consumed only 19.9 per cent of total consumption of industrial products. The narrow base of the consumption of industrial output is not compatible with the higher rates of utilization of industrial capacity. It was also found that even this narrow base of the demand for mass industrial goods was shrinking overtime because the household expenditure on the purchase of industrial goods has been declining both in the rural and urban India (Sau, 1974).

Income inequalities have also created increasing demand for up-market products, especially consumer durables. However, the policy regime prevailing at that time did not encourage the creation of new capacities and effective utilization of existing capacities in the industries supplying up-market consumer durable. The growth in these industries had to wait until 1980s when a strategy to achieve higher rates of growth of industry based on up-market products was evolved. This strategy concentrated on the consumption needs of middle classes which had grown in size and composition (Swamy, 1994; Rao and Natarajan, 1996).

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The growth of the external market was also not impressive due to prevalence of *export pessimism* in the mindset of the policy makers which necessitated the adoption of the strategy of import-substitution for faster internalisation of modern industry. However, the policy regime which was meant to achieve rapid import substitution through higher tariff and non tariff barriers, administered pricing of foreign exchange and excessive regulations regarding foreign trade and foreign technology, on the one hand reduced the demand for Indian industrial goods in the world markets and on the other hand erected strong barriers like the wall of China, which not only prevented the inflow of goods and services but also prevented the inflow of vital foreign investment and technology. This reduced the competitiveness of Indian industries due to creation of capacities in different industries ignoring domestic resource costs. The available evidence clearly shows that the India's share in the world export declined from 1.04 per cent (1960) to 0.48 per cent (1977) (Ahluwalia, 1985, p. 117, Table 6.1).

It is due to the lack of demand support in the domestic market and declining market share of Indian industrial exports in the world market, that a strong linkage emerged between government expenditure and creation and utilization of capacity in the industrial sector. The quantum and composition of government expenditure influenced the industry through its linkages which worked on demand as well as on supply side. On the demand side this linkages operated with the help of multiplier effect of government expenditure, and on the supply side it operated through additional supply of economic and social infrastructure and capital and basic goods supplied by the public enterprises. Hence public investment *crowded out* private investment in plant and equipment on *ex ante* basis. However, in India most of the public investment has been in those lines of production where private investors were not interested to invest or were not allowed to enter.

It has been estimated that until the third five year plan, when rates of growth of industrial output and utilization of capacity were quite higher, plan outlays in real terms increased by 12.5 per cent per annum, whereas, for next decade (1965-66 to 1976-77) the real plan outlay increased by only 3.7 per cent per annum when industry experienced relative stagnation (Shetty, 1994, p. 193). Therefore, it is believed that, decline in public investment during mid sixties and early 1970s was the main reason for the industrial stagnation and wide spread under-utilization of capacity. The subsequent recovery is also attributed to the revival of public investment after 1977.

Furthermore, public investment in infrastructure capital increases marginal productivity of investment and therefore helps in *crowding in* of private investment. In the recent past several attempts have been made to study the relationship termed between public infrastructure and performance of industrial sector

(Tatom, 1991). According to this hypothesis public infrastructure directly and indirectly affects the utilization of capacity in the positive way. Directly it effects utilization because it enters as intermediate service and indirectly due to its complementary with private capital. It is now being suggested that while analysing production function for industrial sector through privately purchased inputs of capital, labour and materials, the stock of public infrastructure should also be included (Retner, 1983; Berndt and Hansson, 1991) and has been empirically tested by Aschauer (1988, 1989, 1989a) and Lyndo and Richmond (1992) for U.S.A.; Berndt and Hansson (1991) for Sweden, Diewert (1988) and Conrad and Seitz (1994) for Germany. What is new in the ongoing debate on the relationship between public infrastructure and efficiency of industrial sector is that some scholars have identified that the neglect of public infrastructure can cause slow down in productivity growth and increasing under utilization of industrial capacity. It has been observed that in the case of India the public investment in infrastructure grew at the rate of 16.7 per cent during 1960-61 to 1965-66, 21. per cent during 1965-66 to 1975-76; and 8.3 per cent per annum during 1975-76 to 1980-81 (Ahluwalia, 1985, p. 77, Table 5.2). The changes in the quantum of public investment in infrastructure clearly follows the trends in the rates of capacity utilization.

Public investment in infrastructure capital increases marginal productivity of investment and therefore helps in *crowding in* of private investment.

Most of the development economists believe that under developed economies follow Say's law of market because they are subject to supply side constraint in the form of savings for the purposes of accumulation. It is because in underdeveloped economies the basic problem is how to increase savings and to convert them into useful capital goods. As accumulation increases, income and employment also increase, true to the aphorism that "supply creates its own demand". However, the existence of excess capacity forced some of the scholars to think about demand side constraint also. Several attempts have been made to ascertain which one of the constraint is more serious in the case of Indian industry and to know whether there exists temporal changes in the relevance of these constraints (Lahiri & Roy 1986; Srinivasan, 1992, Goyal, 1992 and Rao, 1993). Lahiri and Roy, covering the period from 1960-1977, observed that for six years 1963-66, 1973 and 1976 Indian industry worked under supply side constraint regime and during other ten years (1966-72 and 1974-75) industry worked under demand side constraints (*loc cit.*, p. 254). Goyal (1992) found that supply side factors were long-term constraints on Indian industry, whereas demand side constraint was a short run phenomenon which dampened the investment demand in late 1960s and early 1970s. Rao (1993), who has specifically studied the role of demand and supply side constraints in determining the under-utilization of capacity in the Indian industry believes that supply side constraint can be a long term binding constraint if the industry fails to respond to signals. It is because, if an economy is persistently facing shortages of inputs then the industry can either find out alternative sources or evolve substitutes for the concerned input. If the industry does not respond to such constraints, it can be attributed to various institutional impediments created by government regulations. Her analysis reveals that supply side bottlenecks did not impose any long-run constraint on capacity utilization in Indian industry. However, evidence regarding capacity creation and utilization in industrial sector suggests that demand was the long-run bottleneck. A decline in the rate of growth of public investment in mid sixties and early 1970s (i.e. the period corresponding to the period of relative stagnation) and revival of public expenditure in late seventies and early eighties (leading to industry recovery) clearly establish the role of autonomous stimulus to aggregate demand (Rao, 1993).

Summary and Conclusions

The analysis given above about the macro level determinants of capacity utilization suggests that the higher rates of output growth and capacity utilization experienced during 1960-1965 can be ascribed to the massive amount of public investment made in infrastructure, capital and intermediate goods industries which provided supply as well as demand side support to the Indian industry. The adoption of the strategy of import substitution also provided demand side support to Indian industry. However, fall in public investment, droughts, shifting of terms of trade in favour of agricultural sector reduced aggregate demand and poor investment and management of public infrastructure created supply side bottlenecks. The factors together caused slowdown in industrial output and increased the rates of under utilization of capacity during mid sixties and early 1970s, despite the fact that policy regime remained the same.

After late 1970s and during 1980s revival of public investment in infrastructure and reorientation of industrial strategy in favour of up-market white goods provided conditions for the recovery of industrial sector. Since 1991, government of India has adopted the programme of structural adjustment, this programme is

attempting to reduce all kinds of institutional constraints on the supply side to achieve market flexibility. The process of deregulation and liberalisation has increased the intensity of competition. This programme has also imposed restriction on the government expenditure to reduce fiscal deficit. These changes have led to restructuring of the industrial sector. The restructuring has affected output growth as well as capacity utilization in the Indian industry from 1985-1993. The impact of liberalisation on different industries has not been uniform.

The evaluation of the role of different macroeconomic factors suggests that performance of the Indian industry in terms of capacity utilization was more related to certain macro-level structural factors rather than with the policy regime alone. This is because we observed better rates of capacity utilization during two sub-periods 1960-65 and 1985-1993 when policy regimes were totally different. During 1960-65, the Indian economy was experiencing a policy regime determined by Nehru Mahalanobis strategy which desired to achieve self-reliance through planned and regulated development process. While during 1985-93, the policy regime was reoriented towards deregulation, and outward orientation of the Indian economy. This suggests that there does not exist a unique relationship between policy regime and industrial performance. Any combination of policies which is capable of correcting some of the structural imbalances can create appropriate economic environment for better performance.

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Economic Crisis, Poverty and Social Development in Africa

Pradeep Kumar Panda

The present paper examines whether the experience of the 1980s, often called a 'lost decade' for development and especially for the poor, indicates deterioration of social conditions for the African poor. It is seen that as a result of rising poverty and economic crisis, the living conditions have either shown deterioration or reduction in the pace of change in most of the African countries in the 1980s compared with the situation in the 1970s. On the whole, there exist very great differences in socio-economic conditions between low-income and middle-income countries within Africa. In addition, African region has the lowest life expectancy, very high infant mortality and lowest primary school enrollments as compared with other regions of the world. In order to improve the social conditions, and importantly, in the context of on-going economic reforms, the planners and policy makers in Africa should create a new ethical basis to development agendas for the twenty-first century that places human participation and needs first, by redefining social objectives and strategies.

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Introduction

In the 1960s and 1970s, the socioeconomic trends in many African countries were generally positive. However, in the 1980s these trends reversed and many socioeconomic indicators turned out to be negative. Millions of people living in Africa were cut off from the mainstream of social and economic progress by a combination of harsh economic circumstances such as mounting debt, faltering growth and exports, growing unemployment, reduced productivity besides massive and acute poverty.

Why did many African countries witness severe economic crisis in the 1980s? Both internal and external factors were responsible for this crisis. First, domestic policies of many countries neglected the agricultural sector and the small scale producer (including women producers), overvalued exchange rates, weakly formulated fiscal and monetary policies (which generated high inflation rates and created imbalances between different sectors of the economy and between rural and urban areas), subsidized consumption to please the urban population and nationalized profit making enterprises (quickly converting them into loss making public institutions dependent on financially weak central governments). Second, Africa also witnessed difficult climatic and political conditions such as recurrent drought, locust attacks, chronic food shortages, rapid population growth, war and South Africa's acts of destabilisation in the case of SADCC countries. And third, African economy was affected by bad international economic and financial environment including world recession (Adeji, Rasheed and Morrison, 1990). As a result, annual growth rate of per capita GDP declined; balance of payment situation worsened; and fiscal deficit increased. The economic crisis finally led to human crisis by deteriorating the living conditions of many African countries.

In order to correct policy distortions and structural imbalances, many countries of Africa undertook sig-

nificant economic reforms and started implementing stabilization and structural adjustments suggested by the International Monetary Fund and the World Bank. However, the structural adjustment programs undertaken by the countries are controversial. Some analysts argue that the adjustment measures have deteriorated social conditions of the poor (Cornia, Jolly and Stewart, 1987). Some others noted that the developing countries which pursued adjustment measures show continuous improvements in infant and child mortality, nutritional indicators and school enrolment (Preston, 1986; Hill and Pebley, 1989).

Many countries of Africa undertook significant economic reforms and started implementing stabilization and structural adjustments suggested by the International Monetary Fund and the World Bank.

In the present paper an attempt has been made to examine to what extent the living conditions of the population in Africa deteriorated in the 1980s compared with the situation in the 1970s. The rationale of such analysis is to identify whether the experience of the 1980s, often called a 'lost decade' for development and especially for the poor, indicates deterioration of social conditions for the African poor. The data are compiled mainly from the World Bank publications. The countries of Africa have been divided into two categories i.e., low-income countries (N = 28) and middle-income countries (N = 8) according to the World Bank classification, depending on the availability of data. The analysis of socioeconomic trends is based upon the comparison of these two groups of countries during the 1970s and 1980s.

GDP and GDP Per Capita

The growth rate of total real GDP of both low-income as well as middle-income countries in Africa declined steadily during 1971-79 and 1980-87 (Table 1). The yearly growth rate of total real GDP of low-income countries dropped faster as compared to middle-income countries. The low-income countries performed worst in 1980-84 with a growth rate of only 1.2 per cent. The per capita growth rate in Africa (population-weighted average) was very low even in the 1970s, compared to different groups of countries in other regions of the world (Table 2). In the 1980s, the per capita growth rate in Africa became negative and performed very badly compared to other regions. The Asian countries showed an impressive performance with 5 per cent annual growth during 1980s and in fact, performed better than Africa, Latin America and Europe, the Middle East and North Africa. Against this background of the poorest performance of African countries in terms of both real GDP growth rate and per capita GDP growth rate, the next section deals with the trends in poverty.

Table 1: Growth Rates of Real GDP, Africa, 1971-87 (Per cent)

Year	Low-income Countries N = 28	Middle-income countries N = 8
1971-79	3.2	7.3
1980-84	1.2	5.9
1985-87	2.9	3.4
1980-87	1.9	5.0

Table 2: Growth Rates of Per Capita GDP by Region, 1971-87 (Per cent : Population-weighted average)

Year	Africa N = 37	Europe, Middle East,and North Africa N = 14	Asia N = 12	Latin America and the Caribbean N = 23
1971-79	0.7	5.2	2.5	3.6
1980-84	–2.3	1.2	5.0	–0.7
1985-87	–0.9	1.6	5.0	1.3
1980-87	–1.7	1.4	5.0	0.1

Source: World Development Report, 1990, World Bank

Poverty

The conditions of the poor in Africa are grim today. Sub-Saharan Africa, the poorest region of the world, shows a long-term decline in the incomes of the poor. According to the definition of an extreme poverty line of $275 consumption per person per year at U.S. purchasing power parity, in 1985, about 600 million people in the developing countries, including at least one in four Africans and Asians were too poor to afford enough food on a reliable basis (World Bank, 1990).

As shown in Table 3, the incidence of poverty was the worst in South Asia and Sub-Saharan Africa. The World Development Report, (1990) has projected the poverty incidence in the year 2000. Though, one should treat all these projections with caution, the results are striking and give cause for moderate optimism. Compared to other regions of the world where the incidence of poverty is likely to decline in the year 2000, Sub-Saharan Africa could suffer an increase in the numbers of the poor of 85 million between 1985 and 2000. If all

these changes occurred, Asia's share of world poverty would decline from 72 to 53 per cent, while Africa's would double from 16 to 32 per cent (Walton, 1990). Table 4 shows the increase in the number of people living below the poverty line in selected four countries of Africa from 1965 to 1988. In Egypt and Kenya, in particular, the number of people living below the povertyline during 1965-88 increased by more than 130 per cent. This shows the severity of regional differences in poverty within African countries.

Table 3: Poverty in the Developing Region, 1985 and 2000

Region	1985		2000	
	Percentage of poor in population (%)	Number of poor (millions)	Percentage of poor in population (%)	Number of poor (millions)
Sub-Saharan Africa	47	180	43.1	265
East Asia	20	280	4.0	70
South Asia	51	520	26.0	365
East Europe	8	6	7.9	5
Middle East & North Africa	31	60	22.6	60
Latin America & Caribbean	19	70	11.4	6
Total	33	1116	18.0	825

Table 4: Increase in the Number of People Living Below the Poverty Line in Selected African Countries from 1965 to 1988

Country	Number of people below the poverty line (millions) 1965	Number of people below the poverty ine (millions) 1988	Percentage increase
Egypt	3	7	133
Ghana	3	5	67
Kenya	4	10	150
Tanzania	7	12	71

Source: International Fund for Agricultural Development, 1992

The World Development Report (1990), which attempted to reassess the performance of the governments of the developing countries in terms of achieving sustained economic development and antipoverty goals, has emphasized a twin-track strategy: First, a strategy of growth-oriented policy aiming at the poor who derive most of their income from labour. And second, provision of basic social services such as education, nutrition, primary health care and family planning services to the poor. However, without some redistribution of income, assets or power, many developing countries of Africa cannot achieve desired results from such strategies. The next section deals with the analysis of trends in social indicators in the 1970s and 1980s.

Table 5: Social Indicators in the Developing Region, 1985

Region	Under-five mortality rate (per 1000)	Life Expectancy (in years)	Net primary enrolment (in per cent)
Sub-Saharan Africa	196	50	56
East Asia	96	67	96
South Asia	172	56	74
East Europe	23	69	90
Middle East & North Africa	148	61	75
Latin America & Caribbean	75	66	92
Total	121	62	83

Source: World Development Report, 1990, World Bank

Social Development

Table 5, showing the social indicators in the developing regions of the world in 1985, reveals that Sub-Saharan Africa had experienced higher child mortality rate, lower longevity and lower net primary enrolment rate, as compared to other regions of the world. Moreover, according to the projections in World Development Report, 1990, the short-term trend of slow progress in social indicators in Africa during 1980s, if it continues into the 1990s, could lead to primary enrollments in 2000 of only 46 per cent (compared with 86 per cent for long-term trend), and a child mortality rate of 153 per thousand (compared with 136). A substantial expansion of social spending levels and rehabilitation and expansion of health and education services will be required to avoid these declines. While this is possible without an acceleration in growth (as the historical experience of other countries has illustrated), both the feasibility of the required changes and the benefits to the poor would be immensely eased by a sustained recovery in Africa (Walton, 1990). The analysis and trends of individual indicators of social conditions in Africa are described below.

Life expectancy

The single most comprehensive indicator of a population's health status perhaps is life expectancy, which results from nutrition, water supply, educational attainment, sanitation and access to medical facilities.

Sen (1981) notes that as longevity increases, it becomes more of an achievement to raise it further.

A performance index developed by Kakwani (1990) is used in the present paper that gives greater weight to the performance of countries with greater life expectancy. The index is given by $K(L_0, L_1) = 100\ [Log_e(M - L_0) - Log_e (M-L_1)]$, where L_0 is the life expectancy at birth at the beginning of the period, L_1 is the life expectancy at the end of the period, and M is the maximum life expectancy that can be achieved. Thus, the index K measures the logarithmic difference between life expectancy in year 1 and that in the year 0, relative to the maximum attainable, M. We took the value of M to be eighty years. With this index, if life expectancy increases from fifty to fifty-five years (10 per cent), K = 18. A similar five-year increase from fifty-five to sixty years (9.16 per cent) gives K = 22, indicating a greater achievement. K is negative if life expectancy decreases.

Table 6: Life Expectancy at Birth for Females and Males and Performance Index, Africa, 1972-87

Year/ Indicator	Low-income countries N=28		Middle-income countries N=8	
	Females	Males	Females	Males
Actual life expectancy (years)				
1972	45.7	42.9	54.4	49.7
1977	47.5	44.7	56.3	51.6
1982	49.2	46.0	58.3	53.4
1987	51.9	48.6	60.6	55.7
Performance index				
1972-77	5.4	4.9	8.6	6.8
1977-82	5.5	3.8	9.3	7.0
1982-87	9.0	7.8	12.3	9.5

Table 6 presents the average life expectancy and performance index for females and males in Africa. It indicates that for all periods and categories of the groups of countries, females were living longer than males. In fact, in the 1980s also there has been steady progress in life expectancy both in the low-income countries and the high-income countries, although as expected, middle-income countries have higher longevity for males and females compared to the low-income countries. The data, however, shows a slightly better performance in the period 1982-87, more so in low-income countries. Even though life expectancy in Africa increased in the 1980s as compared to the 1970s, in 1991 it was fifty-one years, compared with sixty-two years for all low-income countries of the world and seventy-seven years for the industrial countries.

Table 7: Infant Mortality Rate and Performance Index, Africa 1972-87

Year/indicator	Low-income countries N=28	Middle-income countries N=8
Infant mortality rate (per thousand)		
1972	146	110
1997	133	98
1982	125	88
1987	115	80
Performance index		
1972-77	9.3	11.6
1977-82	6.2	10.8
1982-87	8.3	9.5

Table 8: Change in Child Mortality, Selected Countries of Africa, 1960-85 (Per cent)

Country	1960-65 to 1965-70	1965-70 to 1970-75	1970-75 to 1975- 80	1975-80 to 1980-85	Child mortality rate 1980-85
Egypt	–	14.3	18.3	15.3	166
Ghana	10.1	11.2	13.8	–6.7	160
Liberia	5.1	1.4	11.6	9.5	220
Mali	7.1	9.9	27.2	n.a.	n.a.
Senegal	10.0	2.5	12.0	13.2	210

Source: Hill and Pebley, 1989

n.a.. – Not available

Even though life expectancy in Africa increased in the 1980s as compared to the 1970s, in 1991 it was fifty-one years, compared to sixty-two years for all low-income countries of the world and seventy-seven years for the industrial countries.

Infant and Child Mortality

Infant mortality is a measure of the number of infants per thousand live births, who, in a given year, die before reaching their first birthday. As shown in Table 7, the infant mortality declined consistently during 1972-87 both for the low-income and high-income countries. The performance index which shows that past success makes future progress harder was computed as follows: $P(M_0, M_1) = 100[Log_e M_0 - Log_e M_1]$, where M_0 and M_1

Table 9: Immunization Coverage, Selected African Countries, 1981-84 and 1986-88

Country	Measles			Polio		
	1981-84	1986-88	Difference	1981-84	1986-88	Difference
Algeria	17	59	42	46	63	17
Botswana	75	86	11	77	84	7
Burkina Faso	94	53	–41	2	23	21
Burundi	30	47	17	6	41	35
Cameroon	47	31	–16	6	35	29
Central African Republic	19	24	5	21	20	–1
Chad	8	16	8	1	13	12
Congo	49	63	14	42	67	25
Cote d' Ivoire	28	85	57	34	71	37
Egypt	41	79	38	67	88	11
Ethiopia	8	13	5	7	7	0
Gabon	35	56	21	48	46	–2
Gambia The	70	81	11	70	65	–5
Guinea	44	9	–35	n.a.	n.a.	n.a.
Guinea-Bissau	33	43	10	14	28	14
Kenya	55	62	7	57	74	17
Lesotho	63	75	12	64	79	15
Liberia	83	37	–46	23	12	–11
Madagascar	n.a.	n.a.	n.a.	7	18	11
Malawi	64	57	–7	68	52	–16
Mali	n.a.	n.a.	n.a.	10	6	–4
Mauritania	55	66	11	21	48	27
Niger	16	19	3	5	6	1
Nigeria	20	21	1	24	16	–8
Senegal	67	60	–7	57	53	–4
Sierra Leone	23	31	8	9	16	7
Somalia	16	30	14	81	24	–57
Sudan	3	17	14	4	22	18
Tanzania	50	76	26	53	60	7
Tunisia	55	75	20	61	83	22
Uganda	10	31	21	2	25	23
Zaire	29	39	10	42	34	–8
Zambia	55	55	0	44	57	13
Zimbabwe	43	68	25	46	74	28

Source : Based on WHO data

Note: – n.a.: not available

are the infant mortality at the beginning and at the end of the period respectively. The positive (negative) value of P indicates an improvement (deterioration) in performance. As shown in Table 7, the performance index unlike that for life expectancy has indicated slightly lower performance in 1980s. Table 8 shows the change in child mortality, which is expressed as the number of children per thousand live births who die before the age

of five, in selected countries in Africa. It indicates that situation was troubling in all the five African countries. However, only Ghana showed an increase in child mortality in the period 1975-80 to 1980-85. The deep recession and two consecutive years of drought caused rising malnutrition in Ghana (United Nations, 1989; Alderman 1990). Africa's infant mortality rate in 1991 was almost 50 per cent higher than the average for all low-income countries of the world and at least ten times higher than the rate in the industrial countries (World Bank, 1993). Mortality differentials among African countries are also more striking. There is still great reason for concern in Africa where the progress in infant and child mortality is likely to be slow because of widespread deterioration in incomes and acute rise in poverty.

There is still great reason for concern in Africa where the progress in infant and child mortality is likely to be slow because of widespread deterioration in incomes and acute rise in poverty.

Immunization

The immunization coverage in the selected developing countries of Africa is presented in Table 9. It clearly shows a great cause for concern about the poor coverage of measles and polio especially in the countries such as Central African Republic, Chad, Ethiopia, Guinea, Niger, Nigeria, Sierra Leone, Somalia, Sudan and Uganda.

Table 10: Number of African Countries with Negative Rates of Growth in Per Capita Food Production, 1981-87

Year	Low-income countries N=30	Middle-income countries N=8
1981	15	1
1982	17	5
1983	22	7
1984	21	5
1985	10	2
1986	12	4
1987	26	6

Food Production

As shown in Table 10, out of the 30 low-income countries, fifteen had negative growth in per capita food production in 1981 and 26 had negative growth in 1987. During the same period, out of 8 middle-income countries, only one had negative growth rate in per capita food production in 1981 and 6 had negative growth in 1987. Table 11 gives the average per capita food production indexes. The index is set equal to 100 in 1980. In both low-income and middle-income countries, the per capita food production index in general declined from 1981 to 1987, specifically during 1983-84.

Table 11: Per Capita Food Production Index, Africa, 1980-87 (1980=100)

Year	Low-income countries N=30	Middle-income countries N=8
1981	100	111
1982	100	98
1983	96	84
1984	92	99
1985	99	97
1986	101	96
1987	95	91

Malnutrition

The degree of undernutrition and malnutrition worsened in more than one-third of the Sub-Saharan countries and improved in Asia. Malnutrition contributed to more than one-third of infant and child mortality in rural and urban districts of many African countries (McGuire and Austin, 1986). A study found that during 1980-84 the prevalence of underweight children increased in most Sub-Saharan African countries, remained the same in Latin America and decreased in Asia (Carlson and Wardlan, 1990). The protein consumption pattern of countries did not change at the aggregate level during the 1980s. Iodine deficiency is one of the indicators of micronutrients in terms of nutritional consequences. Of the estimated 800 million people at risk of iodine deficiency in the world, about 13 per cent are in Africa. Table 12 provides the percentage of undernourished population by region. Compared to other regions of the world, one-fourth of the population of Sub-Saharan Africa was undernourished both in 1969 and 1983, followed by South Asia and Central America and the Caribbean. The undernutrition data clearly suggests that per capita food production is insufficient in both low-income and middle-income countries in Africa. Moreover, the average per capita dietary energy supply worldwide reached 2,600 calories per day in 1985, but currently only 2,100 calories are available to each person every day in Sub-Saharan Africa (FAO, 1991).

Table 12: Undernourished Population by Region, 1969 and 1983 (Per cent)

Region	1969	1983
Sub-Saharan Africa	24	26
South Asia	21	17
South-east Asia	18	8
Central America and Caribbean	20	15
South America	9	8
Near East & North Africa	15	5

Table 13: Rate of Growth in Number of Children in Primary School and Net Enrolment Ratio, Africa, 1965-85

Year/Indicator	Low income countries N=28	Middle income countries N=8
Annual growth rate		
1965-75	6.5	4.9
1975-80	7.0	4.0
1980-85	3.2	3.8
Net enrolment ratio		
1965	31	67
1970	35	74
1975	41	80
1980	48	85
1985	48	92

Table 14: Student-teacher Ratio and Rate of Growth in Number of Primary School Teachers, Africa, 1965-85

Year/Indicator	Low income countries N=28	Middle income countries N=8
Number of students per teacher		
1965	45.5	43.6
1970	44.7	44.9
1975	47.3	41.3
1980	46.2	39.1
1985	43.9	39.0
Rate of growth in primary school teachers		
1965-70	5.8	4.1
1970-75	6.0	6.4
1975-80	7.5	5.3
1980-85	4.7	4.7

School Enrolment

Access to educational facilities and services reflects the population's access to human capital which help escape poverty. In Burkina Faso, Ethiopia, Guinea, Mali, Niger and Somalia, only 20-30 per cent of the children are enrolled in primary school. Table 13 shows rate of growth in number of children in primary school and net enrolment ratio in Africa. In 1980-87 the annual rate of growth in number of children in primary school has declined in both low-income and middle-income countries. But the decline was much faster in low-income countries compared with the middle-income countries during this period. However, while there has been a steady increase in net enrolment ratio in middle-income, Africa from 67 per cent to 92 per cent, from 1965 to 1985, during the same period the low-income countries of Africa have also experienced an increase in net enrolment ratio but remained stagnant between 1980 and 1985. As shown in Table 14, both number of students per teacher as well as rate of growth in primary school teachers have declined in the 1980s, compared to 1960s and 1970s. This indicates that because of the cuts in expenditure on education in many African countries in recent years, the annual growth rate of children and teachers in primary schools declined in the 1980s.

Conclusions

The recession of the 1980s undermined the social conditions of millions of people in Africa. Per capita GDP turned out to be negative and this, along with other unfavorable economic parameters, led to a rise in poverty. As a result of rising poverty and economic crisis, the living conditions have shown deterioration in the 1980s. The main findings of this paper are presented below.

1. In low-income and middle-income African countries, life expectancy at birth for both females and males continued to rise and infant and child mortality continued to drop in the 1980s. But the pace of change slowed down in the 1980s, compared with the situation in the

The recession of the 1980s undermined the social conditions of millions of people in Africa. As a result of rising poverty and economic crisis, the living conditions have shown deterioration in the 1980s.

1970s. However, in 1987, the African region had negative growth rate, the lowest life expectancy at birth and very high infant mortality rate as compared with other regions of the world.

2. Despite some improvement in nutritional status in some countries in Africa, the magnitude of nutritional problem continues to be staggering especially in Sub-Saharan Africa where the number of undernourished people showed a massive increase from 60 million at the end of the 1970s to 100 million by the mid-1980s.

3. As regards education, the net enrolment ratio of children improved in both low-income and middle-income African countries, even in 1980s. However, the reduction in the rate of growth in number of children especially in the low-income countries in the 1980s was substantial compared with the 1970s. The student- teacher ratio, a proxy for the quality of education, showed decline in both low-income as well as middle-income countries in the 1980s, compared with the 1970s. The reduction in educational parameters as discussed above is the result of the cuts in expenditure on education in many African countries in recent years. In 1987, the African region had the lowest primary school enrolment ratios among the regions of the world.

4. On the whole, there exist very great differences in socio-economic conditions between low-income countries and middle-income countries within Africa.

The deterioration of social conditions in many African countries in the 1980s leads us to believe that past development efforts and their political structures have not fully recognized individual and community needs, cultural values and capabilities as key elements in eliminating poverty. These phenomena lead one to argue that the needs of people be at the centre of development and that human development must be driven by social rather than mere economic concerns. In other words, it means critical importance of social policy for human development, i.e., setting the goals of investing in human development must be emphasized. Moreover, a degraded social policy environment is detrimental not just to human beings but to economic development, environmental integrity and global security. The testimony to this realization is the recently concluded World Summit for Social Development (1995) at Copenhagen.

The challenge of planners and policy makers in Africa is to create a new ethical basis to development agendas for the twenty-first century that places human participation and needs first, by redefining social objectives and strategies in an integrated manner. Unless this is done urgently, the on-going drastic economic adjustments might further deteriorate the living conditions and contribute to widespread human misery to be borne especially by the under-privileged and down-trodden groups such as women, children and old in most countries in Africa.

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Feature

Some Observations on Commcdity Production and Command Differential

Bhaskar Majumder

The positive volume of physical and the positive rate of growth of output within an economy may fail to ensure the objectives associated with growth. This paper tries to set these questions in the context of technological progress and dualism within a national economy in order to examine not only the technical aspects of higher production possibilities but also to examine if those possibilities can be ensured by the economic agents who propel those possibilities. The implication that follows from the analysis is that for production of commodities to succeed as a reflection of social cooperation, it has to be ensured that the participants are temporarily willing to absorb the shocks latent or revealed, for example, through technological progress. But this requires accommodating these participants in some sunrise production sector. Be it the emergence of such sunrise sector or be it formation of market that offers autonomous demand for the sector with the support of technology-led higher output, the state has to intervene to play the role of a shock absorber and as the superinstitution that engineers market.

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Introduction

The concern of economists for production-centred economic development is as old as the birth of economics as a branch of scientific analysis (Chakravarty, 1988; Hicks, 1971, p. 15-24; Hicks, 1965, p. 36-48; Kuznets, 1961, p. 13; Kuznets, 1965, p. 63, 83, 84, 105; Kerr, 1993, p. 5, 9). It is well established by now that the positive volume of physical output and the positive rate of growth of output within an economy may fail to ensure the objectives associated with growth. An attempt has been made elsewhere to focus on some of these questions (Majumder, 1998). Now a second look is necessary to set these questions in the context of technological progress and dualism within a national economy in order to examine not only the technical aspects of higher production possibilities but also to examine if those possibilities can be ensured by the productive economic agents who propel those possibilities.

In the present paper it is assumed that (1) production of a commodity is an engineering concept in the sense of converting inputs (man and matter) into output (products finally consumable by man and materials and machines for further production) as well as a sociological concept (production of commodities as a refleciton of social cooperation); (2) The mode of production is a type of 'extended family' running a small-size production unit where the controller of non-labour resources, or its French equivalent, 'entrepreneur', selects the technology. This small size remains small even with technological progress, though 'smallness' falls; (3) Real wage is a part of total output produced and is readily spent on output; (4) Economic agents optimize their objective functional (5) Government does not intervene in the production cum technological decisions of the economic agents.

Commodity Production with No Technological Change

Commodity is the sphere wherein economic categories like production, exchange, distribution and consumption take shape. Economic development is an upward movement in the structure of commodity production. Initial output is produced by an individual independent of his own choice and independent of the question of any social consensus. It is the individual compulsion which becomes a social phenomenon. The location of the individual in production space shows at the same time the location of the individual in distribution space. The latter shows the command of the individual in commodity production organised socially.

Command-differential may be interpreted as a derivation from technology-differential. One may try to explain command differential by ownership differential in natural resources. Such an attempt assumes away explanations of how the right of exclusion is conferred on a few individuals, who own the resources to the exclusion of others transform those resources. Let initial commodity production start at time point t_0 with equal access of individuals to natural resources. At time point t_0, some of these individuals will acquire more power (owning and using natural resources) to move ahead relative to others, because of application of superior technology (this technology may include application of physical force also, but essentially it is superior brain power developed via learning by doing). The superior technology leading to unequal distribution of natural resources is taken as the starting point. Though technology-differential as an explanation of command differential is vital, by no means ignore physical non-human resources and manpower whose combination gives

Command-differential may be interpreted as a derivation from technology-differential. One may try to explain command differential by ownership differential in natural resources.

technology a shape, i.e., a commodity that can be ignored. The higher is the state of technology, higher is the importance of non-labour resources (understood as lesser labour-time required for the old product being produced and not as lesser brain-intensity) and the lower is the importance of non-converted natural resources (like land in a gross sense). In fact, it is the labourer who opens up the technological options. "There is, however, a danger in taking too 'dynamic' a view of the problem of technology. Technology is certainly created by looking for it, but there also exists at any point of time a vast collection of already evolved techniques" (Sen, 1975, p. 12).

The higher is the state of technology, higher is the importance of non-labour resources (understood as lesser labour-time required for the old product being produced and not as lesser brain-intensity) and the lower is the importance of non-converted natural resources.

The commodity-technology association for the economy thus can be written as:

$$\{Q, T\} \equiv \{Q_i, T_j\} \quad (1)$$

where Q is a vector of produceable commodities and T is a vector of technologies in production of Q.

$$Q = \{Q_i\},\ i = 1, 2, ..., n$$
$$T = \{T_j\},\ j = 1, 2, ..., m \quad (2)$$

where $m \leq n$, on the assumption of non-identical technology for any two commodities.

T denotes the nature of association between human labour and non-human resources. While a conventional production function explains the movement of Q along a single product curve, T is an operator that explains the shift of the curve. T covers certain characteristics like scale of operations, nature of products etc. (Stewart, 1977, p. 2). Q and T are determined not independently but together. It is not necessary that all the economic agents will have to produce all the n produceable commodities (resource-technology specifying) at a particular period of time. They may choose to produce a subset of the whole.

Consider two individuals, A_1, and A_2, as controllers of two extended families engaged in production of two commodities, Q_1 and Q_2. The production of commodities reflects autonomous behaviour of both A_1 and A_2. One can then arrive at their respective 'command positions' and 'command-differential'.

Example 1

Economic Agents	A_1	A_2

Technology in Use	T_1	T_2
Production of Commodities	Q_1	Q_2
Self Use	Q_{11}	Q_{22}
Excess for Exchange	Q_{12}	Q_{21}
Exchanged Commodities	Q_{21}	Q_{12}
Command Position	Q_{11}, Q_{21})	(Q_{12}, Q_{22})

Let there be equivalence in exchange in terms of a numeraire, which may be any of the two commodities. So $Q_{12} \cong Q_{21}$ for interdependence and hence for exchange to occur, thus showing the existence of A_1 and A_2 in social production. The system generates the same level of output for each period with a given state of technology specific to a given commodity produced by a single economic agent. There is no category as households selling labour to firms. The economic agents are producers, employing their own labour (not hired) and non-labour resources (part of nature) accessible to them. Resource constraint is assumed away, so one gets a production system as a characterization of interdependence among the producers. These producers become consumers in a post-exchange situation (Hicks, 1971, p. 18, 20).

In a situation where commodity produced by one is required by the other, the 'relative command positions' are derived in a post- exchange situation. With repetition of T_1 by A_1 in producing Q_1 and T_2 by A_2 in producing Q_2, there does not come about any command-differential, on the assumption of maintenance of equivalence in exchange. Even if money is introduced to work only as a medium of exchange, this equivalence in exchange is not disturbed. How does command-differential come then?

Accepting $Q_{12} \cong Q_{21} > 0$, the same initial technologies are unlikely to be repeated in producing Q_1 and Q_2. If both A_1 and A_2 move technologically upward to produce more of Q_1 and Q_2, there is a chance that the equality $\lambda Q_{12} = \lambda Q_{21}, \lambda > 1$, is ensured, denoting reducing labour-time required to produce the same commodities following technological progress. However, technological progress in producing Q_1 and Q_2 by A_1 and A_2 respectively are unlikely to be equal or unlikely to move at the same rate so that non-equivalence in exchange and in command position occurs again. The point is that inter-producer technology-differential via generation of surplus or deficit output by one, relative to what is required by the other leads to the ultimate command-differential. Obviously this command differential is a post-exchange phenomenon.

Commodity Production in the Context of Technological Dualism

Technology is seen as a way of combining quantified inputs into final output of a commodity. Commodity is the domain which gives expression to technology, while human labour and man-transformed resources (like machinery and equipment) are the means by which technology is expressed. The theoretical support for such an approach is already there (Hicks, 1971, p. 294). Thus technology by itself is not quantified. What may be quantified are some of its indicators, like a particular technique of production, productivity of a particular input, expansion in production unit by size of quantified inputs and gestation period etc.

Commodity is the domain which gives expression to technology, while human labour and man-transformed resources (like machinery and equipment) are the means by which technology is expressed.

For simplicity of analysis, it is assumed that labour-time applied on nature generates machinery; labour and machinery combined smoothen the transformation of nature into output. In this process, a section of the productive people previously called labourers now will be owners of machinery or may be seen now as owners of non-labour resources in addition to being owners of labour-power. Hence social division of labour gradually accommodates two sections of producers, one as owners of labour- cum-non-labour resources and the other as owners of only labour power. As a matter of fact the initial commodity which may be a machine, shows a crystalized form of labour of both these sections of producers and nature. However, once this distinction is accepted, we can write the production function as

$$Q = f(L, K), f_L > 0, f_{LL} < 0, \quad (1)$$

and $K = K_0 > 0$ and fixed

where Q = physical volume of output

L = Labour time (hour) applied in producing Q

K = machinery and equipment.

The geometric representation of Eqn. (1) is known as the total product curve, one curve representing one state of technology and shifting curves representing

changing technologies. If a single product is considered, then technological improvement denotes improved ways of producing this product, i.e. the scale of production becomes higher which potentially offers more efficiency (Hicks, 1971, p. 109).

Suppose the initial state of technology, T_1, is known to the producer 'by doing', represented by the total product curve, Q (T_1), each point of which shows maximum possible output (Fig. 1) of the product Q, when the producer applies minimum possible labour time, L, operated on a given stock of capital K_0. If the technique of production, K/L, being tan α, then L is determined as L_0 and Q is determined as Q_0. Average product of labour (AP_L) comes to be tan β and Average product of capital (AP_K), tan γ.

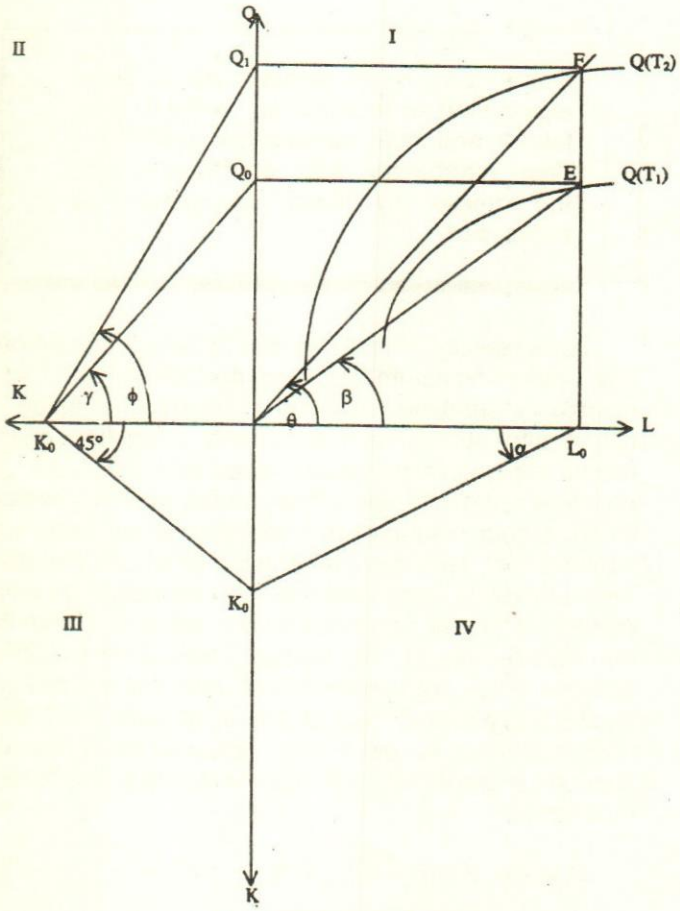

Fig. 1. Technological Change

Suppose, corresponding to a chosen technique of production, tan α, the previously employed labourers working for OL_0 labour-time invent improved methods of producing the same product, so that the total product curve shifts upward to Q (T_2), T_2 being an improved technology. This means that with same L and same K/L, Q rises from OQ_0 to OQ_1, AP_L rises from tan β to tan θ and AP_K rises from tan gamma to tan ϕ. In absence of any enhanced labour employment, it means growth-led higher command of labourers-cum-producers in production, each working for the same number of hours.

In this background, think of a situation where two individuals, A_1 and A_2, as controllers of two extended families, start producing two commodities, non-food (Q_1) and food (Q_2), each with single non-identical technology, respectively T_1 and T_2. Now suppose A_1 learns to improvise, while A_2 does not. What implications will this 'technological dualism' have on total labour employment and exit in the economy, the economy being understood as the production-cum-exchange space provided by the two extended families, controlled by A_1 and A_2 respectively?

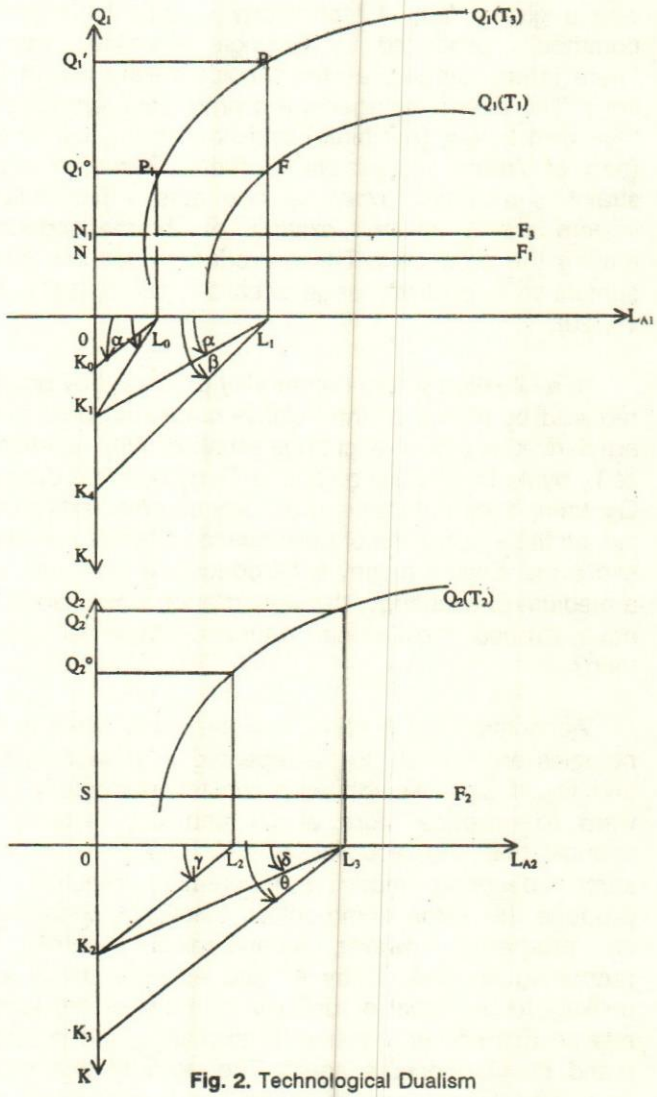

Fig. 2. Technological Dualism

In Fig. 2, the quadrants III and II implicitly show the stock of capital and AP_K, with provisions for changing K implicitly captured by shifting lines, parallely north-east or south-west. A_1 is represented in the upper panel in

Fig. 2, while in the lower panel A_2 is represented. For A_1 there is technological improvement shown by a shift in his total product curve from Q_1 (T_1) to Q_1 (T_3) while for A_2 there is continuity of the same technology shown by Q_2 (T_2). Let ON and OS be the portions of Q_1 and Q_2 required by A_1 and A_2 for internal use (used for both consumption and intermediate purposes). The lines NF_1 and SF_2 may also be interpreted as approximate real wages to support labourers inside the workshops (depreciation of capital included because it enables A_1 and A_2 to continue production as controllers).

Suppose the initial labour employment is OL_1 for A_1 (which is determined if the technique of production is known as before), producing output $OQ_1°$ of Q_1 of which surplus for exchange is $NQ_1°$. If the technique of production is not initially known, somehow chosen say reckoned as tan alpha and given capital-use, OK_1, by A_1. Suppose OL_2 is initial labour employment for A_2, with surplus $SQ_2°$. In case of no technological change, initial employment denotes initial equivalence in exchange, i.e., $NQ_1° \cong SQ_2°$ for such an economy.

Now A_1 experiences technological improvement, so that for the same labour employment OL_1, he can move to point P on $Q_1(T_3)$, capable of producing output OQ_1' and surplus NQ_1'. In the absence of introduction of money to alter the relative price between Q_1 and Q_2, the same exchange equivalence holds good, so that $Q_1°Q_1'$ is the quantity overproduced by A_1 if he is at P. Being now the technology-leader, A_1 can suppress this overproduction by moving to point P_1 on Q_1 (T_3), producing the same output, $OQ_1°$, with lesser labour, OL_0. At P_1 the production-process becomes more capital-intensive or less labour-intensive, a movement from tan α to tan β. If production of Q_1 by A_1 is characterized by fixed coefficient technology, i.e. if K/L is maintained at tanα, then corresponding to labour employment OL_0, capital-use will be OK_0, so that K_0K_1 shows underutilization of capital along with L_0L_1 showing underutilization of labour. Thus technological improvement for A_1 shows resource-saving for A_1. In other words, A_1 is in command in the economy in terms of resource-saving. But what happens to A_2 and to the economy as a whole?

Suppose A_1 sends labour, L_0L_1, to A_2 and A_2 agrees. Then labour employment in producing Q_2 becomes OL_3, so that with the same labour productivity, total output becomes OQ_2' and the new level of surplus is SQ_2' for A_2. For Q_2, capital-labour ratio falls from tanγ to tanδ when A_2 absorbs additional labour L_2L_3 ($=L_0L_1$) sent by A_1.

Since A_1 continues to produce the same level of output $OQ_1°$ and the same surplus $NQ_1°$ as was being exchanged with $SQ_2°(<SQ_2')$, so in this new situation, A_2 with static technology is a loser in exchange of commodities. This may be called 'adverse real terms of trade' for A_2. If A_1 exports capital, K_0K_1, also to A_2 so that A_2 uses OK_3 of capital, thanks to capital import equal to K_2K_3 ($= K_0K_1$) by A_2, then capital-labour ratio rises for A_2, shown by tan theta. This may lead to 'capital import-led technological progress' for A_2 and hence a chance for A_2 to move up as A_1 does.

One strategy of A_2 may be to accommodate labourers coming from A_1, so that the 'new labourers' in A_2 can raise total labour productivity, thus shifting the total product curve upward, as in A_1. In fact, labourers in A_1 were responsible for raising capital per capita, raising labour productivity as captured in technological improvement in A_1. The same via labour mobility, from A_1 to A_2, may lead to technological improvement in A_1. The same via labour mobility, from A_1 to A_2 may lead to technological improvement in A_2, which may be called 'employment-led technological progress', This process in practice is not an easy one, when (1) there may come a labour hierarchy syndrome in A_2, labourers arranged in terms of productivity-linked-wage in A_2, thus bringing about fragmented and even antagonistic production relation in A_2, (2). The labourers engaged and specialized in producing Q_1 may fail to show their higher productivity in producing Q_2 organised by A_2, (3). The labourers in A_2, because of higher real wage in A_1, may be willing to move to A_1, which is however conditional upon the particular skill required for producing Q_1.

Suppose there is no capital export from A_1 to A_2 and/or A_2 is not competent to use the type of capital exported by A_1 and/or A_2 declines to produce more via employing more labour. Then what happens to the economy? Here, A_2 continues to produce the previous level of output, $OQ_2°$, and expects to have initial equivalence in exchange or real terms of trade restored. This will be restored if A_1 with technological progress chooses to continue production at P_1 and manages labour unemployment by reducing working hours per labourer, i.e., offering more leisure without reducing real wage rate and without reducing the portion of Q_1 for internal use. It is irrational for A_1 to go back to point F, surrendering the resource-saving benefits of technological progress.

Now suppose the labourers in A_1 are not willing to have more leisure, as it may happen at a low real wage rate. This will compel A_1 to move up to point P, producing higher output OQ_1', because A_1 cannot surrender the benefits of technological progress. The quantity $Q_1°Q_1'$ now will have two channels to be utilized, if A_1 does not (and since she cannot without making her real

terms of trade adverse) export it to A_2 (and A_2 cannot buy it at the same equivalence, given that her level of output remains unchanged with the same initial technology): (1) raising real wage rate, an upward parallel shift in the line NF_1, implying higher real wage corresponding to higher labour productivity, (2) adding to the stock of capital, an implicit shift in quadrant III, parallel and south west. How far these shifts will be will depend on the relative power exercised by the controllers of capital and owners of labour-power. In Figure 2, in the upper panel, the capital stock is shown to have increased to K_4, an increase by K_1K_4, relative to the initial situation. A_1 could choose a technique of production, tan β, when he was at P_1. He will maintain that technique if he has to follow fixed coefficient technology.

Commodity Production as a Strategic Cooperation

Production of commodities in the economic system characterized by 'extended family' mode and oriented via changing technology at unequal rates for two extended families is ultimately a reflection of cooperation between various categories of workers; they are (i) people working inside each workshop run by the controllers, A_1 and A_2, (ii) people working in one workshop e.g. A_2, accommodating people from another workshop, e.g. A_1, (iii) people working inside production spaces controlled by A_1 and A_2 together, seen in cooperation on the one hand, and potential workers (job-seekers in the working age), if any, outside A_1 and A_2. While there is no job-seeker outside A_1 and A_2, there may come more job seekers from within the 'extended families extended further' by natural rate of growth of population.

Production of commodities in the economic system characterized by 'extended family' mode and oriented via changing technology at unequal rates for two extended families is ultimately a reflection of cooperation between various categories of workers.

Inside the workshop producing Q_1, there is one controller A_1 who owns non-labour resources and uses other members who own only labour power. "So long as the typical firm was only a small workshop with a handful of employees, the capital goods needed for production could usually be acquired by a single person out of his own possessions..." (Hicks, 1971, p. 109). Any cooperation between these two categories is derived from an exercise of uneven but changing bargaining power (not always conflicting) of these two categories. An immediate reflection of this exercise of relative power is an agreement on benefits (real wages or product sharing) for the respective categories. The conflict, if any, between 'labour-reward' and 'non-labour reward' is revealed inside the workshop, which may be resolved ins electing technologies of higher order by the owner of non-labour resources. Advanced technology offers the scope for higher output corresponding to higher productivity of the labourers employed. Higher productivity leads to higher wages, if the labourers do not choose to surrender higher wages for increased leisure. Higher real wages are not dissociated from higher returns to the owners of non-labour resources. The simple implication is that higher productivity-led higher output is shared by both the owners of labour and owners of non-labour resources. The increased share of the owner of non-labour resources is believed to go for addition to capital stock or capital accumulation. Unless there is a vent-for-surplus which may be thought of as a market (or autonomous demand) external for A_1 where such capital accumulation occurs, the options for expanding output with respect to technological improvement will not materialize. Thus it may lead to (1) possible exit of a section of labourers from the workshop where they are employed, (2) possible entry into another sector willing to accommodate the section of labourers thus retrenched, subject to their adaptability to the new environment, (3) raising social costs of unemployment if (2) fails. Thus, ultimately the 'required consensus' for technology-differential-led expanding production depends not only on the cooperation between the labourers and the controller inside a single workshop but on all the labourers and controllers of production units operating in the economy.

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How does the question of consensus come regarding production of commodities in an economy when the participants are willing (and unobstructed) to participate? The key lies in command-differential derived from technology-differential that shows selection and production of commodities by owners of labour and non-labour resources who try to derive highest attainable command in attainable commodity basket.

Each participant is an optimizer of his own goal. Each tries to develop higher-order technology 'by doing', thus trying to reap the benefits of higher productivity, and thus threatening some labourers to face exit in absence of at least equal improvement in understanding, doing and developing technology. Even if all the participants have the same optimization goal with a heroic assumption of 'equal access to information and resources' initially, still then intertemporal, interpersonal inequality in activities is inevitable. Since there cannot be any mechanism in any system which equalizes 'human brain' in operation, so that inequality or command-differential is a natural consequence. Unequal participation cannot bring about a 'meaningful consensus'.

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For production of selected commodities to succeed as a reflection of social cooperation, it has to be ensured that the participants are temporarily willing to absorb the shocks latent or revealed, e.g., through technological progress. But this requires accommodating these participants in some other 'sunrise' production sector. Be it the emergence of such sunrise sector or be it formation of market that offers autonomous demand for the sector with the prospect of technology led higher output, the state has to come. The state has to intervene to play the role of a shock absorber and as the super-institution that engineers market.

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Feature

Venture Capital: Issues, Options and Strategies

A.K. Mishra

Many new and untried enterprises using novel imported technologies cannot often undergo risks in capital investment. For providing them support, venture capital companies (VCCs) have been created, with the primary aim to invest their pool of resources in new and rapidly growing but high-risk industries. The present paper deals with the characteristics of VCCs in India. Although many venture capital firms have earned sizeable profits through careful investments, their operations are risk-prone and are set with uncertainties. This paper after an overview of present status of venture capital in India examines the reasons for the slow growth of venture capital in India. It also makes several suggestions relating to fiscal policy, Company Law, listing guidelines etc.

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Introduction

Technological change and development, being important ingredients of economic development, should be induced through an appropriate strategy. The encouragement of the birth and growth of high-technology small firms is a major factor on which the survival of any economy may depend. Both economists and third world governments realised quite early the key role of new high-technology industries in determining national economic success, and took measures to encourage the rate of formation of new firms and their growth. In this case, whether in relation to new or existing companies, venture capital plays a significant role.

'Venture Capital' is the term applied to investments in 'new and untried enterprises' that are 'lacking a stable record of growth'. It is capital committed, as shareholdings, for the formation and setting up of firms specializing in new ideas, or new technologies, with a large element of risk for the owners of shareholders, but with a potential for rapid growth. A venture capital firm serves as an intermediary between investors looking for high returns for their money and entrepreneurs in search of needed capital for their start ups. Most venture capitalists expect to earn a return, in five to ten years, at a rate that approximately doubles their original investment every 30 months or so. Profit is sought not from dividends, but from capital gains at the time of disinvestment. Once the venture has reached the stage of profitability the venture capitalist disinvests his own investments through available exit routes and redeploys

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the resources in new ventures. The sources of venture capital are companies whose principal purpose is to invest their pool of money in new, rapidly growing ventures, and wealthy private individuals who, either alone or together with others, invest in new businesses in the hope of earning large profits. In addition, venture capital may be supplied by banks, pension funds, trusts, corporations, life insurance companies, normally through special pools that allocate a small percentage of their total investments for this purpose (usually less than 10 per cent).

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Growth of Venture Capital

Global Growth

The concept of venture capital is not new. The discovery of America, the English merchant ventures and many of the Italian city states were based on the venture capital principles. However, after World War II, the business was institutionalised and several of the pioneering investment firms helped start a new era for business. The venture capital industry represents an attempt to institutionalize entrepreneurship, particularly those associated with innovation (but not restricted to technical innovation). But the concept of venture capital as an industry originated in the USA. This surge in enthusiasm for venture capital gathered pace and has been developing spectacularly world-wide since the second half of the seventies. Many governments are experimenting with this US inspired investment discipline as a means to stimulate the fledging enterprises, which they see as so vital to their nation's economic growth. U.K. occupies the second place after US in terms of investment in venture capital. Several OECD countries also have designed and implemented measures to promote venture capitalism. Growth of venture capital in USA, UK and other developing countries is primarily due to rapid growth and extensive potential and commercialization of science and technology. The emergence of unlisted securities market in these countries has further enhanced the scope of venture capital. These opportunities lured the venture capital institutions to invest in high-tech projects under conditions of extreme uncertainty, as those projects were otherwise neglected by the traditional financing institutions.

Initiatives in India

Arrival of venture capital in Indian capital market, though belated, is a welcome development. The concept was adopted in India, after realising the difficulties faced by new entrepreneurs with viable projects, to raise funds from the capital market. The formalised venture capital took its roots when the guidelines on venture capital were issued on 18th Nov. 1988. However, Indian tradition of venture capital can be traced back to more than 150 years, when many of the managing agency houses acted as venture capitalists providing both finance and management skills to riskier projects. The Tata Group's Investment Corporation of India successfully promoted a number of enterprises, like Associated Bearings, Ceat Tyres, National Rayon, and Indian Organisers, during pre-independence period.

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Policy Framework

In the post-independence period the necessity of venture capital institutions was first echoed in 1973 by R.S. Bhatt Committee which recommended formation of Rs. 100 crore venture capital fund. The seventh five year plan (1985-90), approved on November 9, 1985, emphasized the need for developing a system of funding venture capital. Government levied a cess of 5 per cent on imports in May 1986 for launching venture fund. The long-term fiscal policy, announced by the government on the 19th December 1986, emphasised the need for venture capital. It proposed the setting up of a venture capital fund (VCF) with an initial capital of Rs. 10 crore to provide equity capital for pilot plants. Technology Policy Implementation Committee and United Nations Development Programme (UNDP) in 1987, at the behest of the government examined the possibility of developing venture capital in private sector. The budget of 1988-89 gave concessional treatment for capital gains made by VCC/VCF. Formalised venture capital took roots when venture capital guidelines were issued by CCI in November 1988. The guidelines were further relaxed and new set of draft guidelines were issued in 1996. However, institutionalisation of venture capital, as required by guidelines, occurred even before latter were issued. At present twelve institutions in public and private sector have floated their VCCs/VCFs. Risk capital and Technology Finance Corporation (RCTFC), a

subsidiary of Industrial Finance Corporation of India (IFCI), has been one of the earliest in the business. It has also launched a Rs. 50 crore VCF along with UTI. The Industrial Development Bank of India (IDBI) finances innovative projects through an in-house venture capital division, though it does not have a separate company for this purpose. The Industrial Credit and Investment Corporation of India (ICICI) has floated the Technology Development and Information Company of India (TDICI) in 1988, with a corpus of Rs. 10 crore, jointly provided by ICICI and UTI, for providing finance to commercial and market-oriented ventures in form of venture capital. Among public sector banks, SBI Capital Markets (the merchant banking subsidiary of the State Bank) and Canara Bank subsidiary, Can Bank Financial Services, promoted venture capital funds with corpus of Rs. 10 crore each.

In India, the size of venture capital funds through extending equity assistance to industry appears to be small. The capital limits set for availing of finance in most of the schemes in India are also quite low. Certainly, venture capital investments in India have yet to be increased in tune with total requirements. Risk bearing professionalism is visible only as an exception in many VCCs, as suggested by their preference towards established companies. Currently, some of the VCCs indulge in so called venture financing by investing in the equity of the companies whose projects qualify for other conventional means of financing, such as direct equity subscriptions and underwriting facilities from the existing institutional set up. India Investment Fund of Grindlays is a good example where, unfortunately, venture capital is being used to fund projects of well established companies with a proven track record. Direct subscription of equity in new companies, which may or may not involve any new technology, or other such related risks, as being done by Grindlays, can only be regarded as venture capital activity in traditional sense.

Risk bearing professionalism is visible only as an exception in many VCCs, as suggested by their preference towards established companies.

In India, although VCCs generally seek board representation as part of their financial package, they are reluctant to involve outsiders in the business. Further, their hands-on approach seems to limit the scope of this innovative mode of financing. It would be better for VCCs to adopt commercial level of involvement achieved through 'eyes-on' but 'hands-off' approach so as to provide an easy way out of disinvestment. This is because, contrary to opinions of Indian VCCs, a venture capitalist running a portfolio of investments can rarely contribute more than strategic development advice to the management team.

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Debt support including conditional loan is often provided rather than equity – a negation of the very concept of venture capital. However, this limited support through equity is attributed due to restrictions imposed by Companies Act, Income Tax Act and Venture Capital guidelines. There is not much of involvement of private sector due to restrictive nature of guidelines. With both public and private sector companies operating in this field, a clear dichotomy of approach has emerged in this industry. Private sector is more clearly drawn by emerging business opportunities rather than urge to perform the developmental role. Mechanism for co-financing is largely absent due to conservative attitude and small size of assisted projects. Emphasis on technological aspects by previous guidelines had severely limited the very scope of venture capital financing.

Moreover, traditional conservatism of VCCs has made their due diligence process far more selective than required. VCCs in India are extremely selective in making investments. India Investment Fund, for example, though a risk capital fund, has been cherry picking in spite of having good deal flow of projects. According to an estimate, they have come across 120 investment opportunities and only one of every six of these has been sanctioned. They fail to recognise that normal criteria of debt equity ratio and existence of security are not the criteria for evaluating venture capital projects. So a lot of changes in attitudes are called for. In India, no doubt, it has been estimated that only few projects promise good returns for venture capitalists and, hence, due diligence process is required on part of investors. There is a growing awareness among institutions that venture capital investing is a discipline and involves certain steps. However, internal venturing programme is a neglected area in India. Organisational uses of project appraisal are very limited and lack well-defined norms and criteria against which a project is sought to be appraised. Most venture capitalists evaluate the project's risk in isolation, rather in terms of its effect on total risk of fund's portfolio of investments. Thus, adoption of a proper internal venturing programme by VCCs for evaluating potential portfolio

investments is very much required, so as to eliminate risk and increase profit prospects. However, being a nascent industry, venture capital in India's under pressure to take up projects quickly and prove itself. There are many operational hurdles which hinder the progress of this industry. Many hurdles and fiscal constrains will have to be removed to unleash professionalism in the venture capital activities of the financial institutions.

Adoption of a proper internal venturing prog-ramme by VCCs for evaluating potential portfolio investments is required, so as to eliminate risk and increase profit prospects.

With both public and private sector companies now offering venture funds, a clear dichotomy of approach has emerged in the industry. While the public financial institutions play a developmental role, the recent private entrants are obviously profit oriented. They are more clearly drawn by emerging business opportunities rather than developmental aspects. The expectation of investment of 75 per cent for venture funds in well-defined venture activities, as stipulated by the guidelines, appears to be too tall an order and may not be conducive to viable growth of venture capital industry. In view of the guidelines, the venture capital financing activity in India has largely been technology oriented. RCTF, ICICI and IDBI bear technological risks which draws a clear line of distinction between western VCFs and their Indian counterparts. IDBI assists only those projects whose technological base is still untested, unlike in the west where the risk borne by the venture capitalists is primarily financial. RCTF also assists industries to develop commercial R&D and prove a new technology rather than fund proven technology. TDICI also does not finance proven technology in the normal course and tries to develop technology through the commercialisation of R&D. In fact this has limited the very scope of venture capital financing under current circumstances. It must be emphasised that venture investment need not necessarily be confined to hi-tech areas. Products employing locally available raw materials which presently have no economic value could offer significant investment opportunities.

Stage Funded Venture Capital

Venture capitalists generally fund those emerging companies whose starting or continued expansion is circumscribed by finance. Such capital support may take various forms at the different stages of the project. In contrast to most other financing mechanisms for companies, it is observed that a positive relationship exists between the stage of company's development and both the total and average value of the venture investment. Finance by venture capitalists is made available both for early and later stage of company's development. However, the preference of venture capitalists for various kinds of venture capital investments differ. Venture capitalists specialise in one or more stages, but rarely all, due to varying degrees of risk involved. Often, venture capitalists specify their investment specialisation and their participation limits including upper and lower limit in the portfolio firm. The common element in the selection of the investments is the unrecognised potential in some crucial aspect of a firm's business. Seed capital is provided for pre-start-up and the start-up capital is provided for business launch. First and second round capital is used for full scale manufacturing and further business growth. The later stage finance includes expansion capital for accelerating growth, replacement capital for allowing sale of shares and bridge financing for planned exit. Besides these, turn arounds, buy-outs and buy-ins may also be other forms of venture capital financing.

Venture capitalists in India primarily provide finance for start-up, expansion and turn-around. However, experience in other countries indicates that it would be more prudent to adopt a judicious mix of start-up/first stage financing with expansion financing in well-established businesses. The analysis also suggests that management buy-outs (MBOs) have been rare and form a negligible part in the schemes of Indian venture capital funds. However, it may be reckoned unequivocally that MBOs offer sizeable opportunities for deal flow. There are quite a number of groups who would be interested in getting ready cash by spinning off their not-so-profitable divisions/units into separate companies. In fact, many developing countries have shifted their emphasis from early/start-up financing to management buy-outs. It would, of course, be necessary to make a careful study and identify such opportunities in India too.

Experience in other countries indicates that it would be more prudent to adopt a judicious mix of start-up/first stage financing with expansion financing in well-established businesses.

Major Trends

During the last ten years investment of more than 500 crore in 472 companies has been made by these

VCCs. A large percentage of venture capital has been deployed in emerging hi-tech areas which offer faster opportunities of growth/diversification, or which ensure lucrative and faster returns. However, many businesses in non-manufacturing and non-technology sectors have also received capital support. It appears that these institutions can tailor their investments, yet allocate funds to increase returns on investment. Most institutions offer similar financing instruments with equity subscription, conditional loans (i.e. the quasi-equity mechanism to fill the gap between equity and project cost) and normal term loans.

Disinvestments of Venture Capital

The foremost objective of a venture capitalist is to eventually retrieve majority of his investments from the project in the form of capital gains realised through one or another exit mechanisms, such as corporate sale, buy back, stock market listing and OTC quote. SEBI while drafting the guidelines no doubt has taken the pragmatic approach that will greatly improve the prospect of venture capital in India. However, the issue of exit remains to be addressed and the provisions made so far are inadequate and can hardly fulfill the expectation of the industry. In fact the venture capital association has come out strongly against the guidelines proposed by SEBI. The guidelines permit exit only through general offer of sale by VCC/VCF. The listing guidelines, which require 60 per cent of public issue for public at large, would put promoters' interest at stake in case of VCC. There has to be institutional changes which offer venture capitalists the opportunity to off-load their investment. Disinvestment avenues have to be positively encouraged and in this both the government and the securities market have a positive role to play. The effectiveness of OTCEI as an exit vehicle remains to be established yet. This exit mechanism can only yield fruitful result if the VCFs that are the members of OTCEI are allowed to sponsor their own investee companies on the OTCEI. The presence of institutional investors and mutual funds could make this market active in the future. Moreover, buy-back arrangements at pre-determined prices could be created by the assisted companies. Thus far except a few, no venture fund in India has divested its holdings. From an economic stand point the current practice to redeem the hybridized debt through a cash pay out and entering into a buy back arrangement with the promoters is not the optimum route. Acquisition of companies again is likely to take a few years to emerge as an acceptable route in view of the current entrepreneurial ethos in the country. This can only be viewed as a healthy exit mechanism when the financing of buy-outs or take-over of sick companies is included in the definition. SEBI should allow trade sale of stock holding to third party that is very common in other countries.

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From an economic stand point the current practice to redeem the hybridized debt through a cash pay out and entering into a buy back arrangement with the promoters is not the optimum route.

Suggestions

The foregoing conclusions demonstrate the importance of VCCs/VCFs in the development of the country's economy. Congenial environment and favourable government policy initiatives have rendered the task of VCCs/VCFs much smooth, to provide a new fillip to India's industrialization by harnessing the entrepreneurial skill of its technological and professional personnel. Not only is the government very positive to implement this concept, but it has also received enthusiastic support from both the financial institutions and the private sector.

However, there is a dire need to deliberate at length, various issues connected with VCCs/VCFs, for better comprehension of prospects and problems. Certain modifications have to be made in existing laws for enabling government, financial institutions and banks to create an environment that may give impetus to the growth of venture capital in India. The recommendations suggested below are intended to facilitate such an action programme.

Fiscal Measures

Tax incentives and legislative support play an active role in nurturing the growth of any financing scheme. The resources may exist but adequate fiscal incentives and concessions must either be created or, if they already exist, be highlighted and improved. This would help VCCs in raising resources from the investing public and in earning an attractive returns from the investment made in promoted ventures. Existing tax laws, as also the new venture capital guidelines, weigh heavily

Existing tax laws, as also the new venture capital guidelines, weigh heavily against the emergence of venture capital.

against the emergence of venture capital. The specific fundamental amendments needed in tax structure are as under:

Deductions under Section 80cc, which has been abolished in the budget of 1992-93, should be included with certain amendments and should be extended to public investing in VCCs and VCCs investing in a recipient company. The relief should be given without the ceiling of Rs. 20,000 provided earlier under this section. The benefit could be extended, apart from public issue, to shares acquired by private placement directly from the venture capital company. A minimum qualifying percentage may be prescribed to prevent misuse. Section 80cc benefits on the pattern of '*Equity Linked Saving Scheme*' should be allowed. The tax in the present tax structure is levied at three stages, i.e., at the level of the recipient venture, then at the level of VCCs/VCFs and finally at the hand of contributors. Relief should be provided to avoid triple taxation. For this the relief under *Section 80m* should be further liberalised.

Recurring returns in the form of dividend and interest is subject to tax under sections 193 and 194 of Income Tax Act. Tax deduction at source on dividend income would be 21.5 per cent if dividend is payable to a domestic company and 25 per cent if payable to non-domestic company. Exempting the dividend, interest and royality income received by VCFs from taxes or taxing them at 50 per cent of the normal rate on lines of Section 88 hhc, would bring taxation on these incomes more or less in line with the concessional tax treatment of realised capital gains. This would also encourage the corporate bodies to invest in VCCs and help entry of large private sector corporations to establish venture capital divisions. On account of the inherent uncertainties and risks involved in the venture capital financing, the losses of VCCs should be treated as business losses and should be allowed to be carried forward for at least five years, assuming that the venture capitalist will off- load his holding after five years. Normally business losses are allowed to be carried for eight years and are adjustable only against the capital gains of subsequent years. The losses of VCCs needs to be allowed to be set off against the profit of operations on VCFs. Moreover, provisions of Section 115j should not be applied.

Tax policies need to be carefully scrutinised, so as to provide for special incentives for risks the investors undertake while investing in the equity shares of new firms. The present tax system does not differentiate the income earned on risky investments from that on risk-free investments. The tax system should offer concessions for compensating the non-receipt of dividends from new firms during their gestation period. There should not be any discriminatory treatment between the VCCs/Trusts promoted by central financial institutions and those promoted by state level institutions. Mutual funds floated by public sector financial institutions and banks are exempted from Income Tax Act, which should also be made applicable to funds floated by SIDCs.

With a view to strengthen the reserve base of such companies, as also to provide a tax shelter, VCCs should be permitted to transfer a certain percentage of profits to Special Reserve Funds as allowable item of expenditure and such transfers could qualify for deductions in computation of tax liability. This is because, on account of the inherent uncertainties and risks involved in venture capital financing, VCCs/VCFs may not be able to achieve consistent profits each year.

Capital gains law is another hurdle to the success of venture financing. Since the earnings of these funds depend primarily on the appreciation in stock values, they cannot hope to succeed unless the tax laws are amended. The benefit of capital gains, under Section 48 of the Act, is not significant, in view of the fact that the question of capital gains may arise only after 3 to 4 years of investment and that the projects, being in newer/risky areas, may not even succeed.

Company Law Modifications

A comprehensive revision of the Indian Companies Act must be done to sweep away many of the restrictive provisions.

Section 77 of Companies Act prohibits a company from buying its own shares. In a venture funding, when the venture capitalists desire to liquidate their investments, the company may have to buy its own shares, in case there are no buyers for shares, at the stage of disinvestment, so as to ensure compensation to the venture capitalists. Suitable amendments must be therefore made to permit assisted companies to buy their own shares. According to Section 372, investment in a single company shall not exceed 10 per cent of the paid-up capital of a company. Also the aggregate of the investments made in the companies of the same group should not exceed 20 per cent of the capital of the investing company.

Section 370 (inter corporate loans), Sections 269, 309 and 387 (Restrictions on the remuneration of Managing Directors, Directors and Managers) could be suitably amended to enable rewarding managerial personnel in the form of equity shares—the 'sweat equity' as it is popularly known—in addition to their remuneration. VCFs/VCCs in order to ensure hands-on management have to nominate directors on the board. These nominee directors should get the protection under provident fund, E.S.I. Act, etc. and not to be treated as 'officers in default', as defined under Companies Act, 1956.

Section 432 states that if a public limited company invests in a private limited company to an extent of more than 25 per cent in equity, the private company will be treated as public limited company. Such a regulation brings about a restriction on the extent of investments by a public limited company. As a result of this, public—turned—private company would attract each and every regulatory provision of the company law. Due to this, promoters are required to bring in more capital, which is difficult in new/risky projects. The rules and regulations in respect of mergers and acquisitions should be made easy to facilitate take-over by large established companies with expertise in marketing of new products.

Registration of shares by the company in essential and company law can be amended to provide no bar for indicating the minimum buy-back price. Special statutes empowering VCCs to change the management should be contemplated.

There are many small/medium entrepreneurs who have built up their company's reserves by ploughing back of all their earnings, without even declaring dividends. Issue of bonus shares, in such cases, should become possible, even without a dividend track record, if there is an evidence of the plough-back of profits generated. This will help existing promoters to increase their shareholding and become eligible for more venture capital support than if otherwise.

Many entrepreneurs are sceptical of outside investors. They find it difficult to believe that they can get money without being taken over and losing control. They are faced with a problem whether they should trust public sector VCCs more than private sector ones or otherwise. This problem can partly be solved by giving an adequate number of shares to the entrepreneur in the company to ensure that they are not out-voted.

Guideline Modifications

The new guidelines on venture capital talk about VCCs to register with SEBI, and to have two tier structure with freedom to invest in sick and unlisted companies. They can raise equity from domestic market and foreign institutional investors. Eighty per cent of the corpus has to be invested within three years in equity or equity related instruments. Offer of sale can be made by them in any of the recognised stock exchanges or to the promoters.

Many entrepreneurs are sceptical of outside investors. They find it difficult to believe that they can get money without being taken over and losing control.

The Guidelines though relaxed from earlier ones still suffer from many lacunae. Registration with SEBI will no doubt prevent unfair practises but it will subject the books to inspection. This has been really objected to by many venture capitalists. They argue that VCFs Investors are institutions and since retail investors are not involved, there is no need to disclose the records to SEBI. It is therefore required that SEBI should act as a watchdog and not blood hound. Proposal of two tier structure will provide flexibility to VCFs to set up either as a trust or company. Trust structure is suitable in case of winding up as VCFs have definite life. It also becomes easy to distribute income to investors as trusts by making VCFs immune towards operations by segregating management and ownership. However, revamping of structure will require additional expenditure which Indian VCFs may not be able to afford due to their small corpus. Further, such a structure is best suited for mutual funds and need not be replicated for VCFs as institutional investors are involved. World over, VCFs have single layered entity serving both as trustees and Asset Management Company. Hence, the guidelines should not carry the requirement of two tier structure.

Investing in sick units though an accepted form of venture capital technical and managerial expertise, it is unremunerative for Indian VCCs as each investment is limited to 5 per cent of total corpus. To encourage this activity it is desired that the investment limit should be increased to at least 10 per cent.

Organisational Aspects

VCCs should be able to take decisions, give quick decision, identify and appraise projects quickly, provide good management assistance and systematically monitor the projects in hand. They must take steps to give proper training to their personnel to develop a new cadre of professionals, with expertise in emerging high

technologies for assisting entrepreneurs. Executives from various industries should be educated about the salient features and utilities of venture financing schemes as distinct from other investments.

In venture capital business, investor-management relationship is critically important for the success of venture capital assisted companies. Understanding this partnership is the first necessity for prospective entrepreneurs. Very often, there is a credibility gap between the investor and the entrepreneur. By the very nature of venture financing, the financier needs to be an integral part of the venture, rather than a passive investor, and has to have an active say in management (which is often achieved by his large stake). This may not suit the family-and-friend sector of Indian management and may act as an initial psychological barrier in the progress of venture financing in India. However, this barrier will have to be overcome for rapid growth of the business. Venture capital can succeed only if it is based on mutual confidence and clear appreciation of the partnership role. If a successful relationship is established in venture capital organisation, the reward of partnership will be highly profitable for both the venture capital investor and the promoter of the project. Entrepreneurs should be assured that the venture capitalist would retire as and when the project is commercialised and becomes profitable.

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A very high degree of standard is required, to establish, maintain and scrutinise the projects for their commercial viability. Our educational system is not capable enough to match laboratory research with its commercial application. A suitable appraisal method, hence, should be developed by VCCs for assessing risk and commercial viability of the technological projects in Indian conditions. This would require close subjective coordination, rather than objective judgement, between VCCs and Research and Educational Institutions.

Venture capitalists themselves should take up the task of promoting entrepreneurs. They should identify business opportunities, develop business plans and match them with the prospective entrepreneur who is in a position to avail of these opportunities. An agency must be established to bring together the venture capitalist and the entrepreneur.

In the Indian context, VCCs/VCFs could try to identify U.S./European/Japanese manufacturers of products and arrange a match between them and other smaller Indian firms engaged in an allied line of manufacture. When established companies in the public/private sector launch a programme of expansion/diversification, they are often in need of vendors for supply of products and components. While the big projects might be assisted by way of long-term finance/working capital by financial institutions/commercial banks, the venture capital arms of these could interact with these and prepare a programme of ancillarisation. The smaller ancillary firms could then be potential candidates for venture capital. The institutions should treat 'conditional loans' as equity for reckoning debt-equity ratio. Conditional loans recovery is based on payment of royalty on sales. Institutions should not specify conditions, which makes it obligatory for the investee company to seek permission to pay such royalty. Similarly, there need not be any restriction placed by the financing institutions for assisted companies to offer their shares in the market or sell to the promoter.

Capital Issue Modifications

The listing guidelines provide that at least 60 per cent of the issued capital (with exceptions) should be offered to public. This rule should be relaxed for venture capital assisted company. These companies should be permitted to offer 20 to 25 per cent of the issue to the public and the balance to the promoters. This will ensure easy disinvestment for the venture capitalists and, at the same time, help the entrepreneur to retain control in the venture.

In the matter of listing, venture capital promoted companies, which normally begin as private limited companies and have generally less than Rs. 3.00 crore capital, should be allowed to be automatically listed in the stock exchanges, once these units reach the dividend paying stage. However, conditions must be set that there will have to be a public issue of, say, of 20 per cent to 30 per cent, after a specific period of time.

Other Measures

To nurture the growth of venture capital on sound and professional lines, there is need for promotion of indigenous technology development, technology transfer and absorption, including professional tests and evaluation methods and equipments. The liberalised policy of government on imports has virtually put technology imports on the OGL list; this inhibits indigenous technology development. The non-availability of proper support system required for successful commercialisation, as also other support services required for tech-

nocrat entrepreneurs and protection of indigenous technology against repetitive and inappropriate technology import are also some of the major constraints. Active measures should be undertaken to remove these constraints. It would be far better to allow OGL imports of only design and drawing so that indigenous development gets a fillip. The policy should be modified soon and import of total technology should be permitted only in exceptional cases. These initiatives would pave the way for the systematic development of technology venture financing in India.

Periodical preparation of an illustrative list of hi-tech companies by government (e.g. bio-technology, semiconductors, solar energy, energy saving and non-conventional energy) which would qualify for the fiscal and financial concessions allowed to venture capital will contribute to growth of this concept. The state governments should create an equity fund to strengthen the equity base of small industries, in addition to the ongoing venture capital fund, with corpus of Rs. 250 million to Rs. 1000 million in every state, depending upon the size and the individual requirements of states.

As in the U.S., the functions of venture investment for small firms should be undertaken by the matured and proven agencies in the private and public sector. For instance, the experienced private investment companies and underwriters may assume this specialized responsibility. Industrially advanced states in India could launch specialized venture capital organisations to assist small industries.

Concluding Remarks

A separate national VCF, covering all the aspects of venture capital financing and offering a comprehensive package of technical, commercial, managerial and financial assistance and services to entrepreneurs, along with offering innovative solutions to the varied problems faced by them in the business promotion, technology transfer and innovation, must be established. The fund should have active contribution from financial institutions and banks, so as to have massive financial resources at its disposal, for promotion of viable new businesses in India, to take advantage of the oncoming high-technology revolution and pave the way for the setting up of high-growth industries.

In view of the on-going process of technological upgradation in Indian industry and emergence of high-technology industries, there is considerable scope for technology-related risk finance. Public apathy towards the present policy of permitting completely new companies to make public offer of their shares and getting themselves listed on stock exchange has further evolved the need of risk finance. Institutionalisation of finance for such opportunities and ventures in the form of venture capital has no doubt accelerated this process. However, it is evident that there are bottlenecks which have to be overcome before venture financing can be set up on a firm footing in India. The present constraints are mostly environmental and could be eliminated through policy measures. The government with a view to encourage venture capital has taken certain steps such as announcement of guidelines and OTC market. It is now essential for government and VCCs to review and resolve the issues that could come in the way of growth of this industry on sound and professional lines. If the operational hurdles that at present hinder progress of the industry are removed, venture capital could become more than a mere buzz world. The suggestions outlined above are indicative and not exhaustive in nature. They could help venture financing schemes to become an attractive proposition and also inspire the private sector VCCs to evolve innovative technology schemes and translate them into viable returns. All this can go a long way in harnessing the entrepreneurial skill of India, pushing it in the right direction and raising it to new technological heights.

If the operational hurdles that at present hinder progress of the industry are removed, venture capital could become more than a mere buzz world.

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Feature

Applying Verdoorn's Law to Indian Small Scale Sector

Hina Sidhu

The trends in total factor productivity (TFP) are generally assigned greater importance in the context of industrial growth particularly in the developing countries. While factor productivity across industries have been reviewed extensively, there are very few studies investigating the variation in productivity growth vis-à-vis its determinants. In the present study, different sets of data (time series and cross section) reveal mixed evidence about the application of Verdoorn's law to the SSI sector in India. Time series analysis carried out for the 1973-93 period indicates that the Verdoorn's law is applicable to the SSI sector for the period 1981-93 whereas it is not applicable for the period 1973-81. Cross-section analysis of statewise data supports the application of Verdoorn's law to the SSI sector only when the investigation takes into account the growth in output and growth in labour productivity. Cross section analysis of industrywise data does not provide strong evidence about the application of Verdoorn's law to the SSI sector in India.

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Introduction

Growth of industrial sector is determined by the resources use pattern and factor productivity. Due to limited resources, particularly in the backward and the developing regions, the acceleration of industrial growth and its sustainability over the longer period depends upon the improvement in total factor productivity (TFP). Growth in TFP contributes to industrial development through the demand route as the efficiency of factor use pattern would reduce the cost of production as a result of which the producer can afford to place the product at competitive prices which leads to rise in turnover and profitability. Additional resources generated out of rise in productivity are mainly used for the expansion of business and providing pecuniary and non-pecuniary incentives to workers. Therefore, the studies examining trends in TFP are assigned greater importance in the context of industrial growth particularly in the developing countries.

The growth in output is one of the determinants of the growth of TFP. Growth in output is expected to be positively associated with the growth in TFP due to two important factors: (i) technical progress and (ii) economies of scale.

The growth in output is one of the determinants of the growth of TFP. Growth in output is expected to be positively associated with the growth in TFP due to two important factors: (i) technical progress and (ii) economies of scale.

When technical progress is treated as exogenous, then higher growth in output would lead to higher

growth in productivity because (a) higher output growth will permit more addition to new and superior technology which further increases productivity, and/or (b) rapid growth in output may shorten the lag in the application of latest managerial skills because there is reduced uncertainty and quicker adoption of improved technology.

Arrow (1962) viewed endogenous technical progress as a process of learning which is the outcome of various attempts to solve a problem. As such, the cumulative investment coupled with practical experience will determine productivity. Schmookler (1966) argued that the industry in which output grows fast, would undertake greater investment. Therefore, one would expect a positive association between the long term growth in output and productivity.

The economies of scale also influence the output-productivity relation. Economies of scale may be internal or external or both. Some of the economies, which are technological in nature, get covered under the technological progress. An important contributor to scale economies is specialisation. While different firms specialise in different products within the same industry, different workers specialise in different jobs within the same firm. Hence, output growth is also an important determinant of specialisation (Goldar, 1986).

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As early as in 1942, Fabricant observed a positive association between the growth of output and labour productivity (Verdoorn, 1949). However, the study by Verdoorn examined this relation and his conclusion that over the longer period there is a fairly constant relationship between the growth in output and the growth in labour productivity received wider recognition. In particular, he used the following equation to empirically examine the relationship:

$$P = a + bQ$$

where P = productivity growth,

Q = output growth, and

a and b are parameters.

Verdoorn claimed that the average value of elasticity of productivity with respect to output is 0.45, though it may vary in the broad range of 0.41 to 0.57. This was later popularised as Verdoorn's law.

Kaldor and Rowthorn put forth their own arguments while explaining the Verdoorn's law. Kaldor (1966, 1975) emphasised that to test the Verdoorn's law, the relationship between (i) productivity growth and output growth and (ii) employment growth and output growth should be examined. On the other hand, Rowthorn (1975a; 1975b; 1979) argued that there is no gain in estimating both the equations as suggested by Kaldor because the first relationship can be tested from the growth rates of productivity as well as employment while the other relationship is derived through the identity.

According to Kaldor, a sufficient condition for the presence of economies of scale is the existence of a significant relationship between the rate of growth in labour productivity and the rate of growth in output. This is indicated by the statistically significant regression coefficient. Although Kaldor did not discuss in detail the theoretical part of his interpretation of Verdoorn's Law, it appears that he considered it to be some kind of technical progress function.

Many authors including Verdoorn himself have concluded that Verdoorn's Law is merely a conventional Cobb-Douglas relation expressed in terms of growth rates, with output as regressor (Erkin Bairami, 1987-88). Kendrick and others have pointed out that the relationship between productivity growth and output growth is reciprocal in nature. Kendrick and Grissman (1980) examined the statistics of United States for 20 manufacturing industries for the period 1948-76 and observed that the coefficient of correlation between the rate of Growth of total factor productivity and the rate of change of output was 0.60 which supported the application of Verdoorn's law to the U.S. industrial sector.

Empirical evidences based on extensive data strongly support the application of Verdoorn's law to the manufacturing sector in a large number of countries (Goldar, 1986; Katz, 1969). As per most of the empirical studies the Verdoorn coefficient lies in the range of 0.4 to 0.7.

Empirical evidences based on extensive data strongly support the application of Verdoorn's law to the manufacturing sector in a large number of countries.

As regards application of Verdoorn's law to the industrial sector in India, Mehta (1980) did not find any relationship between output and productivity growth for the 1953-65 period as the coefficient of correlation was only 0.14. On the other hand Goldar (1986) in his study of time series data for the 1960-70 period for 37 three digit industries observed significant relation between output growth and labour productivity which supported the application of Verdoorn's law. This also implies presence of scale economies in the industrial sector in India (Swami, 1993). His study showed that one per cent growth in output led to about 0.44 per cent growth in labour productivity and the main contributory factor to increase in labour productivity was the capital deepening. Agarwal and Ganesh (1991) examined the data for 41 three digit industries for the period 1973-87 and found that the Verdoorn's law is applicable to the large scale manufacturing sector. However, when they examined the data for two sub-periods 1974-78 and 1982-86, their study did not support the application of Verdoorn's law for the 1982-86 period. Thus it can be concluded that different studies pertaining to large scale industries in India have revealed mixed evidence about the application of Verdoorn's law. The SSI sector in this respect is still a neglected area.

Different studies pertaining to large scale industries in India have revealed mixed evidence about the application of Verdoorn's law.

The SSI sector has consistently registered an impressive, growth over the 1973-93 period in terms of the number of enterprises (9.3%), employment (6.6%), production (9.7%) and exports (12.3%). It is observed that the factor productivity in the SSI sector has been higher than that of the large scale sector (Sidhu, 1996). This indicates that the modern SSIs are emerging as important contributors to the manufacturing sector in India. Therefore it is important to examine the relationship between growth in factor productivity and the growth in output in the SSI sector in India. The present study is an attempt towards this direction.

Data Source

Comprehensive statistics on SSI are available from both the two censuses of SSI conducted by the Development Commissioner (SSI), Govt. of India. The Govt. of India Report of First Census of SSI with reference year 1972 was published in 1977 and the Report of the Second Census of SSI with reference year 1987-88 was published in 1992 (Govt. of India, 1977, 1992). Both the censuses provide statistics on the industrywise number of units, employment, capital employed, output, value added, and wages paid.

The analysis is based on three sets of data. The first set of data i.e., time series statistics for the period 1973-93 were obtained from the Handbook of Industrial Statistics, Office of the Economic Adviser, Ministry of Industry. The other two sets of data i.e., statewise and industrywise statistics were obtained from both the Censuses of SSI. These data are aggregated for the entire country. State/UT level data are available for 28 states/UTs while industrywise data are available for twenty one 2 digit industry groups. As the study examines the time series as well as discrete series data, it is expected that different conclusions would emerge from the three different sets of data.

Methodology

The productivity and output relation are examined on the basis of data pertaining to different industry groups, different states and different years. As the SSI census data are available for two points of time, the factor productivity and the growth in factor productivity in the SSI sector are point to point estimates. To examine the relation between Factor Productivity and output growth, the factor productivity is estimated by Direct Method.

Direct method of factor productivity is the geometric average of the partial factor productivity indices. The partial factor productivity is obtained by dividing value added by the respective factors of productivity. If we define partial factor productivity index of capital by PFPI (K), that of labour by PFPI (L) and total factor productivity index by TFPI, then

$$\text{PFPI (K)} = \frac{V(t)}{K(t)}$$

and

$$\text{PFPI (L)} = \frac{V(t)}{L(t)}$$

where V (t) = index of value added for the year *t*,

K (t) = index of capital investment for the year *t*, and

L (t) = index of labour employment for the year *t*.

The TFPI by the Direct Method will be calculated as:

$$\text{TFPI} = \frac{V(t)}{[K(t) \times L(t)]}$$

or $\{ \text{PFPI (K)} \times (\text{PFPI (L)}\}^{1/2}$

Analysis of Results

The regression results (Table 1) reveal mixed evidence about the application of Verdoorn's law to the SSI sector in India. In case of time series data for the period 1973-93, the value of coefficient is 0.36 which indicates that one per cent increase in output leads to 0.36 per cent increase in labour productivity. The regression coefficient is highly significant. Further analysis of time series data reveals that during the 1981-93 period, one per cent increase in output led to 0.49 per cent increase in labour productivity. However the results of the period 1973-81 show very weak relation as the value of co-efficient is 0.11 only. From the time series analysis one may conclude that Verdoorn's law is applicable to the SSI sector for the period 1981-93 whereas it is not applicable for the period 1973-81. The reason may be that during the 1973-81 period the SSI sector registered significant growth in the number of units resulting in substantial rise in employment but, there was relatively slow growth in production particularly in the new SSI units. This caused considerable fluctuations in the output-labour ratio. As a consequence the regression results show weaker relation between labour productivity and output for the period 1973-81. On the other hand, the output-labour ratio recorded almost continuous growth during the 1981-93 period as a result of which the regression results reveal significant relation between labour productivity and output. It has also been observed that the Verdoorn Law is valid only when the level of production is on the rise (Sangha, 1992).

Regression results of statewise data reveal that the coefficient lies in the range of 0.42 to 0.48 in three different equations: (a) 0.48 in the relation between growth in labour productivity index and growth in output index, (b) 0.47 in the relation between growth in labour productivity and the growth in output (Here labour productivity is measured by the ratio of value added to labour) and (c) 0.42 in the relation between growth in labour productivity (output-labour ratio) and the growth in output. In the other three sets of relations, the value of regression coefficient is (a) 0.34 in the relation between growth in TFP and growth in output, (b) 0.13 in the relation between labour productivity index and output index, and (c) 0.10 in the relation between total factor productivity index and production index.

In case of industrywise analysis, the value of regression coefficient varies in the range of 0.27 to 0.04. The value of coefficient is (a) 0.27 for the relation of growth in TFP and growth in output, (b) 0.24 for the equation

Table 1: Regression Results Showing Application of Verdoorn Law to the SSI Sector in India

Sl. No.	Functional Fora	Constant a	Coefficient b	*t*-Value of b	Value of R^2	d.f.
1. Time Series Data						
	O/L Ratio = f (Output) : 1973-93 data	29349.6868	0.0045	31.5010*	0.98	18
	LN O/L Ratio = f (Ln Output) : 1973-93 data	5.2683	0.3640	15.3428*	0.93	18
	LN O/L Ratio = f (Ln Output) : 1973-81 data	8.9706	0.1102	1.8641**	0.37	6
	Ln O/L Ratio = f (Ln Output) : 1981-93 data	3.2425	0.4937	28.2154*	0.99	10
2. State-wise Data						
a.	Labour Productivity Index = f (Output Index)	106.1934	0.1254	3.9067*	0.37	26
b.	Total Factor Productivity Index = f (Output Index)	91.2547	0.1025	3.5436*	0.33	26
c.	Growth in TFP = f (Growth in Output)	-2.7161	0.3439	2.3052**	0.17	26
d.	Growth in Labour Productivity Index = f (Output Index)	-3.3110	0.4755	3.7607*	0.35	26
e.	Growth in O/L Ratio = f (Growth in Output)	0.2041	0.4201	5.9768*	0.58	26
f.	Growth in V-Added/L Ratio = f (Growth in Output)	-3.0375	0.4669	3.6277*	0.34	26
3. Industry-wise Data						
a.	Labour Productivity Index = f (Output Index)	138.0082	0.0408	1.7746***	0.18	14
b.	Total Factor Productivity Index = f (Output Index)	113.2237	0.0408	1.7746***	0.18	14
c.	Growth in TFP = f (Growth in Output)	-0.5504	0.2719	2.2869**	0.27	14
d.	Growth in Labour Productivity Index = f (Output Index)	1.1871	0.1785	1.3611	0.12	14
e.	Growth in O/L Ratio = f (Growth in Output)	1.9608	0.2422	1.8042***	0.19	14
f.	Growth in V-Added/L Ratio = f (Growth in Output)	1.2333	0.1544	1.2021	0.09	14

* Significant at 1% ** Significant at 5% *** Significant at 10%

showing the relation of growth in labour productivity (output-labour ratio) and output growth, (c) 0.18 in the relation between growth in labour productivity index and output index, (d) 0.15 in the growth in labour productivity (value-added per worker) and growth in output. The value of coefficient was very low in two cases: (i) it is only 0.04 in the relation between index of labour productivity and production index and (ii) 0.06 in the relation between TFP index and production index.

An important observation is that the regression relation is statistically significant only in a few sets of equations. While the time series data strongly supports the application of Verdoorn's law to the SSI sector in India for the period 1981-93, the industrywise data for two time points does not show statistically significant relation. This is due to very low value of either *R* square or *b* coefficient. The statewise data indicates that the Verdoorn's law is applicable to the SSI sector only when it is examined through the relation between growth in output and growth in labour productivity.

While the time series data strongly support the application of Verdoorn's law to the SSI sector in India for the period 1981-93, the industrywise data for two time points does not show statistically significant relation.

Conclusions

While there are a number of studies on the review of output and productivity in the manufacturing sector in India, very few have examined the output-productivity relationship. The present process of restructuring Indian economy through liberalisation and decontrols has put the small enterprises at a critical juncture of intricacies concerning their future. Therefore, for any change in policy related to small industries there is a need to evaluate various aspects related to productivity of small enterprises. Empirical studies of the large scale sector reveal strong evidences of positive association between growth in output and factor productivity. In this study it is observed that the Verdoorn's law has restricted application to the SSI sector in India as different sets of data provide different results. While some results support the application of Verdoorn's law to the SSI sector in India, the others do not provide any evidence of its application. As such this study suggests that one must examine the alternate sets of data before concluding about the application of Verdoorn's law to any economy. As factor productivity is critical for the survival of units, the Verdoorn law can be used as an alternate measure to test overall performance of the industrial sector.

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Feature

Enhancing Manpower Productivity: The Experience of Bhilai Steel Plant

G. Upadhyaya

Of the various resources that go into production processes, the human resource is unique in enhancing productivity of an organisation. This is not an issue of quantitative labour productivity, rather the focus is towards a wider concept of human productivity encompassing quality and intrinsic aspects. The present paper amply demonstrates how these palliatives are achieved at Bhilai Steel Plant—one of the prestigious units of SAIL. The manpower productivity enhancement is feasible through strategic adoption of the interventions, viz, managerial policy decisions attuned to the organisational culture and milieu. In particular, the paper highlights landmark activities with which Bhilai plant overcame its productivity crisis in mid eighties and rose to its present towering status. Bulk of the efforts are concentrated in ensuring optimization of labour productivity and ensuring total quality management.

G. Upadhayaya, Executive Director (P&A), Steel Authority of India Ltd. Bhilai Steel Plant.

Organisational Performance

A common-sense term in management productivity is a measure of output resulting from a given input. It is an index of outflows with reference to one or more given inflows. Managers use productivity to measure organisational efficiency by comparing production outputs with reference to various input factors. Of the various resources that go into production processes, the human resource is unique. Man is not merely a factor of production, but is also, in many ways, the very purpose thereof. This makes the challenge of enhancing productivity the critical dimension of organisational performance.

Man is not merely a factor of production, but is also, in many ways, the very purpose thereof. This makes the challenge of enhancing manpower productivity the critical dimension of organisational performance.

Conventionally, the index of human performance has been labour productivity. However, labour productivity has become synonymous with physical output in quantitative or volume terms, and the trend is to move towards a wider concept of manpower productivity, which encompasses, in addition to quantity, the qualitative and intrinsic aspects also. The focus also shifts to process performance rather than mere outcomes. As a result, human issues will, in the future, acquire a much greater significance in the quest for enhanced productivity.

The present paper intends to share the experiences of Bhilai Steel Plant in its quest for enhancing manpower productivity through the strategic adoption of interventions attuned to the organisational culture and miiieu.

Plant Overview

Bhilai Steel Plant is an unit of Steel Authority of India Limited, which is the largest metallurgical organisation in the country, and the tenth largest steel producer in the world. With five integrated steel plants, and four alloy/special steel plants, SAIL has a commanding presence in the Indian Steel scenario. With a turn-over well over Rs. 15,000 crores during 1996-97, SAIL is amongst the first group of PSUs who have been conferred the navaratna status.

Bhilai Steel Plant is the flagship of SAIL. Nestling amongst the verdant fields of the Chattisgarh region of Madhya Pradesh, Bhilai Steel Plant has been the nucleus of the industrial development of the essentially agrarian region. The plant bagged the coveted Prime Minister's trophy for the best integrated steel plant thrice during the last four years. The success indicators of Bhilai runs into an impressive list of hard business parameters:

- Consistent history of performance orientation, as reflected through the record of achieving rated capacity at 1.0 MT, 2.5 MT and 4.0 MT stages, soon after commissioning.
- Steady rise in Labour Productivity. (Labour Productivity rose from 65 T/M/Y in 1985-86 to 126 T/M/Y in 1996-97)
- Continuous optimisation of techno-economic parameters including energy consumption, yield, and input of raw materials.
- Adaptability to perform in a competitive market environment, as reflected in continued growth without any budgetary support.
- Consistent profitability.
- Significant export performance.

Approach to Productivity

Manpower productivity enhancement is multi-focussed, innovative and based on the indomitable will of the Bhilai collective. For proper understanding of the Bhilai experience, we would like to focus on five major dimensions of our productivity strategy:

- Adopting Labour productivity as a performance variable.
- Enriching the role of the employee and the employee in his role.
- Involving the employee collective in the change process.
- Evolving an organisational climate to facilitate productivity.
- Nurturing managerial productivity.

Labour Productivity Performance

Manpower Sizes

The major steps taken by Bhilai Steel Plant in its efforts towards adopting Productivity as a performance indicator are given below:

In the initial years of the plant in late fifties, systematic manpower norms were not available. The plant also underwent phased expansion of capacity from 1.0 million tonnes per annum to 2.5 MT in early seventies and finally to 4.0 MT in mid-eighties. This resulted in extensive adhoc recruitment continuing up to mid eighties and a peak manpower level of 65,000 was reached in 1986.

The year 1986 is a landmark in the history of SAIL, as it marks the beginning of an era of human resource based strategies for organisational renewal. As a part of the above exercise, optimisation of manpower was carried out by adopting systems like analysis of manpower utilisation pattern, micro level action planning and adoption of labour productivity as a vital performance target.

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The industrial engineering department carried out a comprehensive manpower study of the more than 90 plant departments and recommended an immediate manpower of 61,000 [phase-1] which with the adoption of better workpractices can be progressively be reduced to 46,000 [phase-2] against the actual availability of 65,000. The personnel department jointly with the industrial engineering department carried out discussions with the heads of department and later on shop floor union representatives. By 1989, agreements were signed with the union for operating a manning of 61,000.

Following three facilitators were used to achieve the targeted manpower norms:

- A voluntary retirement scheme was introduced for six years in which large number of higher age-group employees separated.
- Multi-skill positions were created through job-clusters
- The plant introduced a budgeting system for annual manpower plans which was rigorously monitored.

The manpower has been progressively optimising since then and is today at a level of 50,000. The optimisation has been achieved through a human and incremental process without creating an environment of panic; in this situation only a thin razor action instead of axing was adopted.

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Budgeting System for Manpower Planning

The manpower budgeting system has been largely instrumental in accelerating planned reduction of manpower while at the same time preventing any disruption of production process due to continual reduction of working hands. The system has been fine-tuned across the years and the current budget parameters are based on following:

- discussions with HODs to know their true requirement.
- arriving at a recruitment proposal keeping room for annual reduction of around 1200 persons
- presentation of the proposal to BOD.
- recasting of HR plan as per the board approval.
- preparation of department level manpower budget depending on replacement policy.
- periodic reviews.

Pruning mines contract labour

The plant has a satellite cluster of mines which feed raw materials like iron ore, lime stone and dolomite. Considering the low level of technology, these mines were largely manned by large number of unskilled and illiterate local villagers through contractual agencies. In nineties, they projected a dismal scenario:

- low output mining operations
- depleting deposits in mechanised areas
- inability to cope with the rising productivity and quality parameters of the plant.
- under-utilised manual labour.
- symptoms of militant unionism

The change management strategy undertaken in 1995-97 comprised of following steps:

- exit of about 4000 number of contract labour through voluntary retirement.
- conversion of contract labour into departmental piece rated labour with a favourable age-mix.
- mechanisation of manual mines

Putting people in productive shifts

Steel making being a continuous process, the plant operation is distributed in to 'A' shift [6 AM to 2 PM], 'B' shift [2.0 PM to 10 PM] and 'C' shift [10 PM to 6 AM]. In addition to the above, some employees are required to come in 'G' shift from 8 AM to 4.30 PM to handle planning & co-ordination jobs, collection & distribution of stores and spares, major repairs and precision jobs. Persons in A, B and C shifts are directly placed in production and maintenance jobs and are rotated on weekly basis in the three shifts. Persons earmarked for general shift remain fixed in the same shift over a period of time. Across the years, the size of 'G' shift manpower increased at the cost of other shifts mainly due to the general tendency to avoid the work load in the production line. In 1992, a comprehensive review was made and a plan was chalked out to shift back the under-utilised segment of 'G' shift employees into production shifts. By 1997, more than 4,000 employees have been placed back into the production shifts.

Instilling organisational discipline

Efforts in this direction has been continued since major benefits were reaped by elimination of practice of overtime and introduction of direct reporting system (i.e. in lieu of recording attendance through a separate time keeping agency). In order to enable the departments to cope up with higher productivity target, extensive ground level deliberations are held and suggestions are generated for introduction of positive work practices.

The issues taken up under the performance plan for 1997-98 are:

- New battery in Cokeoven Department to be manned by existing employees of the deptt with more machine flexibility.
- Reduction of loco crew size.
- Excess soaking pit operators are to be utilised as crane operators after training
- Restructuring of manning of steel shop with a higher productivity target.
- technicians are to work as riggers in Engineering Shops initially before they are posted permanently.
- Merger of three sections of Research & Control Lab.
- Role clarity of tasks between Central and Shop Maintenance functions.
- Expansion of capacity of Oxygen Plant-2 simultaneous with reduction in actual manning

Employee Roles

Multiskilling for flexibility and job-enrichment

This objective gives a sense of completeness and wholesomeness to an employee. A beginning was made in the year 1988 to gradually introduce job structures which would facilitate the worker to take up multiple numbers of traditional compartmentalised jobs. This was intended to help the departments to cope up with the reduced manpower. This was also meant to reduce job monotony, enthuse the workers with variety, improve their utilisation hours and more important to enable them to attach a better meaning to their job. This combined with a cluster pattern of growth and revised manpower norm was extensively discussed with the line managers and the unions and multi skilling of the structure was implemented.

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Later on it was discovered that introducing a multiskill structure was not enough. Reinforcement has to be provided in the form of training in matching skills and attitude. The training set-up therefore embarked on a massive drive to identify training needs across the organisation and carrying out the programmes both at the shop floor as well as in the training institute.

Succession planning for key categories

The high rate of natural separation (2500 per year) in the plant has been offering an opportunity for planned optimisation of manpower. But the same also turned out to be a problem An analysis conducted in 1994 indicated that more than 90 per cent of a total of more than 14,000 separation expected in next five years are in the skilled categories. There was thus a potential situation of skill depletion in most of the departments. The situation was grave in view of the fact that steel making skills are not ready-made available in the employment market.

An analysis conducted in 1994 indicated that more than 90% of a total of more than 14,000 separation expected in next five years are in the skilled categories. There was thus a potential situation of skill depletion in most of the departments.

Reviewing the situation, a skill preservation project was initiated combined with a long term succession plan up to 2000 AD. Key categories in all the departments were identified in consultation with the heads. It was decided that replacement against separations will be given at least six months in advance so that the new recruits are properly equipped with skill and experience before they actual take over. Individual wise successors to different positions were worked out and master plans for their training and promotion schedules were evolved.

Training for one third employees every year

Upgrading and fine-tuning of people's competency has become the corner stone of productivity strategy for most business organisations. This was all the more relevant to us especially as technological modernisation in steel plants imply heavy investments. Realising this, efforts in the directions of both skill development as well innovative learning practices have been adopted. The plant training institute today imparts training to more than 20,000 employees annually on a wide spectrum of thrust areas covering skill development, supervisory development, managerial effectiveness and team building. This way each and every employee is exposed to a

development programme at least once in three years. The expenditure on training has nearly trebled since 1986 to the current level of Rs. 9 Crore per annum. The organisation has also entered into a training collaboration with the British Steel Co. to benefit from advanced areas of training.

One of the training module aiming to achieve operational competency at the ideal level and enhancement of productivity is the Unit Training module. Under the module, the correct operating practices are first determined, documented and training manuals are prepared on this basis separately for every job and training is given on one to one basis. Till date 259 training modules have been introduced. In the area of maintenance, training manual based inputs have been prepared for all basic engineering skills including fitting, electrical maintenance, etc.

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Improving quality of new recruits

The impact of new recruits is marginal if the organisation is an old one and volume of new intakes is low. In the case of Bhilai however the annual intake volume averages at 1,200. The skill and attitude of these new members are therefore have a crucial bearing on productivity.

Realising this the recruitment process is being continually reviewed. During 1988, a decision was taken that no recruitment even at the lowest scale of pay will be made without a minimum qualification of matriculation. Induction of unqualified persons was considered counter to the ongoing modernisation of the plant as well as from safety point of view. In the same year a major decision was taken that even the lowest level new recruits has to under go three months of basic skill training in the training institute before he is deployed in the shopfloor. In 1990, a decision was taken to impart multitrade training to all skilled new recruits before they are sent to departments and are asked to meet their multiskill jobs. The new recruitment category [TOT or Technician-cum-Operative Trainee] combines skills of two allied trades over and above their basic ITI skill in their 18 months training period.

While integrated steel plants all over involve difficult physical environments, some of the jobs here in departments like Coke Ovens, Blast Furnace, Steel Melting Shops are far more exacting than others. To place productive people in these positions a special recruitment category (Operative Trainees) was introduced in the year 1992 with higher physical standards and lower age mix [upper age limit 21 years] and a detailed selection process focusing on their physical capability.

Standard Operating Practices

These Standard Maintenance Practices (SMPs) are documented guidelines for systematic and standardised execution of critical jobs. These documents have been developed in most of the plant departments. The number of SOPs and SMPs in the seven ISO 9002 department are close to 700. These activities are in line with the overall efforts for instilling quality in all spheres. ISO 9002 has been awarded to five major production units in 1996 in addition to two departments who were accredited in 1992. Efforts are on to acquire the certification in remaining few production departments in near future.

In the area of Human Resource Management also, standard operating practices have been defined for 90 major establishment activities including sanction of leave, processing of LTC, system for final payment, sanction of various advances, etc. These SOPs have been documented and published in two volumes, which provides handy referential guidance for all personnel functionaries at different levels.

Employee Involvement in the Change Process

Corporate initiatives

Efforts have been made in Bhilai to achieve employee involvement in the change process through a series of Corporate Initiatives of SAIL by focusing on various aspects of change to a desired level.While the broad outlines of these initiatives are forged at the top management level, subsequently the managers in the site and cross section employees are subsequently covered under communication sessions. During recent past such drives have been undertaken under following heads:

- Strategy for managing change [March, 93]
- Effective Implementation of Corporate Strategies [November, '93]

- Achieving leadership in Customer Satisfaction [April, '94]
- Cultivating a Culture of Customer Satisfaction [June, '95]
- Benchmarking for Global Competitiveness [April, '96]
- Accelerating change in SAIL [April, '97]
- Cost reduction and Resource Generation [June, '97]

The need for sense of direction to personnel is even more acute in case of the today's managers. Appreciating this, a conscious direction is always given to enable the people to rise above their function and to locate a higher meaning to their work. In practice, this has been attempted by evolving organisational vision, goals, desired culture and norms of behaviour.

The vision statement of SAIL reads as under:

"To achieve market leadership and prosper in business through satisfaction of customer needs by continual improvement in quality, cost and delivery of product and services."

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The core values reflecting essence of a desired culture in the organisation are as under:

- Customer Satisfaction
- Concern for People
- Consistent Profitability
- Commitment to Excellence

Encouraging flow of ideas from employees

Successful organisations are those which are able to create a culture whereby employees willingly and regularly think on their jobs for bringing out all round development. The plant is firmly committed to this and this commitment is reflected in its suggestion scheme.

An idea or a proposal received from an employee which facilitates improved productivity, systemic progress, enhanced customer service are being accepted as suggestion. The main objectives of the scheme are to give a fillip to the implementation of creative ideas which benefit the plant and also help to motivate the employees through recognition and reward.

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The current employee suggestion scheme was adopted in 1992 with a decentralised processing, concept of token gift for every accepted suggestion and involvement of union in the evaluation committee. As a result the number of employee suggestion has gone up from around 250 in 1991-92 to more than 35,000 in 1997-98. The plant has also bagged the coveted national award for excellence in implementation of suggestion by INSSAN (Indian National Suggestion Scheme Association) as many as five times during last six years.

Innovative ability and outstanding contribution in the field of productivity has led several Bhilians to bag "SHRAM" awards of the government. The year 1997 saw four Bhilians to bag the 'SHRAM RATNA" award, the highest Shram award presented to any body in the country since the award was instituted in 1985.

The QC movement was initiated in Bhilai in late 80s with the objective to tap collective creativity through voluntary participation. From a humble beginning of 1 project per week in 1988, through various promotional measures and training inputs, we have risen to 40 projects per week totalling 2200 projects in 1997-98. The cumulative number of QC projects handled till March 1997 is 6269.

Internal customer satisfaction (ICS)

This model intends to prevent different wings of the organisation from working in cross-purposes and is based on the promise that only by satisfaction of the internal customers, we can satisfy the external customers. The model, therefore applies to the total customer-supplier chain with the organisation under which

each department is a supplier first and then a customer. The ICS model was adopted in the plant in Nov'93. The total process of ICS has four phases.

- Phase-1 in the ICS model involves reaching an agreement with the customers for fulfilling specific requirements through a process of discussion, helping each other to overcome some of the internal weaknesses and building capabilities to overcome the internal weaknesses.
- Phase-2 is preparing the performance budget for the department to fulfill the objectives of the customer department and also to develop micro-plans to achieve the budgeted results of the department.
- Consolidating the performance budgets to annual performance plan for the plant and conversion to financial budget for the plant are activities involved in the third and fourth phases.
- The annual plan for the HR group is finalised after taking into consideration the expectations of the internal customers of the personnel function. This includes the line managers, grassroot employees, employee associations and associate departments like Finance, Training etc.

Evolving Organisational Productivity Climate

The IR climate

This may be evident from the fact that not a single manday has been lost due to any IR issue during last six years. The bipartite culture is rooted in the 125 management-union forums operating at plant, function and department level. These committees cover a wide spectrum of issues like production, productivity, safety, welfare, sports, cultural activities, Suggestion scheme, grievance, and canteen services. The apex committees like Central Production Committee and Joint Committee are chaired by the chief executive and the head of works division.

Motivational climate

As many as six different types of incentive packages for employees are in operation aiming to improve productivity, techno-economics and quality. The latest of them known as Adhoc Reward Scheme, is updated every month to create monthly challenges in productivity and internal customer satisfaction.

Besides above, non-financial reward schemes are also in vogue to motivate outstanding individual and group performance.

- Those of us who are fortunate to be part of the plant collective also delightfully observe a number of subtle and people sensitive phenomena:
- employee turnover other than natural wastage is invisible at 0.5 per cent.
- those who leave very often want to return
- along with a few absenting employees, there are many more who make it a point to reach their workspot much before the official shift.
- no formal job-description exist even though there are over 1200 varieties of job.
- the shop floor is so egalitarian that an observer will find it hard to distinguish between an attendant, a technician and a supervisor.

In major production shops, about a third of the earnings of the employees accrue on account of various production incentives. This acts as a significant motivating factor for enhanced performance, which inturn, is reflected in the organisational performance in both quantitative and financial terms.

To reward superlative performance, both by individuals and by groups, which have brought about significant savings/revenue generation, and/or have resulted in process improvement in production, maintenance and service areas, the Nehru awards are conferred upon deserving employees every year. This includes, Jawahar awards for individual executives, Nehru awards for individual Non-executives and Jawaharlal Nehru group awards for team performance. During 1997, 587 employees were presented these awards.

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The organisation climate

Organisations like individuals live and grow with a unique personality of their own which distinguishes them from others. This uniqueness is rooted in a complex web of values, traditions, patterns of communica-

tions, production performance, leadership styles and role structures. Members of the organisation work within and are continuously influenced by this internal environment which is called Organisation Climate [OC]. While a small minority of outstandingly good workers and extremely deviant workers will behave the way they do irrespective of OC, the fact remains that for majority of employees OC is key to excellent performance.

OC based interventions were initiated in the Bhilai in the year 1992 when a climate survey was carried out on a mammoth 10,000 sample employees inviting their perceptions on different elements of the organisation climate viz. Openness, Collaboration, Trust, Authenticity, Proactivity, Autonomy, Confrontation, Organisational Belongingness, Role Clarity, Career Development and Job Satisfaction. The survey data were analysed and details of findings were shared among the employees. A number of HRD initiatives were initiated based on the above survey feedback.

For systematic evolution and implementation of HRD initiatives task force based projects were also initiated under HRD Orientation Programme [1992] and HRD Enrichment Programme [1995].

Nurturing Managerial Productivity

Stimulatic managerial productivity

The Executive appraisal system is a composite tool which along with objective assessment of performance unleashes a number of development processes. The performance is assessed against work planning parameters in terms of fixation of Key Performance Areas and annual tasks/targets. The appraisal process in Bhilai also involves half yearly and annual review discussions between the appraise and the appraiser, Joint fixation of tasks/targets, preparation of self-assessment report by the appraise and identification of training needs.

Sharpening Managerial Competency

The corporate exercises mentioned in para 6.1 are specially focussed for sharpening managerial skills. A couple of workshops held in October 1993 revealed that there is a gap between our intentions in corporate initiatives and achievements or in other words the gaps of implementations. In order to build in implementation capability, a number of core groups were formed and the recommendations were communicated to all the executives.

The successful manager today is not a boss, but an effective leader of his people. With this motto, week long development modules have been held covering the executives focusing on following themes:

- Action Leadership programme
- Micro planning programme
- Collaborative working
- Personnel effectiveness programme
- Team Members role
- Developing Subordinates

Conclusions

An effort has been made in this paper to deal briefly with the landmark activities with which Bhilai overcame its productivity crisis in mid eighties and rose to what it is today. The paper of course does not make any claim to explain vast details of the actual process with which the metamorphosis took place. The activities however can provide cues to experiment with, by organisations looking for quantum jumps in productivity.

As one approaches the onset of the 21st century, the world has become a global market. Performance has now to be bench-marked against not only the industries' best in the country, but across the continents. Since our products have presently to compete with the best products from overseas, it is but natural that production processes and productivity efforts must be able to compete with the world's best. Bhilai is conscious of the challenge and is gearing up to meet it.

Before concluding, it may be useful to list down some of the experimentations in this field which currently are being undertaken in Bhilai:

(a) Application of mentoring on all new recruits

(b) Introduction of a structured channel for transmission of positive work culture from the elders to the younger employees in a new forum called, 'Trainer-Trainee-Guardian Forum'.

(c) Development oriented appraisal system for all employees.

(d) Re-orientating the Recruitment System focusing on attitudinal factors.

To synergise the impacts of these wide ranging productivity improvement activities, **Long Term Manpower Plan** up to 2003 AD has been forged out; it has objectives of arriving at an appropriate manpower to reach a productivity level of 160 TMY, to arrest the upward trend in labour to sales ratio and to support

Bhilai's growth plan in the ensuing years. Under the plan, a number of strategies like revision in shift system, merger/re-organisation of departments, changes in wage structure, rewards to primarily based on shop profitability etc. are envisaged.

On the whole, then its the productivity itself that's on the anvil. This simple ratio exemplifying excellence and signifying growth is a perennial beacon for Bhilai. As it moves into a business world that has scant regard for the less productive, Bhilai's experience of a productive synergy of steel making will hopefully hold it in good stead. But we know there are always new thresholds to conquer. □

Telecom Regulatory Authority of India*

After the NTP was announced, the government realised the need to set up an independent regulatory authority as there would be several service providers including the DoT. It was decided to set up the Telecom Regulatory Authority of India, borrowing principles from the governing acts of the Federal Communication Commission of the United States, Oftel (Office of Telecommunications) of the UK and Austel in Australia. According to the TRAI Act, 1997, the regulator has the following functions:

- To ensure technical compatibility and effective interconnection between different operators and service providers.
- Work out and oversee the revenue sharing arrangement between different service providers
- To spell out and ensure time frames for making available local and long distance DoT circuits between service providers
- To protect consumer interests through strict enforcement of:
  - (a) Service quality standards
  - (b) Time to contact
  - (c) Time to repair
  - (d) Frequency of breakdowns
  - (e) Call completion rates
  - (f) Fair billing administration
- To facilitate competition and promote efficiency in the sector and facilitate growth and innovations in service
- To ensure compliance of licence conditions, universal service obligations and the stated pricing policy operators and service providers
- To protect national security interests
- To resolve issues between service providers
- To fix tariff for telecom service and ensure price regulation
- To advise the government on technology options, service provision and related matters
- Any other matter referred to it by the government.
- However, the pleas of private bidders for basic telecom services that the regulator should be instituted before the bids went unheeded, and TRAI came into existence as late as January 1997. So far, only four in a panel of seven members have assumed office.

Source: National Infrastructure Report - 1998 Asian Institute of Transport Development.

Feature

Quality Benchmark Deployment: Case Study on Hospitality Industry

A. Srividya, B. Singh & B.A. Metri

Better Hospitality can be planned and provided if customer expectations are identified and adequately evaluated. In the present paper Quality Benchmark Deployment (QBD) technique is used to quantify and evaluate the customer needs in hospitality industry. The study has been conducted on a five star hotel company whose turnover is in excess of Rs. 900 lakhs. In the study four critical success factors (CSFs), reliability, responsiveness, empathy and tangible amenities and their respective subfactors have been identified and evaluated. The data used in the QBD process include, personal interviews and questionnaire survey. QBD matrices are presented and the priorities of the customer needs are determined. This helps to select the CSFs to benchmark and analyse on priority basis. The analysis of the CSFs reveal that the customer satisfaction and process improvement in an industry results in positive difference in financial performance.

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Introduction

The hospitality industry adopted a reactive approach to customer needs based on the notion that "good will" and "good name" created through performance in the past are enough to attract customers which is not true any more since the customers demands have risen. Furthermore, the overseas firms are penetrating the previously untouched local markets and this has elevated the customer expectations. The competition in the industry is increasing day by day. The intensity of competition has been fueled by factors such as fragmentation of the industry, globalisation of the market and the enhanced bargaining power of customers. These factors among the others, have changed the nature of competition among the hotel industries and compelling them to adopt new business strategies for their survival in such a competitive environment. To gain competitive advantage, QBD is one such powerful tool, which responds to the new competitive conditions of market today.

Quality Benchmark Deployment

QBD is a process of employing mathematical analysis using a series of matrices, a rectangular arrangement of data into rows and columns, for the process relationships in the organisation to quantify quality and establish priorities to benchmark the process. Basically this is derived from well known QFD technique (Akao, 1990). Quality Benchmark Deployment technique identifies the organisation process, practices and structural factors such as the organisational structure and culture, technology, environment and costs that satisfy customers expectations. It also identifies appropriate performance measures including key process variables that indicate the satisfaction of customer expectation. Meeting customers needs upto their expectations is measured in terms of customer satisfaction. The quantifiable measures of performance are driven by the

processes, practices and structural factors of the business and are known as performance drivers. These are often interrelated, create value and consume resources. The structural factors often must be changed before an organisation's process and practices can be improved. QBD is a organisational tool that assists the industry managers to understand customer expectations sufficiently to develop priorities for these expectations that are customer oriented. QBD is not an end in itself, but rather a means to an end ... a more satisfied customer.

Quality Benchmark Deployment technique identifies the organisation process, practices and structural factors such as the organisational structure & culture, technology, environment and costs that satisfy customers expectations.

Methodology

The present study adopts the three methods of approach:

- Industry Survey
- Personal Interview and
- Questionnaire Survey.

Industry Survey

The organisation in this study project is a five star hotel company operating in the Indian hospitality industry. It is a 90 room hotel consisting of 80 double rooms and 10 suites. The hotel has restaurant, banquet facilities and shopping arcade. 70 per cent of the target clientele of the hotel comprises of corporate executives. The current occupancy rate is 50 per cent. The hotel is in its fourth year of operation. It comprises three business units: (i) Customer needs, (ii) Customer groups and (iii) Tangible amenities.

The turnover of the company is Rs. 906 lakhs against a total expenditure of Rs. 386 lakhs resulting in a gross operating profit (G.O.P) of Rs. 519 lakhs. The business unit-1 of the present studies has a turnover of Rs. 777.66 lakhs against a total expenditure of Rs. 280.50 lakhs and G.O.P of Rs. 497.16 lakhs. The other two units have turnover, expenditure and G.O.P. of Rs. 128 lakhs, Rs. 106 lakhs and Rs. 22 lakhs respectively. The present study is based on business unit-1.

TQM philosophy has been successfully implemented in this organisation to gain competitive advantage over the competitors in the field and it continue to be a main weapon of the business in maintaining that advantage. The current practices and process of the organisation have been reviewed during the survey with a view of analysing those factors that are considered to be most critical to an organisation's success.

TQM philosophy has been successfully implemented in this organisation to gain competitive advantage over the competitors in the field and it continue to be a main weapon of the business in maintaining that advantage.

Personal Interview

Focus-personal interview approach is used for the qualitative analysis of customer expectations. The customers are chosen for interview on the basis of three criteria: genders, nationality and customers hierarchy. The interviews are conducted with five customers who oftenly stay in this five star hotel. They lasted about 30 minutes with each customer which included open discussions and specific questions. The results of the interview provided the basic input for the generation of questionnaire – the main study tool. Four critical process factors (CSFs) and their subfactors have been identified through interview (Table 1). Since the interview was more open ended, the details of the interview is not included in this paper.

Table 1: QBD Matrix

CSFs → / Voice of Customers ↓	Reliability	Tangibles	Responsiveness	Empathy	
Importance rating	4	3	4	3	
Maximum satisfaction	44.00	28.00	32.00	12.00	
Actual satisfaction	30.76	18.20	20.94	8.33	
Target	40.00	25.00	25.00	10.00	
Rate of improvement	1.30	1.37	1.20	1.20	Total
Absolute weight	5.20	4.11	4.80	3.60	17.71
Demand weight	30%	23%	27%	20%	100

Questionnaire Survey

Based on CSFs and their sub factors questionnaire has been prepared. A mailed questionnaire survey ap-

proach is used and respondents are asked to respond the questionnaire by assigning number from 1 through 4. The number 4 is most important and number 1 is least important. A total of 100 questionnaires were distributed to the customers (who are familiar with this hotel) in major state capitals in India. 90 per cent customers responded to the survey and this data is used for the process quality analysis.

Process Quality Analysis

Quantification of Customer Needs

Once the data is collected, the first step is enter the CSFs and importance rating data into the QBD matrix as shown in Table 1. Next, the actual customer satisfaction ratings (C_s) for each CSF is computed by the formula:

$$C_s = \sum_{i-1}^{n} Q_i R/N$$

where

Q_i = question number 1, 2, ...n.

R = Importance of rating

N = Number of Customers

After evaluating actual satisfaction rating, the target has been chosen as suggested by the hotel management by taking into consideration of their professional experience and the practical possibility of achieving the rate of improvement in the next quarter. The next step involves the following computations:

(i) Rate of improvement = Target / Actual customer satisfaction rating

(ii) Absolute Weight = Importance rating × Rate of improvement

(iii) Demand Weight = $\frac{\text{Individual absolute weight}}{\text{Total absolute weight}} \times 100$

It is clear from Table 1 that demand weight is a product that has considered all the factors involved. It indicates the relative intensity with which customer needs are desired. On the basis of demand weight value CSFs are ranked for benchmarking/CSF analysis.

CSF Analysis

This analysis has been carried out for (a): Reliability, (b): Responsiveness (c) Empathy and (d): Tangibles includes the amenities provided by business units 2 and 3. Moreover, the survey shows that 64.28 per cent of customers are not utilising this CSF as amenities available are much below the expectations. Hence, further is not done for this CSF. In this analysis along with the survey data, Ishikawa diagram – a quality tool is mainly used to investigate the critical areas in the processes and sub processes.

Table 2: CSFs and Sub factors

Sr. No.	CSFs	Sub factors
1.	Reliability [Ability to perform the promised service dependability and accurately in the stipulated time]	(a) House keeping (Ready room, clean, comfortable, laundry) (b) Front Office (Reservation, Secure environment) (c) Engineering (Well equipped, proper working condition, good amenities) (d) F & B/Kitchen (Good food, minibar)
2.	Tangibles [Customer perception of physical facilities, equipment, personnel and communication materials in the other business units]	(a) Pool (b) Shopping arcade (c) Fitness centre (d) Business Centre (e) Restaurant (f) Conference (g) Banquet facilities
3.	Responsiveness [The willingness to help customer and provide prompt and comfortable service]	(a) Reception (b) Cashier (c) Doormen (d) Bell boy (e) Duty Manager (f) Room attendant (g) Telephone service (h) Respond quickly
4.	Empathy [The care and individual attentions towards customers]	(a) Guest relations (b) Recognise and anticipate needs (c) Courteous & warm welcome

Reliability

For achieving the targets and required rate of improvement in reliability, it is necessary to further analyse the sub factors to identify the inefficient process by evaluating the customer perceptions. The survey indicates that F&B/kitchen department needs improvement. It further reveals that the process improvement is related to the adequate stocking of the minibar. This would be possible if the procurement division keeps adequate stock of beverages which would entail an additional inventory cost of Rs. 20,000/-. Here the relevant sub process is inventory management. The performance drivers are inventory procurement and average inventory cost. The performance indicators are inventory turnover (days) and inventory

ratio. The gap analysis is shown in Table 3 and the financial performance of the process is represented in Table 4. These tables show, how qualitative gap in inventory is closed by internal benchmarking without affecting the profit of the organisation.

Table 3: Inventory management process gap analysis.

Performance Driver	Performance Indicator	Actual	Target	Rate of Improvement
Inventory procurement	Inventory turnover (days)	46	35	1.3
Average inventory	Inventory turnover ratio	8	10.42	1.3

Table 4: Financial performance with improved inventory management process

Measures	Actual (in Lakhs)	Target (in Lakhs)	% Change
Average inventory	1.50	1.17	22.00
Annual inventory cost	12.00	12.20	1.66
Total expenditure	280.50	280.70	0.07
Operating profit	497.16	497.16	–

Responsiveness

The efficient and prompt workforce responsiveness results in customer satisfaction and is purely depend on workforce availability and skill. This can be achieved by decreasing the workforce absenteeism and workforce turnover and imparting formal training. The workforce turnover and absenteeism per cent are the control ratio which determine the availability of workforce.

Table 5: Workforce process gap analysis

Performance Driver	Performance Indicator	Actual	Target	Rate of Improvement
Workforce availability	Availability index	0.654	0.785	1.2
Workforce skill	Revenue per employee	39628.20	45136.75	1.2

The data indicated that the turnover and absenteeism is 1.10 per cent and 2.50 per cent respectively in a workforce of 234. The availability of these parameter is 0.6545. Presently the revenue generated per employee with ordinary skill is Rs. 39,628.20. The rate of improvement considered for both availability and skill is 1.2 (Table 5). The availability can be increased by radically altering the employee selection development and employee rewards and recognition. The qualitative gap in workforce can be closed by imparting formal training and the skill can be monitored quantitatively by increasing in revenue per employee as a result of training. Table 6 shows the financial performance after considering the improvement in the workforce.

Table 6: Financial performance with improved workforce process

Measures	Actual (in lakhs)	Target (in lakhs)	% Change
Training expenditure per employee	–	21336.75	–
Total expenditure	280.50	285.50	1.78%
Total income	777.66	790.55	1.65%
Operating profit	497.16	505.05	1.58%
Net profit	174.96	179.01	2.31%

Empathy

This includes customer relations process which depends upon the organisations ability to recognise and anticipate the customer needs and exceptions. The improvement in this process is quantitatively reflected by the increase in number of customer acquired and retained. The existing budget for increasing the occupancy rate is Rs. 22.03 lakhs. In its present occupancy rate of 50 per cent, acquired customers are 40 per cent and retained customers are 10 per cent. Out of the total budget, Rs. 18.09 lakhs is an expense for acquiring customers and Rs. 3.94 lakhs for retaining customers. The management is spending Rs. 55/- for acquiring one customer and Rs. 30/- for retaining each acquired customer. The maximum customer acquisition and retention deemed possible by the management in 70 per cent and 25 per cent respectively, even if there is no limit to spending.

If the budgetary allocation for acquisition is increased by 9 per cent then expenditure per customer will become Rs. 60/- and target for acquisition rate will be 42.20 per cent. As a result of this, the total rise in customer will become 5.5 per cent. The revenue will increase by 4.2 per cent and the expenditure will increase by 0.57 per cent. The gross Profit and net profit will increase 6.24 per cent and 9.51 per cent respectively. Similarly, if the budgetary allocation for customer retention is increased by 16.75 per cent (i.e. Rs. 66,000/-) then expenditure per customer will become Rs. 35/- and the target for retention will be 11.22 per cent. As a result the total number of customers will increase by 12.20 per cent. The total revenue, expenditure, gross profit and net profit will increase by 2.33 per cent, 0.23 per cent, 3.52 per cent and 5.37 per cent respectively. Table 7 and 8 show the gap analysis and financial performance improvement for the customer relation process.

Table 7: Customer relations process gap analysis

Performance Driver	Performance Indicator	% Actual	% Target	Rate of Improvement
Customer acquisition	Acquisition rate	40	42.20	1.055
Customer retention	Retention rate	10	11.22	1.12

Table 8: Financial performance with improved customer relation process

Measures	Actual (in lakhs)	Target (in lakhs)	Change (%)
Process expenditure	22.03	24.31	10.35
Total expenditure	280.50	282.78	0.81
Total income	777.66	828.48	6.53
Operating profit	497.16	545.70	9.76
Net profit	174.96	201.00	14.88

Table 9: The final scorecard

Customer Perspective					
CSFs	Actual	Target	Rate of improvement		Priority
Reliability	30.76	40.00	1.30		I
Responsiveness	20.94	25.00	1.20		II
Empathy	8.33	10.00	1.20		III
Tangibles	18.20	25.00	1.37		–
Internal Business Perspective					
Sub-process	Performance Driver	Performance	Actual	Target	Rate of Improvement
Inventory management process	1. Inventory procurement	Inventory turnover (days)	46	35	1.3
	2. Average inventory	Inventory turnover ratio	8	10.42	1.3
Workforce process	1. Availability	Availability index	0.654	0.785	1.20
	2. Skill	Revenue per employee	39628.20	45136.75	1.20
Customer relation process	1. Acquisition	Acquisition rate	40%	42.20%	1.055
	2. Retention	Retention rate	10%	11.22	1.12
Financial Perspective					
Customer satisfaction	1. Acquired customer		13140	13865	5.5
	2. Retained customer		3285	3686	12.2
Growth	Sales growth		777.66 lakhs	841.37 lakhs	8.2
Profitability	1. Expenditure		280.50 lakhs	287.78 lakhs	2.6
	2. Operating profit		497.16 lakhs	553.59 lakhs	8.2
	3. Net profit		174.96 lakhs	205.05 lakhs	17.2

Results and Discussion

Quality Analysis

Process quality analysis is a key to total customer satisfaction. Along with QBD technique, Ishikawa diagram also has been used to locate critical sub-processes and carryout the process quality analysis. The result of the inventory management process is two fold: (i) increased service level and (ii) reduced time for procurement and sales. In the workforce process, the formal training, improves the skill and availability of workforce which ultimately improves the level of service along with the financial performance of the organisation. Small investment in customer relation process tremendously increase the customer acquisition rate and customer retention rate. Consequently, it increases the occupancy rate and organisation's profit.

Financial Performance Results

The result of achieving total customer satisfaction with necessary improvement in the process and sub process is an improvement in the financial performance. The target set for financial measures is on the basis of strategic focus benchmarking which is concentrated on strategic competitive strength and weaknesses. Table 8 shows the final scorecard representing the customer perspective, business process perspective and financial perspective.

Conclusions

Understanding customer expectation is a pre-requisite for delivering superior service in hospitality industry, since customers compare perception with

expectations when judging company's service. The QBD is an excellent tool to rank the customers expectations for benchmark. For the identified CSFs, it revealed that customers expectations are in the decreasing order of magnitude namely, reliability, responsiveness, empathy and tangibles. The case study recognizes that customer expectations and process improvement make a difference in financial results. QBD requires extensive data, rigorous analysis and combined judgement of key decision makers. The outcome of this process is both profit and growth and is reflected by the financial measures for each process improvement.

The case study through QBD has brought forward these perspectives: customer perspective, business perspective and financial perspective which are equally important in determining the success of the company.

A real commitment to continual improvement at all levels of company is an essential requirement for successful application of QBD. Those organisations which begin to implement continual improvement, total quality management (TQM) and just-in-time (JIT) will be in a better position to take position to take advantage of QBD for gaining a competitive advantage in a dynamic market environment. □

Corrigendum

The acknowledgement at the end of the paper "Industrial Training, Skill Development and Innovation" by G.D. Sandhya and N. Mrinalini (p. 225) in Vol. 39, No. 2, may be read as:

Acknowledgement

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Feature

Adoption of Quality Management Concepts Amongst Indian Manufacturers

B. Bhadury & P. Mandal

The adoption of quality management concepts and its tools is in transient state in Indian manufacturing. Owing to liberalization of the Indian economy manufacturing industry is experiencing an increasing pressure for improvement in quality of its products and services, for which it is adopting tools and techniques of quality improvement. In general, there has been an appreciable improvemeent in the adoption of quality concepts in recent years in the Indian manufacturing industry. Though in the past a few sporadic attempts were made to assess the extent of adoption of quality concepts, no sincere attempt has been made to study the extent of adoption of quality concepts in a historical perspective. The work reported here reveals the propagation of quality management practices among Indian manufacturing companies over a period of sixteen years, from 1980 to 1996. The present paper reports the findings of a mail questionnaire survey conducted on 500 selected companies in 14 types of industries. The extent to which quality management practices have been implemented are reported and the obstacles to adoption are identified. The survey also identifies the role of government for promotion of quality in industry and R&D activity.

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Introduction

The practice of quality management techniques helps companies to improve internal efficiencies (Baker, Potter and Schroeder, 1993; Gunasekaran, Korukonda and Yli-Olli, 1994) and become more competitive (Reed, Lemak and Montgomary, 1996; Sohal, Ramsay and Samon, 1992). However, this may not be the case in developing countries where the economies are primarily regulated by government policies and the scope of fierce competition is restricted. In a regulated market economy the companies may enter into competition not necessarily based on the operational efficiencies but due to other considerations such as socio-economic, human and political factors. Regulated market economies have protected their companies from both external and internal competitions for a long time and this has resulted in a different kind of industry setting-distinctively different from what is observed in the Western economies.

Especially during the second half of 1990s, rapid invasion of modern quality concepts for regulated economies has taken place in developing countries (Adam Jr., *et al*, 1996 and Rao, Raghunathan and Solis, 1996). However, it remains to examine that to what extent quality management concepts have been successfully adopted by companies in developing economies.

The present study attempts to answer the questions

In a regulated market economy the companies may enter into competition not necessarily based on the operational efficiencies but due to other considerations such as socio-economic, human and political factors.

raised above. Data for this study has been collected by means of a questionnaire survey to gauge the progress in the adoption of quality management concepts in the Indian manufacturing sector over the 16 years period from 1980 to 1996.

Survey Design and Methodology

As in many other countries, quality is a "buzz" word in India. The Indian economy was protected from external competition for a long time through planned economic development and only in the recent years open competition (internal as well as external) has been encouraged. Quality has become the 'slogan' with which Indian companies are trying to compete in the open market.

Many Indian manufacturing companies have taken up the difficult task of spreading awareness of quality concepts among their employees and the subsequent implementation of these concepts. This is evident from newspaper reports of more and more companies being certified to ISO9000 standards. The industry as a whole is experiencing an increasing amount of pressure to improve quality of its products and services. This pressure is coming from both domestic and foreign competitors.

Many Indian manufacturing companies have taken up the difficult task of spreading awareness of quality concepts among their employees and the subsequent implementation of these concepts.

Motwani *et al*, (1992) conducted a study to identify the degree to which quality management practices were present in Indian manufacturing organisations. This showed that the modern concepts of quality management were practiced in general by the large Indian manufacturing organisations. Quality certification is becoming an acceptable way of enforcing quality concepts in India. According to a Survey (Confederation of Indian Industries, 1995) among ISO9000 certified companies, 54 percent of 330 respondents stated that there had been an improvement in their product and process quality after obtaining certification. Again study conducted by Philipose and Venkateswarlu (1980) showed that only 24.0 per cent of the Indian manufacturers used control charts while 32.0 per cent used some type of sampling plans. In fact, at that particular point of time, quality concepts were limited to the use of acceptance sampling and process control charts.

The aims of the present study on quality management comprise:

- The types of quality management practices that are being followed and the number of years they have been in practice;
- The level of implementation and the aspects of quality management which are being followed;
- The obstacles to implementation of quality practices and their causes;
- The benefits from the use of quality management practices;
- The role of government in the promotion of quality management amongst Indian manufacturing organisations.

The questionnaire has been designed as per the procedures (Oppenheim, 1992). The questions were framed to enquire into various aspects of the implementation of quality management practices. Additional questions were asked regarding the sources of training on quality management practices. Besides the survey design conformed to:

- ISO 9000 guidelines with respect to vocabulary was referred to for the standardisation of terms used in the questionnaire;
- Questions were aimed at collecting information on quality management practices from 1980 to 1996.

Two sample questionnaire were available as aids in thee task of preparation of the questionnaire, namely the Advanced Manufacturing Technology survey form (Sohal, 1997) and Geelong Regional Quality survey form (Mandal, 1995). However, these pertained to the Australian industry conditions and specifications, and did not match the conditions of Indian manufacturing industry. Consequently sample questionnaires are useful as reference.

A total of 500 medium to large manufacturing companies were selected from different regions of India for this survey. The questionnaires were sent to the works address in preference to corporate office address so that Works Manager or the General Manager of Works could furnish all the information sought in the form. The addresses of companies were selected from the Directory of Indian Industries (Arokiasamy, 1996).

After reviewing the responses by mail, it was decided to interview some of thee respondents by visiting their organisation. Thee reasons for this was to:

- take their practical suggestions and experience into consideration;
- discuss the work related to quality being done in their organisation;
- discuss the initial results from the analysis of the responses received, and
- collect the questionnaire responses if there was any company in that location which had not responded till then or remind the concerned person to complete the survey form and return it as quickly as possible.

Response to questionnaire from industries such as textile, cement, paints, tyres and computers was poor despite reminders after 1 month. Hence, another reminder letter along with the fresh questionnaire form was sent to selected 60 companies. Their responses were crucial from the analysis point of view and for the purpose of obtaining the status of quality management practices in these industries. A total of 102 usable responses were received which amounted to response rate of 20.40 per cent.

Quality Management Practices

Attitude Towards Quality Management Practices

Opinion was sought on the current attitude of the respondent's company on the use of Quality Management Practices (QMP) after the liberalisation of the Indian economy. A high 90 per cent of the companies felt that the current attitude to QMP is supportive whereas the remaining 10 per cent of the companies felt that there has not been any change. Their response indicate that after the opening of the Indian economy, the focus has shifted to quality and the use of QMPs to face the competition resulting from the entry of multinational corporations (MNCs) in India. This was also ratified by the discussion conducted during the interviews of industry personnel and quality experts.

Their response indicate that after the opening of the Indian economy, the focus has shifted to quality and the use of QMPs to face the competition resulting from the entry of multinational corporations (MNCs) in India.

Questions were also asked as to which type of quality standard certification had been obtained by the respondent company, the time taken to obtain certification and whether the certification was for the entire company or a particular division/production unit(s). The results are shown in Table 1.

Table 1: Certification to Quality Standards

	Number of Responses	% of Respondents
ISO 9001 Certification obtained	38	37
ISO 9002 Certification obtained	41	40
Both ISO 9001 and ISO 9002 obtained	4	4
In the process of obtaining ISO 9001 Certification	6	6
In the process of obtaining ISO 9002 Certification	11	11
Industry specific standard obtained	2	2

A large number of responses came from ISO 9000 certified companies (81 per cent). At present there are more than 1,500 companies in India certified to ISO 9000 standards[14]. However, according to Taylor (1996) this number is very low compared to the United Kingdom, having 22,000 certified companies in 1993.

Table 2: QMP in Industry

Practices	Percentage of respondents adopting the practice
Total Quality Management (TQM)	52
Statistical Process Control (SPC)	67
Quality Circle (QC)	48
Hundred Per cent Inspection (HPI)	60
Sample Inspection (SI)	83
Batch Inspection (BI)	62
Quality Certification (Q CERT)	73
Benchmarking (BM)	28

It is significant to note that as many as 52.0 per cent of the respondents are practicing TQM (Table 2). TQM in India is still in the nascent stage. Until recently there was no market compulsion to embrace modern quality management practices by Indian organisations. TQM has been adopted to a large extent by companies located in the western region. These facts were also established during discussion with industry people. A reason for this is that most of the multinational

Table 3: Year-wise Spread of Quality Management Practices

	Number of Responses									
	Before 1980	1985	1987	1989	1991	1992	1993	1994	1995	1996
TQM	–	2	2	1	10	5	5	12	10	3
SPC	15	5	6	1	6	8	4	9	12	2
QC	2	4	4	8	5	3	8	7	5	2
HPI	46	2	6	4	1	8	2	3	1	2
SI	62	6	4	1	8	2	3	1	2	1
BI	47	5	1	1	5	5	20	24	15	6
Q CERT	–	–	–	–	5	5	20	24	15	6
BM	–	3	2	–	4	2	5	3	5	3

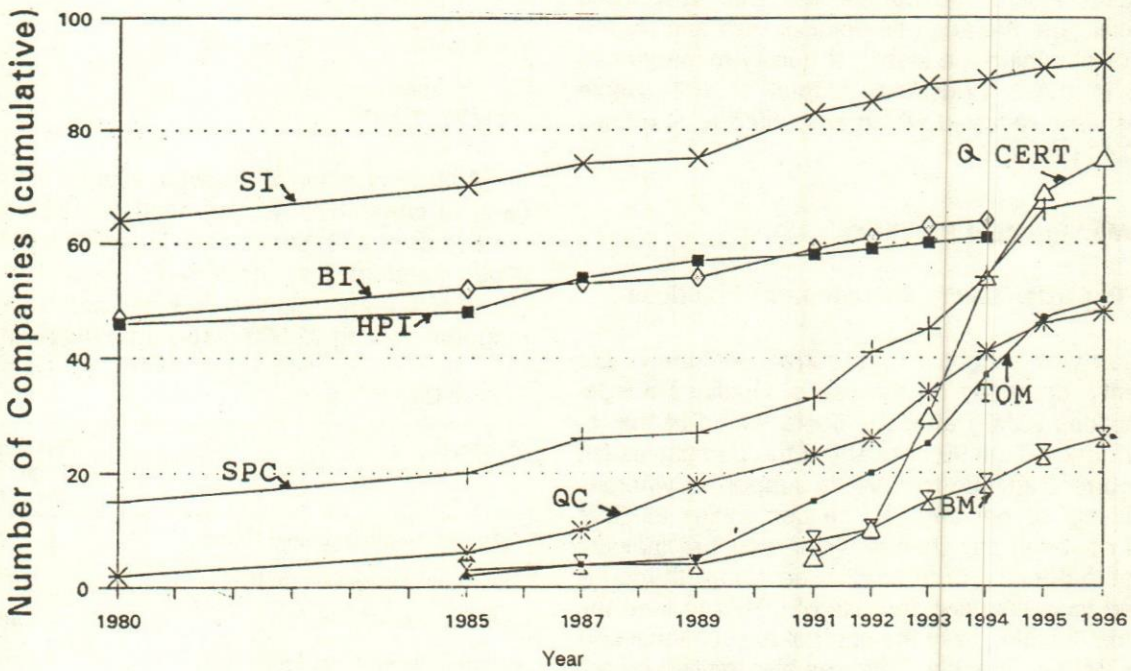

Fig 1. Spread of Quality Practices

companies are located in the western region of India and these companies are more receptive to new ideas such as TQM in comparison to their native counterparts.

Until recently there was no market compulsion to embrace modern quality management practices by Indian organisations. TQM has been adopted to a large extent by companies located in the western region. These facts were also established during discussion with industry people.

Hundred per cent inspection (HPI) is being carried out on a large scale (60.0 per cent). It is prevalent in all types of industries and dominated by the automobile (70.0 per cent), machinery equipment (73.0 per cent), electronics (72.0 per cent), electrical (58.0 per cent), primary metals (57.0 per cent), and chemical (46.0 per cent) industries. HPI is mainly practiced in critical areas of manufacturing and inspection.

A survey conducted by Philipose and Venkateswarlu (1980) showed that only 24.0 per cent of Indian manufacturers were using control charts and 32.0 per cent were using sample inspection. The present study reveals that there has been a vast improvement in the use of control charts and sample inspection. This increase has resulted

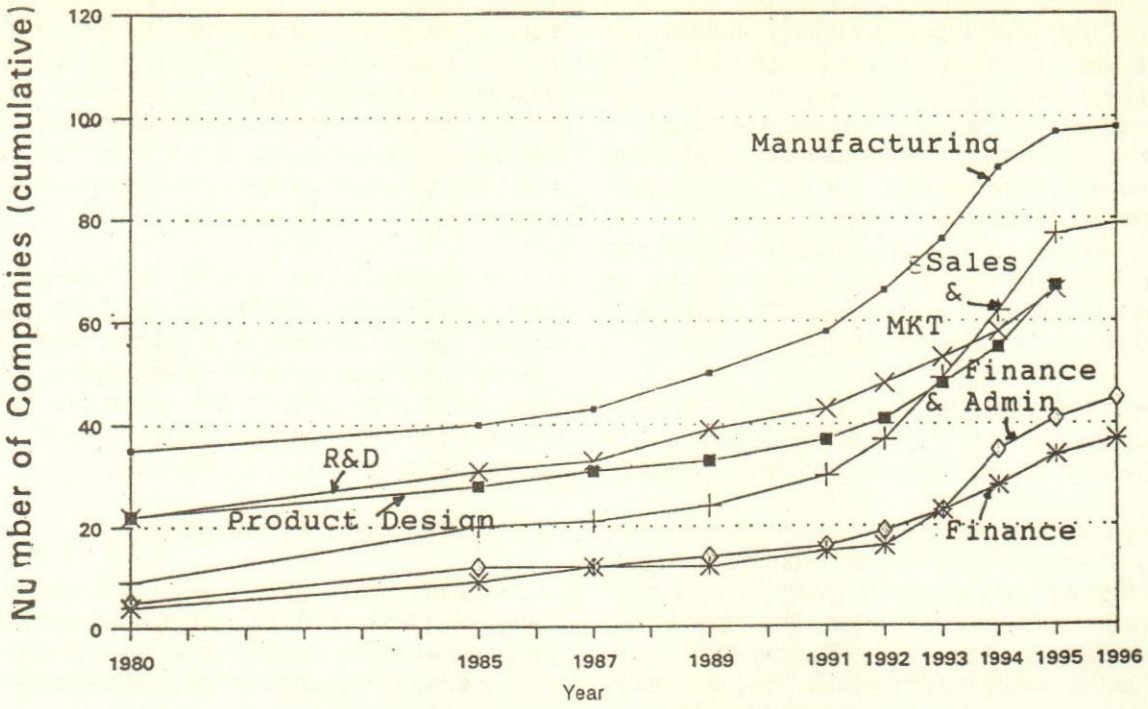

Fig. 2. Implementation of QMPs in Functional Areas

from greater awareness and higher competition in the mid-nineties urging companies to manufacture superior products. Quality Circles (QC), which are an important component of TQM, are being practiced by less than half of the organisations. QC has universal application in all functions of an organisation. By which employee participation can be increased to solve problems. If QC concept is effectively implemented, it will contribute towards team working, harmony and participation of every one in an organisation for continuously enhancing total quality and productivity.

If QC concept is effectively implemented, it will contribute towards team working, harmony and participation of every one in an organisation for continuously enhancing total quality and productivity.

Other quality management practices that have been adopted by Indian manufacturers are design of experiment (DOE), analysis of variance (ANOVA), business process re-engineering (BPR), good manufacturing practices (GMP), quality improvement projects, JRD-QV Evaluation[1], total productive maintenance (TPM), demeriting program, loyalty build up (helping suppliers for single sourcing of materials), target area control, Kaizen, 5S, and waste elimination.

Respondents were asked to indicate which quality management tool(s) had been adopted in their organisation and the year in which it was first introduced. The summary of the year-wise spread of quality management practices is shown in Table 3.

Figure 1 shows in graphical form the spread of quality management practices among manufacturing companies. The line graphs show a distinct rise in the rate of introducing new QMP in Indian companies after 1991. This is the time when the Government of India took rapid measures in opening up thee economy to outside competition.

Table 4: Extent of QMP in Functional Areas

Functional Area	Fully	Partly	Not at all
Manufacturing	88%	12%	Nil
R&D Manufacturing	59	18	23
Marketing	44	28	28
Finance and Administration	19	30	51
Human Resources Management	39	32	29

Table 4 shows the extent of QMP in various functional areas in the respondent companies. From the responses,

1. JRD-QV is an award which is open to companies of large business house in India. The design of the JRD-QV award is based on the Malcolm Baldrige National Quality Award (MBNQA).

it was found that QMP has been mainly implemented throughout the manufacturing and manufacturing services area including R&D. This is only to be expected. However, the fact that a large number of implementations have been in marketing, human resources management and finance and administration is a very encouraging sign. Partial implementations were mainly in human resources management, finance and administration and marketing. It was also found that 51 per cent of the companies had not implemented any quality initiatives in the area of finance and administration.

The year-wise implementations of QMPs in major functional areas is shown in Fig. 2. All the major functional areas showed an increasing trend from 1980 onwards.

All major aspects of quality management function are being implemented in Indian organisations (see Table 5). Workers participation in quality management has the least response compared to other aspects but even in this case, the figure is significantly high. These suggest that the quality managers in Indian manufacturing companies are following a comprehensive approach to quality management and the approach comprises of simultaneous attention of top management support, employee training, worker participation, customer feedback and supplier quality evaluation. This is a very encouraging sign for Indian manufacturing.

Indian manufacturing companies are following a comprehensive approach to quality management and the approach comprises of simultaneous attention of top management support, employee training, worker participation, customer feedback and supplier quality evaluation.

Table 5: Aspects of Quality Management Function

	Responses (in per cent)
Active involvement of top management	96
Ongoing Training	91
Worker participation	81
Customer feedback	93
Supplier quality evaluation	85

Company Quality Policy

CQP exists in 92.0 per cent of responding organisations. It is heartening to note that 27.0 per cent of respondents had issued the CQP to their customers and 32.0 per cent to their suppliers. However, only 79 per cent of the respondents have circulated the CQP to all the employees of the company. It should be noted here that the CQP must be communicated to all employees involvement is to be expected.

Responsibility for quality is allocated to all managers/supervisors in 54 per cent of organisations, to quality control department in 28 per cent of the organisations and to some managers/supervisors in 7 per cent of the organisations. Fifty-seven per cent of the respondents indicated that responsibility for quality is given to all people in the organisation.

Quality Management Procedures

The incoming goods inspection is mainly through sample inspection in 80.0 per cent of the companies. The other respondents stated that a check on the supplier quality assurance system or self certification is practiced.

Vendors as part of company's quality management training program are not given enough prominence in Indian manufacturing industries. The vendors being prequalified in majority of the responding companies is highlighted by the response of 91.0 per cent. A large proportion of the companies have multiple vendors for the supply of materials. 37 per cent of the companies use multiple vendors for supply of all materials/components, whereas 59 per cent of the respondent companies follow the practice of multiple sourcing for some materials/components. Single sourcing of materials is practiced by only 4 per cent of respondent companies. The role of consultants in 80 per cent of the responding companies is for training and in 55 per cent of the responding companies is for introduction of new practices. Thus, there is a need for well qualified and experienced consultants.

Thirty-seven per cent of the companies use multiple vendors for supply of all materials/components, whereas 59 per cent of the respondent companies follow the practice of multiple sourcing for some materials/components.

Obstacles to Adoption of QMP

Respondents were asked to express their opinion on whether they agree or disagree to the existence of obstacles to the use of QMP. Fifty-one per cent of the

respondents agreed while the remaining 49 per cent disagreed. Because of the small difference, it is difficult to arrive at any conclusion and further investigation/discussion is required to reach any consensus.

Table 6: Obstacle to Non-Use of QMP

	Response (in per cent)
Too expensive to introduce	4
Benefits less than costs involved	12
Resistance by managers/supervisors	15
Resistance by employees	7
Lack of understanding by managers	25

The obstacles to the non use of QMP throughout the company are mainly (i) a lack of understanding by managers (25 per cent) and (ii) resistance by managers/ supervisors (15 per cent). The benefits being less than the cost involved is another important factor and 12 per cent of the respondent felt this to be an obstacle. Whereas 7 per cent stated it to be resistance by employees and only 4 per cent felt that it was too expensive to introduce (see Table 6). The remaining respondents had marked this question as not applicable to them. Some of the respondents had written that because QMP was introduced in a phased manner, there was no resistance from the employees.

The causes for such obstacles in the adoption of new practices are mind block, old habits and the lack of co-operation of the employees resulting in resistance. Perceived threat to job security is another important factor giving rise to less support for the new initiatives. The major problems encountered in the implementation of quality initiatives are technical (43 per cent), managerial (45 per cent), cultural change (84 per cent) and financial (24 per cent). The respondents identified that cultural change is the major problem encountered in implementing quality improvement programs. Managerial intervention is the next major problem area. Cultural change is the physical and mental attitude towards change or introduction of new practices. Old habits are difficult to change when new techniques of doing things are implemented or introduced.

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R&D activities are linked closely to the QMP in 80 per cent of the organisations. The expenditure on R&D as percentage of annual sales revenue is small, and in most cases, it is less than 1 per cent. Ramchandran (1996) estimated that R&D investment as percentage of sales turnover was around 0.61, whereas it was about 0.51 per cent in 1992 as per Deptt. of Science and Technology Study (1993). Training of QMP in the respondent companies is provided mainly by private consultants (in 69% of the companies). Bureau of Indian Standards (in 25 per cent of the companies) and foreign collaborators/consultants (in 31 per cent of the companies) are the major providers of QMP training.

With regard to the support from government in QMP implementations, about 54 per cent of the respondents expressed that the support was not adequate, whereas 26 per cent felt that the support was sufficient. Grants, subsidies and help in promoting quality are the various forms of assistance sought by the respondents. A number of respondents indicated that assistance from government in the form of remittance of quality standard certification costs, exemption of import duty to buy equipment for calibration and a government policy for quality improvement would accelerate the adoption of quality improvement programmes amongst Indian organisations.

A number of respondents indicated that assistance from government in the form of remittance of quality standard certification costs, exemption of import duty to buy equipment for calibration and a government policy for quality improvement would accelerate Indian organisations.

Major Findings

The analysis presented above leads to the following major findings:

1. TQM is prevalent in majority of the manufacturing companies in India and there has been an upward trend in its adoption since 1985. TQM being a good strategy for improving organisational performance, the Indian manufacturing

companies should implement TQM in enhancing quality of products and organisational culture.

2. Traditional quality management tools such as Statistical Process Control (SPC), Hundred Per cent Inspection (HPI), Sample Inspection (SI) and Batch Inspection (BI) have been in use in manufacturing companies even before 1980.

3. Quality Circles (QC) had its root established in India during the early part of 1980s. At present almost one-half of the responding companies are implementing Quality Circles. QC, being an important constituent of TQM, are expected to generate greater people participation and teamworking in Indian manufacturing industry.

4. Benchmarking is comparatively a new technique in Indian manufacturing and has been implemented rapidly since 1991.

5. Certification to ISO 9000 standards is being actively pursued by Indian manufacturers.

6. The level of implementation of quality management practices is mainly concentrated in the manufacturing and its related services areas. Marketing, human resources management, finance and administration functions have received attention in recent years.

7. Active involvement of top management, ongoing training, worker participation, customer feedback and supplier quality evaluation are the main activities identified amongst the responding organisations. This indicates a positive sign for effective implementation of QMP in Indian manufacturing.

8. There appears to be little understanding of the extent of benefits that may be derived from quality initiatives by Indian managers. Very few respondents provided concise answer and in most cases the reason was cited to be the lack of statistical data. Direct interviews with industry experts revealed that the benefits of quality initiatives are associated with many factors such as new technology import, market demand, inflation, etc. A study amongst ISO 9000 certified companies [8] reported improved product quality in 49 per cent of the companies, lower cost of manufacturing in 23 per cent of the companies, reduction in customer complains in 39 per cent of the companies and higher motivation in 36 per cent of the companies.

9. The major impediments to the adoption of quality management practices in Indian manufacturing is the lack of understanding by managers, resistance by supervisors/managers and the benefits being less than the cost involved to implement new practices. The causes for such obstacles are: mind block, old habits and lack of co-operation resulting in resistance from the employees. Job security is another important factor giving rise to less support for the new initiatives.

10. Quality is becoming the responsibility of all the employees in Indian organisations rather than just the quality control department.

11. R&D (a major driving force for quality improvement) is attracting investment only to the order of less than one per cent of sales revenue. R&D investment should be increased in order to face stiff competition resulting from the entry of multinational corporations in India.

12. A proper estimate of quality related training expenses in Indian manufacturing companies is not available. Even though 81% of the respondents were certified ISO 9000 standards and the clause numbers 4.16 and 4.18 of ISO 9000 standard makes it mandatory to maintain such records, most of the companies failed to provide details of their training expense budget. Commercial secrecy and unwillingness in sharing this information with others are believed to be the main reasons.

Discussions and Conclusions

The research reported in this paper provides much needed information on the nature of quality management practices in Indian manufacturing industry. The survey of practices over a 16-year period (1980 to 1996) established, in a historical perspective, the quality management practices, quality policies and barriers to quality management practices.

The analysis of survey data shows that there is an upward trend in the implementation of quality management practices in all the functional areas such as manufacturing, human resource management, marketing, finance and administration and R&D. The rate of adoption of quality concepts in Indian manufacturing in recent years, mainly after 1991, is high and coincides with the liberalization of the Indian economy.

Indian manufacturing industry has adopted the necessary strategies to improve its quality management practices in order to face the challenges brought upon to it due to liberalization of the economy. In our opinion, Indian manufacturers should focus on the following

three important areas in order to establish itself as a strong and competitive sector of the economy.

Firstly, the management of manufacturing companies should stress on improving organisational culture. This is important from the point that in order to achieve and sustain excellence, organisational culture has to be transformed to one of team working, harmony and participation. Only then can a long term gain in quality and productivity be achieved. The essential tasks are:

(i) The implementation of quality circle concept.

(ii) Maintaining transparency in decision making and involving people in implementing workplace changes.

(iii) Giving recognition to individuals for new ideas in improving products and manufacturing processes.

(iv) Improving the sense of ownership amongst employees.

(v) Educating everybody about the products being manufactured, processes and the end use of the products. Education should also focus on the value addition aspect of everyone's job.

Secondly, quality improvement through upgrading of technology should be looked into seriously. A vision of world class quality with obsolete technology can never be achieved. To upgrade the existing technologies manufacturing companies should increase R&D investment from its present level, which is about one per cent of sales turnover. It is heartening to note that to boost R&D investment after the liberalization of the economy the Government of India has taken the following steps:

(i) Income tax relief on R&D expenditure.

(ii) Weighted tax deduction of 125% to industries for sponsoring research in national R&D laboratories, in any of the five Indian Institute of Technology and universities.

(iii) Accelerated depreciation of 40% on new plant and machinery for manufacturing goods from indigenous know-how.

(iv) Custom duty exemption on specified goods for use in R&D projects funded by industries and undertaken by in-house R&D.

(v) Full exemption from excise on goods manufactured from indigenous know-how and patented in India.

Thirdly, manufacturing companies should be in the lookout for the training and development opportunities that may exist within India and abroad. It was noted during the interviews that organisations such as Confederation of Indian Industries, Bureau of Indian Standards, National Productivity Council and Associated Chambers of Commerce were deeply dedicated to the needs of the manufacturing industry. Many companies have benefited from these organisations for their efforts and practical training on quality management practices. These organisations had been acting as catalysts in changing industry practices and keeping them abreast of latest development in the world. The role of training providers is of paramount importance to manufacturing industry, particularly in the following areas:

(i) to identify and strengthen the industry in training and implementation of quality management practices.

(ii) to keep the industry and government abreast of global developments and provide up-to-date information.

(iii) to work towards globalisation and integration of Indian industries into world economy.

(iv) to create awareness and support industry efforts on quality and customer satisfaction.

(v) to meet the training needs of small, medium and large companies.

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Feature

Japanese Management Techniques in Indian Construction Sector

Dhawal Mehta & Niraj R. Shah

In construction industry, raw material and labour comprise the bulk of the total cost (about 75 per cent) coupled with the problem of frequent exodus of trained labour. This puts the industry in India out of competitive edge in global construction industry. Against this background, Japanese Management techniques, viz., the so called 5S-s are highly relevant. for adoption in Indian construction industry. Case studies highlighting the comparitive performance of Japanese and Indian construction companies are included in the present paper.

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Construction Industry: An Over-View

An important economic activity providing vital infrastructure facilities for national growth is the construction industry. It is the second largest activity after agriculture in India. The proportion of outlay for construction is about 50 per cent of national plan, which makes it the single largest planned outlay. It plays an important role in the building of the nation and in India it employs approximately 21 million people. In order for the construction industry to pick up momentum, modern construction techniques and technologies will have to be adopted. Time and cost overruns are common features which push the total cost upwards.

In order for the construction industry to pick up the momentum, modern construction techniques and technologies will have to be adopted.

In construction, raw material and labour comprise the bulk of the costs in the industry, at around 75 per cent of total cost. The industry is marred by the absence of a committed labour force. Frequent exodus of workers to farming leads to de-skilling of labour. But with the entry of MNC's in the field, the industry is feeling the need for an organized and regularly trained workforce. The present paper is concerned with applicability of Japanese management techniques to Indian construction sector.

Japanese Scenario

A recent study, by FORTUNE magazine, based on annual revenues shows that out of 500 big organisations of the world, 126 organisations are only from one small country – Japan! In these top 500 organisations, there are 13 construction engineering com-

panies, out of which 9 are from Japan followed by France (3) and US (1).

Japan, a country so devoid of natural resources has out-produced many industrial giants with vast resources and from a land of scarcity has become a land of abundance. In fact, Japanese Industry has very little competitive advantage as competitive advantage is traditionally understood. There is no oil gushing out of the ground. There are no vast mines reaping with iron core. The coal veins are poor and uneconomical. The forests are scraggy. The country cannot even grow enough food to feed its people. Then why is Japanese industry considered such a threat in so many lands?

Japan, a country so devoid of natural resources, has out-produced many industrial giants with vast resources and from a land of scarcity has become a land of abundance.

A decade before and after World War II, Japan was ill-reputed for the quality of its products. Now the tables have turned. Japanese companies have become the synonymous for quality products with comparatively low price and considered threat to many companies in several countries.

How does Japan do it? This question has been puzzling business people, scholars and consumers alike. Most of the scholars, studying the success of these, attributed the secret to techniques such as Just-In-Time (JIT), KANBAN, Quality Circles, Total Waste Elimination, Poka-Yoke, Total Quality Management, etc. However, none of these, or the cultural factors can be accorded the credit, in absence of the most important common factor, the 'KAIZEN system'.

The Japanese Management Principles are being accepted and used very effectively by Western and European organisations. Some Indian organisations are also using these principles very successfully, e.g. Maruti Udyog Ltd., Escorts Ltd., Modi Xerox, J.K. Jutes Ltd., etc., while in the construction sector, many of the companies are now becoming more conscious about 'Quality' and are trying to get the ISO 9000 certificate for Quality Assurance to survive and grow in globalized and privatized cut-throat market.

Management Philosophy

Japanese philosophy of management mainly revolves around time schedule of project construction, irrespective of any constraints whatsoever. Any time overrun is viewed seriously and adversely at moral, social, political, and official levels and brings bad name to the organisation. According to Japanese, "*Jikan*", the Japanese word for time, is the essence of their working. Cost is a function of *Jikan* (time). Therefore time overruns are avoided as far as possible even if there may be loss on the project by increased manpower, additional mobilization of machines and equipment and working round the clock.

Sincerity, dedication, determination and honesty towards the work are the tenets of the Japanese culture. They work for the project, for the company, for the country, and for the self in the last. They do not postpone any activity for tomorrow and work as per the requirement of job. Their day finishes only when their day's job target is completed. They believe in finishing as much work as possible in the beginning of the project itself even if it may not be required immediately. This philosophy is similar to that of Indian proverb, "*Jo Kal Karna Hai So Aaj Kar, Jo Aaj Karna Hai So Ab*". But Japanese practise it in real life and try to achieve as far as possible.

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Working Environment

Their next important concept of working is that the progress and achievement of any activity depends upon advance future planning, detailing from macro to micro level, in-depth and detailed study of each activity, thorough and full preparation for the next activity in time, timely mobilization of resources, quick decisions and efficient communication. They work under a system which has been outlined and coded on the basis of past experiences and performances. In Japanese system, contribution of individual may not be very significant but as a team they are very strong.

The basic system for any activity or project the Japanese are adopting is the PDCA cycle: Plan, Do, Check, and Act. In this system, Japanese spend more time on planning. They plan each and every activity, macro to micro, in detail and prepare an executory system for them. On the basis of the planning they execute the project/activity precisely. This gives some result for

checking and analyzing. And the analysis opens some more doors/fields for improvement actions.

The act becomes the problem for the next cycle and the planning is being done. Thus, the PDCA cycle runs continuously. For planning and executing of any task, an encouraging environment should be there with simplified tasks which reduces the time to complete the task and also reduces/eliminates the wastage.

Japanese Management Techniques

The Japanese also use some of the general management tools/techniques in construction industry, such as:

5-S: This is a systematic fundamental technique for improvement activities in house-keeping, inventory control etc.

Seiri	= Structurize
Seiton	= Systemize
Seiso	= Sanitize
Seiketsu	= Standardize
Shitsuke	= Self-Discipline

TPM: Total Productive Maintenance concept for upkeep of the equipment, aiming at *zero* down time with the help of Total Employee Involvement.

TWE: Total Waste Elimination concept for eliminating the wastage of any form at any stage of the execution of the project/activity.

JIT: Manage your resources such a way that there is no shortage or unnecessary storage of materials, which leads to unnecessary blockage of the funds.

KANBAN: It is basically an information system, to support JIT system.

POKA YOKE: It is a Japanese word meaning error-proofing system in support of *zero* defect operations.

TQM: Total Quality Management a systems approach for problem solving and is a high road to KAIZEN culture.

By implementing these methods, the complexity of the work reduces. Thus the simplified and systemized process help the employees to perform their tasks more effectively and efficiently.

Application of these tools/techniques on a regular basis to achieve continuous improvements is known in Japanese principles as 'Kaizen'.

The main mottos of Japanese Project Management are: Safety with no accident; Completion in time; No cost overruns and Quality as committed.

It is very clear that the concepts and principles followed by the Japanese are not new. These common concepts are well known to everyone. But the most important thing is how sincerely these are practised and in what ways these are adopted in real working. Sometimes, Japanese smile and say:

"The bamboo aptly depicts the traits found in the Japanese People. It can be bent or stretched, but when released, snaps back to its original form and strong. The Bamboo's resilience, strength flexibility and longevity are legendary. The bamboo's influence on Japanese life is all pervasive."

For purpose of case studies two companies one in Japan and one in India where chosen: (A) M/s. Obayashi Corporation and (B) ABC Ltd.

The Japanese Corporation

M/s. Obayashi Corporation is a Japan based public limited construction company. The company has started its business in 1882 by doing domestic construction work. After World War II, the company has played a major role in redevelopment of the country to stand and grow out the ashes of the bombarding over its two major cities.

The company's corporate office is in Tokyo, Japan with 88 domestic branches and offices and 18 overseas offices. There are more than 800 large scale project underway all over the world. The company carries out the designing and construction work of bridges, airports, piers, roadbeds, trestles, stations and commercial/residential high rise buildings.

Quality Policy of the Company

To provide customers with good quality product through the implementation of Quality Assurance programme established basically upon the requirement of applicable specifications and contractual obligations.

Responsibility of every individual assigned to a project is to yield a quality product which will meet the need and requirement of the customer's within the stipulated time. For this the department has planned and established Quality Assurance and Quality Control

manuals both designed to promote uniformity of working and eliminate deficiency from work. The implementation of Quality Assurance (QA) programme is monitored by conducting regular audits to ensure that the work is progressed consistently in accordance with the established manuals. The department is also responsible for the implementation of QMS including the overall management of overseas projects carried out by the department."

Quality Objectives of the Company

The department is committed to achieve the following quality objectives whereby the target is defined by the management team as follows:

(a) Schedule: Zero day/project delay

(b) Budget : Final Budget < Initial Budget

(c) Quality : Repair cost shall not be more than 0.3% of the contract sum.

(d) Safety : Zero accidents for all projects.

Application of Japanese Management Principles

The company has developed its own quality control programme. Obayashi's total quality control programme was originally called SSK – *sogos* (overall) *shitsu* (quality) *kanri* (control) – was renamed SK. The SK is a integrated quality control system of the company which consists number of management principles for the quality work.

Obayashi views SK as a corporate wide endeavor, and they are constantly searching for ways to improve every phase of company activity. It pays close attention to facility lay-out, materials handling stores lay-out to avoid mixing of materials, spoilage etc.

On the work site of the bridge construction, there are many big machinery and plants. For easy and smooth working condition, there should not be any breakdown of equipment during the construction period. For this, the site management uses the Total Productive Maintenance technique.

For each plant/equipment, a team is formed which includes the maintenance engineer/s, operator/s and helper/s of the equipment. 5-S is done daily by all team members twice. They check the fuel level, lubricating oil level, air pressure, water coolant level, etc., as per the type of the equipment. As 5-S is done by the operator/helper, any minor or major fault is found out immediately. Periodical checking of the plant/equipment is done which includes the checking of the inner side of the machinery, washing/cleaning the whole/partly equipment, etc.

As a part of TPM, the auditing team checks the equipment condition periodically based on some defined criteria like reliability, safety, maintainability, etc. The equipment history record is prepared and maintained by the engineer-in-charge (with the help of the operator/s), which contains the history of equipment like date of purchasing, type/make of equipment, total working hours, total breakdown hours, idle time, efficiency in terms of fuel and lubricating oil, output, etc. With the help of the history card, the overall equipment effectiveness is found out which indicates the area/parts for improvement/maintenance as also the losses due to breakdown, if any. The goal of the TPM team is to achieve zero breakdown of plant/equipment during the operation.

The site management team of the project firmly believes in the PDCA (Plan, Do Check, Act) cycle for the management of the project. Project planning is done very systematically. As per the availability of the resources and time limit with due regard to the Quality of work, the project is divided into major activities. The activity, then, is divided into many micro activities with detailed resource allocation. For example, for the concreting work of a pier, the activity is micro-planned with the duration of the activity, the person/s in-charge for the activity, requirement of skilled/unskilled manpower for procurement, requirement of specific type of equipment/plant, requirement of raw materials for the work, etc. For performing any activity, the system is designed precisely so that there is no ambiguity about the work among the employees. This system helps to complete the task very easily in time and with quality.

After planning the activity, the activity is performed as per the planning only. The whole project is monitored under the direct supervision of the Dy. Project Manager (Execution) and his team. In the periodical meetings, the progress of the project is reviewed and the decision for overcoming any difficulty is taken very promptly. For monitoring of the project, Dy. Project Manager uses the computer softwares like MS-Project and Primavera.

Waste Elimination

The employees, the operators and other concerned employees do TPM for maintaining *zero break-down* level for plant and equipment and the top authority plans and monitors the project very effectively. Thus the chances of the wastage in the process is very few.

The stores being well organised, the site is clear for easy transportation, so that wastage in time to find out/sort out any material is less. As the site layout is

very effective, wastage in motion of workers and plants is minimised.

As the objective of the planning is to 'make it easy to do things right and difficult to do things wrong', quality is achieved easily without any addition cost.

The Indian Enterprise

ABC Ltd., is a major public limited construction company in India. They are Construction Engineers and Contractors. The company carries out the design and construction work of bridges, aquaducts, tunnels, dams, cooling towers, chimneys, commercial/residential projects, etc.

Although this is a major construction company in India and using the old concepts of working, they are now thinking in terms of having a TQM approach and aiming for ISO 9002 certification. This is due to the fact that domestic and global market is getting more and more competitive. In order to survive and remain in the market, the company is now trying to adopt new methods of management.

Project Background

The project comprises construction of a Reinforced Cement Concrete bridge in Gujarat is being constructed by ABC Ltd., under active supervision of Public Works Department (PWD) of Government of Gujarat (GoG). The contract of the construction of the bridge is awarded to the company on the lump sum contract basis.

Work Practices

The site management at ABC Ltd., is using traditional management techniques for planning and monitoring of the project. Given below are the steps for the purpose of comparison with our earlier case study of M/s. Obayashi Corp. However, the employees working in this organisation, do not have the clear idea of the benefits which can be derived the systematic approach as followed by M/s. Obayashi Corporation.

The major concreting work of the project is carried out with the help of a Ready Mix Concrete plant with the truck mounted concrete containers on the one (left) side of the bridge while on the other (right) side, the concreting work is carried out with concrete mixers. The arrangement of the materials near the RMC plant is in star-pattern. The improper partition between two materials increases the chances of the materials getting mixed. Thus the quality of the structure may be affected. On the other side, the placing of the materials near the mixers is not properly planned. The territories of different types of the materials are also not defined.

The steelyard of the work site is located near the passageway. The placing of the incoming reinforcement bars sometimes creates difficulties in the easy transportation of the vehicles. A separate place is provided for placing cut/bent bars, but the bars are not put in a proper way. This creates difficulties in the handling the bars during work. The bars are used in the 'first in first out' (FIFO) principle. So the bars, which are bent/cut first, are not used immediately and due to their idleness and direct contact with the ground, some of them get rusted. Thus the use of these rusted bars may decrease the strength of the structure.

In the stores sections, most of the materials are placed in the wooden racks with horizontal and vertical planks for separation. The materials are placed in the racks without due care. The stores staff checks the physical quantity of the materials only. In some cases, duplication of the work of checking occurs while in some cases, checking is not done at all because of non-availability of specific assignment for each employee.

On the work site of the project, there are many big plants/equipment like cranes, batching plant (RMC), diesel generators, etc. The mechanic section takes care of the maintenance of these plants. For planning and maintaining the plants/equipment, the traditional method is being used. In this, every major plant like Crane, RMC, Generators, etc., is checked by the engineer in charge with the help of operator/helper. The fuel level, lubricating oil level, air pressure gauge, etc. are checked and logged in. Generally this is checked by the operator. Sometimes, the operator fills the logbook without checking the different gauges. And this may lead to a serious breakdown.

The equipment history record card is prepared for every major equipment. But sometimes, this is also not up-dated. For example, a diesel generator was brought from another site. In the history card of the equipment, it is stated that the condition of the generator was good and the service was done before dispatching it to the site. But during the testing of the equipment on the site, it was found that the shaft of the prime mover of the motor was not functioning well. This led to change of the shaft and whole-to-part checking of the equipment.

Out of the four cranes, only two are in good working condition while the other two require the constant minor/major maintenance work. Thus, more working

hours are spent on repairing of the cranes. Due to poor-working condition, both the cranes consume more fuel and lubricating oil than normally required.

The RMC plant is a very vital equipment of the project. But the operator of the plant is not fixed. Three persons of the mechanical section operate the plant as per requirement. The operators do not have any basic know-how of the properties of the concrete like water-cement ratio, idle mixing time for the concrete, etc. Thus, the quality of the concrete is directly affected by the negligence of the operator in mixing the concrete.

The maintenance of the plants is done as a reactive maintenance. The repairing work is done only when the equipment is not working. The monitoring of the plants and the analysis of the efficiency data is generally not considered for future planning and maintenance of the respective plant/equipment.

The Project was planned to be completed by February 1996. But due to a number of reasons both from client's and contractor's side, the project is getting delayed.

Project planning is done only for major activities. The Resource allocation for above activities is done based on experience. Planning is generally done only at macro level. For example, sinking of the well for the pier will be done between period mm.yy and mml.yyl. For this activity, micro planning is not done, like detailed material and machinery allocation, responsible person/s, etc.

Monitoring of the project is generally done by Project Manager with the help of the Senior Engineer and two Asst. Engineers. The responsibility of the work is not properly divided among the team members. Whenever the engineer is free, he visits the site and checks the progress of the work. Due to this, the duplication of the work is common. The authority among the concerned authorities is also not defined. So for the same type of work, the site supervisor gets two different types of instructions which leads to the ambiguity of the performance of the work. Thus the procurement of the work gets delayed.

Weekly meetings are held for reviewing the project. But in these meetings also, real monitoring work is not done. It turns out to be a mere 'passing the bulk' game with fingers pointed at one another for the problems faced. For example, crane no. 3 was out of order due to some mechanical fault. The required spares were not available in the stores. The work was delayed by about 4 days. The maintenance department blamed stores for not keeping spares while the stores section counter-blamed the maintenance department for not giving directions about the requirement of specific spares.

In other example, which shows the lack of co-ordination between the sub-contractors, the pre-cast beam sections were not ready for placing reinforcement bars for casting well cap. Due to this, the whole activity of erecting the well cap got delayed by about 12 days.

The decision making process of the site management is rather slow. The decisions are generally taken by the Project Manager and Asst. Engineer. Due to lack of planning and co-ordination, the quality of work is also affected, For example, there was an incident in which the concreting work of well staining was to be done, the arrangement on the site for which, was made by the workers. By the time the concrete mixer plant started mixing the concrete, the first container was already ready for procurement. Thus, lack of co-ordination caused segregation of the ingredients of the concrete and this affected the quality of the structure. So after the removal of the firm work, the weak portion of the staining was removed and the repairing was done.

Lot of wastage is found on the work site. Lack of planning and co-ordination and breakdowns of the equipment are common phenomena (*chalta hai* attitude). As 5-S is not done, many a time temporary shortage of materials/tools is observed. This temporary shortage affects the progress of the work.

In the case of the non-availability of the pre-cast beam sections, the wastage of time was about 2 days. While casting those beam sections, the concrete used was of grade M35 rather than M25. Due to this, there was wastage in the form of excess quantity of cement used in the concrete.

Over-production also takes place, sometimes, due to lack of planning and co-ordination. Thus, for using this over-produced concrete, some arrangement is made which requires excess time and manpower and inventory.

The site management is trying to solve the problems and difficulties arising in the work process. But the causes behind these difficulties are not targeted. So, in some cases the same problem arises again due to failure to take remedial action and lack of planning and co-ordination. Thus, the improvement in the work process and progress is not found. And sometimes, these conditions demotivate the employees and workers.

Discussion

There is a world of difference between the overall management practices of Indian construction sector and their Japanese counterparts as is clearly evident from the above comparative analysis of a company each from the Indian and Japanese construction sectors. While the Japanese believe in holistic planning and systematic implementation, incorporating healthy practices like 5-S, TQM, Kaizen, PDCA approach etc., the Indian construction companies lack sound planning and implementation of whatever planning is made again is poor. Ineffective co-ordination and absence of concern for quality and waste minimisation leads to cost and time overruns.

Suggestions

For enhancing the quality of the work-processes, minimizing the cost, adherence to time and maximizing the benefits, the Indian construction companies would do well to consider the following suggestions:

1. The companies should implement, firstly the basic principles like PDCA cycle, Five-S, TPM and KAIZEN.
2. Before implementing these practices, an in-depth study of the company's existing working practice should be carried out.
3. After in-depth study, the principles should be implemented in customized form.
4. A constant feedback of the implemented principle/s is very essential for successful implementation.
5. The performance appraisal of the employees should be carried precisely for improvement of the process.
6. After becoming comfortable with these principles, the other higher order principles like TWE, KANBAN, Poka-Yoke, TQC, JIT, etc. should be implemented systematically.

Concluding Remarks

The principles and concepts of Project Management adopted by Japanese are not new. These are well known to every one but their implementation in actual practice needs work culture, environment, working philosophy, devotion, involvement and smooth flow of resources. This cannot be developed by one individual but can be achieved by collective efforts of all agencies/employees involved in the process. In this connection, one should not hesitate to learn and adopt the techniques and systems being used by other countries to implement these concepts for better results.

The principles and concepts of Project Management adopted by Japanese are not new, but their implementation in actual practice needs work culture, environment, working philosophy, devotion, involvement and smooth flow of resources.

However, we often fail to implement any foreign practices, because we tend to copy first, then struggle and give up. Actually, the typical reaction starts with excitement, confusion and ends with frustration. After several months of unexplained shame and shambles, the movement is aborted and life is back to normal. So, we should try to appreciate the principles underlying the new culture/system and then adopt it with modified and customized form.

In the current milieu, it is imperative that the above concepts are thoroughly reviewed and cultivated in our working to avoid time and cost overrun of the project and to give maximum benefits to profession, society and country which shall ultimately pass on to individuals.

□

Feature

Analytic Hierarchy Process: A Productive Alternative to Multi-Attribute Decision Making

Jack A. Wu & Nesa L. Wu

Although several procedures for assessing multi-attribute utility functions have been developed (see references cited), the majority of these studies examined only the choices among weighted schemes for additive utility functions. Industry often avoids techniques that are unduly complicated, regardless of the effectiveness of that approach. The Analytic Hierarchy Process(AHP), developed by Saaty provides an accurate means for estimating the relative values of preferences by analytically combining normalized values at different levels. This method allows us to break a problem down into components or attributes, investigate these components separately and arrive at overall relative values for the choice objectives.

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Introduction

Analytic Hierarchy Process (AHP) is based on a process that requires the decision maker(s) to provide judgments about the relative importance of various criteria and then to specify a performance for each decision alternative relative to each criterion. The relative importance of the criteria and the relative importance values of each decision alternative, relative to each criterion, are then mathematically combined to generate a priority ranking, giving the overall preference for each of the decision alternatives. The methodology of the AHP is explained in this paper and is illustrated to find the solution to a complex multi objective decision problem, called the China model. The objective of the AHP method is to make choices amongst alternatives, based on their relationship to the criteria and overall goals. In this way complex situations are broken down and analyzed in their set hierarchy. The *Process* nature of the method allows people to rethink data, to gather new information, to negotiate data, as time warrants such data negotiation, and to formulate group consensus on data through the proper running of decision-making sessions. In this sense, this method is quite dynamic in nature.

Methodology

The Analytic Hierarchy Process (AHP) has the unique ability to rank decision alternatives based on both qualitative and quantitative factors. The method's analytic nature implies that both objective and subjective data are translated into numbers and that mathematics is used to evaluate such data, so that one can explain choice results scientifically. The choice results can be either expert choice results or group choice results, depending on whether the data were generated by interviewing one expert or a group of people. The

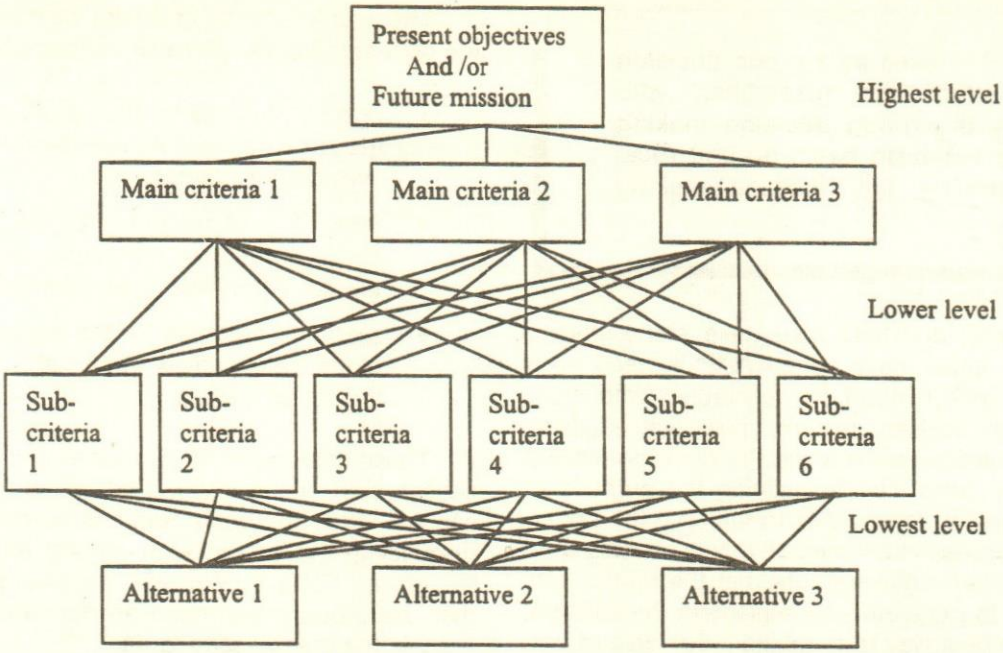

Fig. 1. AHP Hierarchy Structure

term *hierarchy* implies that the decision problem can be broken down and structured in various levels or hierarchies. The levels normally consist of goals, criteria, subcriteria and alternatives.

The Analytic Hierarchy Process (AHP) has the unique ability to rank decision alternatives based on both qualitative and quantitative factors.

The AHP is accomplished through the following four basic steps:

1. Developing the hierarchy of the problem
2. Collecting the data of the problem
3. Establishing the normalized weights
4. Deriving the solution of the problem

Problem Hierarchy

Developing the hierarchy of the problem consists of decomposing the complex decision problem into various levels. Each level of hierarchy represents manageable attributes or criteria, by which the alternatives or decisions of the lowest level of the hierarchy are judged.

Developing the hierarchy of the problem consists of decomposing the complex decision problem into various levels.

Figure 1 represents three levels of hierarchy. The highest level, consisting of three main criteria, in turn, are decomposed into another set of subcriteria, corresponding to a lower level of hierarchy. The last or lowest level of hierarchy consists of the decision alternatives of the model.

Structuring any decision problem hierarchically in this fashion is an effective way of dealing with complexity and identifying important attributes to achieve the overall objective of the problem. The AHP allows flexibility to aid in the management decision making process. Furthermore, it allows for the dependence-independence relations among attributes by decomposing them into different levels of hierarchies.

When groups of people in an organisation are involved in structuring the hierarchy of the problem, conflict often arises which need to be resolved prior to data collection. The hierarchical structure is often quickly defined when the group such as advisory board is fixed. However, when the group make up varies – such as experts, non-experts; staff personnel, upper and lower level management; etc. – reaching consensus is often a

When AHP is used as a group decision making effort, the researcher, who structures the group decision making must first establish basic ground rules before running the decision making sessions.

major undertaking and may take quite some time to accomplish. In either case, when AHP is used as a group decision making effort, the researcher, who structures the group decision making must first establish basic ground rules before running the decision making sessions. These rules include defining the purpose of the session (ranging from either to improve the understanding of the problem or to reach a final specific solution of the problem); making sure that the participants are committed to generate and implement the solution; formulating the best way to combine judgments of participants; and above all setting priorities and procedures for agreeing on the hierarchy and data.

Data Collection

After establish AHP scheme, entries of data obtained are put into pairwise comparison matrices. One will assign relative value scales in a pairwise fashion with respect to attributes of one level of hierarchy, given each of the attributes of the next higher level of the hierarchy. This process is continued for all levels of the hierarchy. Each relative value or scale in these matrices reflect the relative importance of one attribute of the pair over the other attribute of that pair. If objective data is available, the judges may use it in assigning weights. However, their personal belief, judgment or information may also be used to define these values or scales. Saaty (1977, 1980) has suggested a nine-point scale (Table 1) that has been found highly reliable and within the number of options that respondents can handle.

Table 1: Rating Scales for Verbal Judgment

Judgments	Rating	Reciprocal Judgment	Rating
Extremely preferred	9	Extremely less preferred	1/9
Very strongly preferred	7	Very strongly less preferred	1/7
Strongly preferred	5	Strongly less preferred	1/5
Moderately preferred	3	Moderately less preferred	1/3
Equally preferred	1	Equally less preferred	1
and in between preferences (8,6,4 and 2)		and in between preferences (0.13, 0.17, 0.25 and 0.5)	

The data for the structure depicted in Fig. 1 requires the generation of ten pairwise comparison matrices:

- one 3 × 3 matrix for the pairwise comparison of the three main criteria with respect to the objectives and/or future mission;
- three 6 × 6 matrices for the pairwise comparison of the six subcriteria, each with respect to one of the three main criteria; and
- six 3 × 3 matrices for the pairwise comparison of the 3 alternatives, each with respect to one of the six subcriteria.

These entries can be generated through group consensus vote or through individual judgment. The consensus vote approach requires a great amount of discussing and cooperation among all participants of the group. For a 4×4 matrix, for example, this means that the group must reach an agreement on each a_{ij} entry in the matrix (see Fig. 2).

$$\begin{bmatrix} 1 & a_{12} & a_{13} & a_{14} \\ a_{21} & 1 & a_{23} & a_{24} \\ a_{31} & a_{32} & 1 & a_{34} \\ a_{41} & a_{42} & a_{43} & 1 \end{bmatrix} = \text{A example: } \begin{bmatrix} 1 & 5 & 6 & 7 \\ 1/5 & 1 & 4 & 3 \\ 1/6 & 1/4 & 1 & 1 \\ 1/7 & 1/3 & 1 & 1 \end{bmatrix}$$

where $a_{ij} = \dfrac{1}{a_{ji}}$

Fig. 2. Pairwise Comparison Matrix

However, if there is a significant disagreement among the participants concerning an a entry in a matrix, then the geometric average of all participants' entries for a_{ij} can be used for the entry:

$$a_{ij} = \left(\prod_{\kappa=1}^{N} a_{ij}^{k}\right)^{1/N} \quad \ldots(1)$$

where N is number of participants and a^{k}_{ij} is entry a_{ij} of k^{th} participant

This geometric mean preserves the reciprocal property in the pairwise comparison matrix and is therefore an appropriate rule for combining judgments:

$$a_{ji} = \frac{1}{a_{ij}} = \frac{1}{\left(\prod_{\kappa=1}^{N} a_{ij}^{k}\right)^{1/N}} = \left(\prod_{\kappa=1}^{N} a_{ji}^{k}\right)^{1/N} \ldots(2)$$

Establishing the Normalized Weights

If a matrix of pairwise comparison $A = (a_{ij})$, which is positive and reciprocal, is perfectly consistent then:

$$a_{ij} = w_i / w_j \quad ...(3)$$

where w_i is weight of attribute i.

These normalized weights w_i (with $w_i < 1$ and $\sum_{i=1}^{n} w_i = 1$) can be calculated by normalizing any column j of matrix A:

$$w_i = \frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}} \quad ...(4)$$

for all i = 1,2 ..., n

However, errors in judgments are commonly made when collecting data. If this in the case then normalized weights for attributes form a matrix of pairwise comparisons $A = (a_{ij})$ is obtained by computing the principal right eigenvector. This is achieved by raising the matrix A to increasing powers k and then normalizing the resulting system:

$$w = \lim_{k->\infty} A^k e^T / e\, A^k\, e^T \quad ...(5)$$

where e = (1, 1,..., 1)

Since Saaty's method computes w as the principal right eigenvector of matrix A,

$$Aw = \lambda_{max}\, w \quad ...(6)$$

where λ_{max} is max eigenvalue of A

λ_{max} = n if A is consistent

λ_{max} > n if A is not consistent

this method yields a natural measure for inconsistency. Because $\lambda_{max} - n$ reflects the degree of inconsistency, normalizing this measure by the size of the matrix gives us the consistency index:

$$C.I. = \frac{\lambda_{max} - n}{n-1} \quad ...(7)$$

where:

$$\lambda_{max} = \max \left[\frac{\sum_{j=1}^{n} a_{ij}\, w_j}{w_i} \right]$$

for i = 1, 2,..., n

This consistency index, C.I. can now be compared to the consistency index of a purely randomly generated matrix, R.I. (see Table 2) as follows:

$$C.R. = C.I./R.I. \quad ...(8)$$

If C.R. < = 0.1, then one can be satisfied with the collected data and can proceed to the next phase. Otherwise, data need to be recollected in an effort to reduce the inconsistency.

Problem Solution

The solution of the problem involves finding the composite vector of normalized weights, that reflects the relative priorities of all alternatives at the lowest level of the hierarchy. Since successive levels of hierarchy are related as can be seen in Figure 1, the single composite normalized vector of weights for the alternatives on the lowest level is determined by multiplying the vectors of weights of the successive levels.

The Chinese Model

Background

The AHP methodology is now applied to establish relative priorities for various strategic alternatives faced by a typical Chinese firm.

Industry reform is one of the most important cornerstones of the Chinese "Modernization" policy. After more than one decade of self-imposed isolation the Chinese economy rebounded at an amazing pace during the last two decade and gained an unprecedented vigor as result of its new industrial autonomous and open-door policies. The new economic policies brought about new stimuli as well as new responsibilities to plant managers. Now, the Chinese plant

Table 2: Random Inconsistency Index (R.I.)

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R.I.	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

After more than one decade of self-imposed isolation, the Chinese economy rebounded at an amazing pace during the last two decades and gained an unprecedented vigor as result of its new industrial autonomous and open-door policies.

managers are no longer merely the executioners of the State's directives but are fully, or to a great extent, in control of the destiny of their organisation and are totally responsible for the consequences of their own decisions. Unlike their Western counter parts, the Chinese managers are facing much broader choices of policy alternatives without, or with very inadequate availability of economical and statistical information during their decision processes. A basic policy decision today for many of the Chinese plant managers is to decide which of possible alternatives to choose in order to modernize their operations and to enlarge their market shares.

Problem Structuring

In order to modernize and become successful, some of the possible alternatives plant managers can choose from are:

- entering into a joint venture with a foreign firm (JV);
- importing foreign technology (IT);
- developing their own technology (DT).

The overall objective of the organisation can be achieved through any one of the above alternatives, but at a different extent and speed. These differences result from the different levels of adaptation of modern management and production technologies under different policy alternatives. This complicated issue can be addressed through the use of the Analytical Hierarchy Process which provide us with a rational and systematical decision procedure without relying on any tangible data that are not available in most cases.

Objectives of the Model

The Management objectives of a plant in the Chinese model can be subdivided into the following three basic groups:

1. Human elements (HE); job security (JS), income and fringe benefits (IF), working conditions (WC), skill and knowledge (SK), social prestige, and work autonomy.
2. Economic elements (EE): reliability (RA), profitability (PF), productivity (PD), flexibility, stability, market shares-domestic-, market shares-international-(MI), foreign connections, lead time, longevity.
3. Social and political elements: state objectives, provincial objectives, municipal objectives, community objectives, national prestige, national security, and economic dependency.

Technological Measures

In order to achieve management and operational modernization, Chinese plant managers are adopting, attempting or interested in the following modern technological measures: office automation (OA), new product development, fixed (FA) and variable automation, computer aided design (CAD), computer aided manufacturing systems, flexible assembly systems, computer aided testing, data acquisition and retrieval, management information systems (MIS), group technology (GT), mechanized material handling, inventory management, quality assurance (QA), supply assurance, marketing programs, and reversed engineering (RE).

All of the above measures are competing for very limited resources that are available to Chinese plant managers. All or some combination of the above measures may be adopted at different levels for a given period of time, depending largely upon the type and the availability of the internal and external resources of the plant. The above mentioned policy decisions may open up some of the resources which otherwise would not be available to the plant.

The Model

A policy decision situation for a typical computer manufacturing company is presented in this model. A number of the above mentioned objectives and technological measures, as shown by their abbreviations between parentheses in the above list, are appropriate to construct this model.

The hierarchical structure of the model consists of four levels of decision factors and the overall objective of the model is "modernization" as defined by the Chinese policy makers of the plant. The first level of the hierarchy consists of two factors. They are the human elements (HE) and the economical elements (EE). At

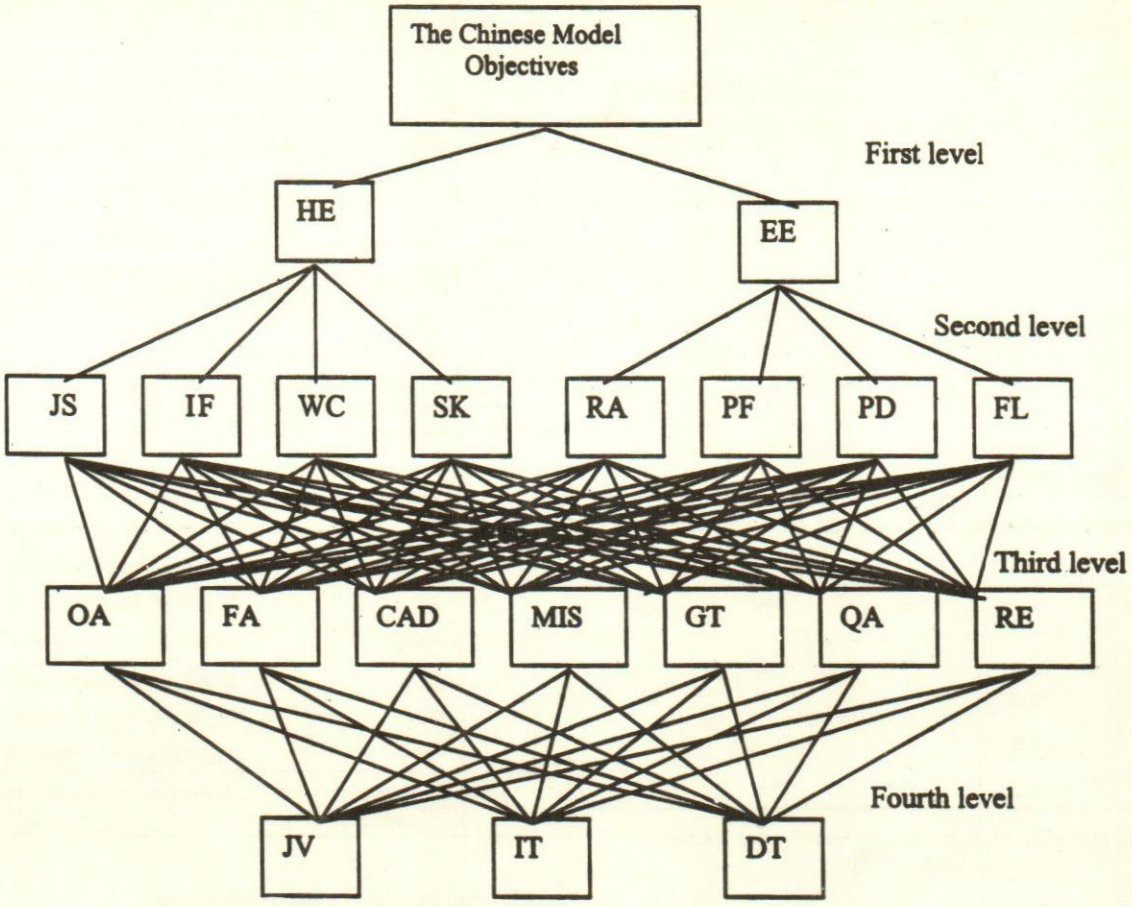

Fig. 3. Hierarchy Structure for the China Model

the second level of the hierarchy each of these two elements is further broken down into four factors each. Amongst the human elements the company considers the following factors as very important: job security (JS), income and fringe benefits (IF), working conditions (WC) and skill and knowledge (SK). Of the economic elements following four are important for this model: reliability (RA), profitability (PF), productivity (PD) and international market (MI). The third level of the structure includes seven of the technological measures that the company deems important to achieve modernization of management and operations. These are: office automation (OA), fixed automation (FA), computer aided design (CAD), management information systems (MIS), group technology (GT), quality assurance (QA) and reversed engineering (RE). Finally the fourth level of the structure includes the three policy alternatives: entering a joint venture with a foreign firm (JV), importing technology (IT) and developing its own technology (DT). The structure of this model is pictured in Fig. 3.

The hierarchical structure of the model consists of four levels of decision factors and the overall objective of the model is "modernization" as defined by the Chinese policy makers of the plant.

Collection of Data

As mentioned earlier, collecting data begins with the judges or decision makers assessing weights based on available objective and/or subjective information for the criteria at all levels of the hierarchy as shown in Fig. 3. The judgmental comparison of attributes can be given by several groups or individuals. Since the collective consensus will most likely be adopted in the chinese management decision process, only one set of judgmental and pair wise comparisons for the structure is pursued to generate weights for each level of the hierarchy.

Level 1: while lacking other opposing evidence, the weights are equally distributed as 0.5 for HE and

0.5 for EE. These two elements are considered to be equally important by management.

Level 2: the relative importance of level 2 attributes are reflected in the following two square matrices (Figures 4 and 5).

	JS	IF	WC	SK
JS	1	2	4	4*
IF	0.5	1	2	3
WC	0.25	0.5	1	1
SK	0.25	0.33	1	1

* Entry of 4 means that JS is moderately to strongly preferred over WC

Fig. 4. Matrix of Attributes for the Human Elements Matrix # 1

	RA	PF	PD	MI
RA	1	2	2	4
PF	0.5	1	1	2
PD	0.5	1	1	2
MI	0.25	0.5	0.5	1

Fig. 5. Matrix of Attributes for the Economical Elements (Matrix # 2)

Level 3: the relative contributions of the selected technological measures, i.e. the level 3 attributes, to each of the eight objectives can be reflected in eight matrices. As an example, Figure 6 shows the pair wise comparison of the technological measures with respect to productivity (PD).

	OA	FA	CAD	MIS	GT	QA	RE
QA	1	0.2	0.5	1	1	2	0.5
FA	5	1	3	5	4	8	3
CAD	3	3	1	2	2	4	1
MIS	2	0.2	0.5	1	1	2	0.5
GT	2	0.25	0.5	1	1	3	0.5
QA	0.5	0.13	0.33	0.5	0.4	1.0	0.25
RE	2	0.33	1	2	2	4	1

Fig. 6. Matrix of Attributes at Level 3 With respect to Productivity (Matrix # 9)

Level 4: finally, each of the three strategic plans are evaluated in terms of their likely contributions to the technological measures which can be implemented by this plant. Seven matrices, one for each technological measure, can be constructed to reflect the pair wise comparison of the three strategic plans. Figure 7 shows the matrix of attributes of the strategic plans with respect of Office Automation.

	JV	IT	DT
JV	1	2	5
IT	0.5	1	3
DT	0.2	0.33	1

Fig. 7. Matrix of Attributes at Level 4 With respect of Office Automation (Matrix # 11)

Table 2: Schematic Format for the Calculation of Normalized Weights for Level 3 of the Model

		OA	FA	CAD	MIS	GT	QA	RE
HE = 0.5	JS =	Eigenvalues of matrix 3						
	IF =	Eigenvalues of matrix 4						
	WC =	Eigenvalues of matrix 5						
	SK =	Eigenvalues of matrix 6						
EE = 0.5	RA =	Eigenvalues of matrix 7						
	PF =	Eigenvalues of matrix 8						
	PC =	Eigenvalues of matrix 9						
	MI =	Eigenvalues of matrix 10						
Normalized Weights for Level 3		Mathematical Combination of above Eigenvalues						

Estimation of Relative Weights

All 17 matrices (two for level 2, eight for level 3 and seven for level 4 of the hierarchy) are evaluated through the calculation of Eigenvalues as proposed by Saaty. Tables 2 and 3 show the schematic format for the calculations of the normalized weights for levels 3 and 4 to the model. Finally, Tables 4 and 5 show the actual results of the calculations of all Eigenvalues. The overall results or the normalized weights for the objective of the Chinese strategic planning model are in the last row of Table 4.

Table 3: Schematic Format for the Calculation of Normalized Weights for Level 4, the Objective of the Model

	JV Joint Venture	IT Import Technology	DT Develop Technology
OA =	Eigenvalues of matrix 11		
FA =	Eigenvalues of matrix 12		
CA =	Eigenvalues of matrix 13		
MIS =	Eigenvalues of matrix 14		
GT =	Eigenvalues of matrix 15		
QA =	Eigenvalues of matrix 16		
RE =	Eigenvalues of matrix 17		
Normalized Weights for Level 4	Mathematical Combination of Above Eigenvalues		

Table 4: Calculation of Normalized Weights for Level 3 of the Model

		OA	FA	CAD	MIS	GY	QA	RE
	JS = .4686	.1075	.0538	.1075	.1613	.1613	.2151	.1935
HE = 0.5	IF = .2864	.0952	.1905	.0952	.0952	.1429	.1905	.1905
	WC = .1259	.1667	.1852	.1574	.1389	.1481	.1111	.0926
	SK = .1191	.1188	.0495	.1980	.1782	.1485	.1683	.1387
	RA = .4445	.0701	.1430	.0362	.0712	.3571	.1791	.1433
EE = 0.5	PF = .2222	.1501	.0602	.2403	.1201	.2425	.0784	.1084
	PD = .2222	.0793	.3840	.1571	.0793	.0995	.0412	.1596
	MI = .1111	.0383	.0744	.0943	.1882	.1896	.3771	.0381
Normalized Weights for Level 3		.0996*	.1398	.1180	.1192	.2043	.1687	.1504

*.0996 = 0.5 [(.4686 × .1075) + (.2864 × .0952) + (.1259 × .1667) + (.1191 × .1188)] + 0.5 [(.4445 × .0701) + (.2222 × .1501) + (.2222 × .0793) + (.1111 × .0383)]

Analysis of Results

Based on above calculations for this sample case, the most effective policy to achieve the multiple objectives of this Chinese manufacturing plant is to enter into a joint venture arrangement. If additional factors are relevant to this company, they can be added to the model at any time and may result in different conclusions. However, the analytical process for deriving the solution will be the same as demonstrated in this case, regardless of the amount of variables, the multitude of objectives and the diversity of judgmental opinions the decision makers have to handle. The analytical hierarchy process is a very effective management tool in handling this type of situation. In addition to the analytical results, the structure of the model itself provides us with a great deal of information on the structure and function of the system in its lower levels and the interaction among different levels of the model. With clearly defined objectives and explicitly expressed decision factors, the analytical hierarchy process model provides both flexibility and consistency to the decision-making process. While the choices are clear but the availability of data and information are sketch as it is the case in most of the developing countries, the analytical hierarchy process can play a very important role in improving the objectivity and rational of the management decision making process.

In addition to the analytical results, the structure of the AHP model itself provides us with a great deal of information on the structure and function of the system in its lower levels and the interaction among different levels of the model.

Table 5: Calculation of Normalized Weights for Level 4. The Objective of the Model

	JV Joint Venture	IT Import Technology	DT Develop Technology
OA = .0996	.5874	.2951	.1175
FA = .1398	.1493	.4746	.3761
CA = .1180	.5714	.2857	.1427
MIS = .1192	.7142	.1429	.1429
GT = .2043	.2429	.2555	.5016
QA = .1687	.7142	.1429	.1429
RE = .1504	.5874	.2951	.1175
Normalized Weights for Level 4	.4904*	.2672	.2424

* 0.4904 = .0996 × .5674 + .1398 × .1493, +.1180 ö.5714 + .1192 × .7142 + .2043 × .2429 + .1687 × .7142 + .1504 × .5874

Conclusions

The computation of the principal right eigenvector as shown in equation (Barren and Person, 1979) and suggested by Saaty is highly unstable numerically because of the rapid growth factor of the elements of matrix A, as it is being raised to increasing powers. An alternate way for generating the principal eigensystem is the power method as computerized by Sanchez (1982).

of stress.

If no computer program is available to calculate the eigenvector weights of pairwise comparison matrices, then these weights can be approximated using the following two-step procedure (Wu and Wu).

Bettman J.R. and Kakkar O. (1977), "Effects of Information Presentation Format on Consumer Information Acquisition Strategy", Journal of Consumer Research, Vol. 3, pp. 233-40.

Barron F.H. and Person H.B. (1979), "Assessment of Multiplicative Utility Function via Holistic Judgments", Organisational Be-

Ivancevich, 1987). If these extra-organisational (or life stresses) become too severe or too numerous resulting maladaptive patterns and possibly physical and mental disorders (Dohrenwend, 1973; Holmes and Rahe, 1967; Holahan and Moos, 1985; Rahe, Bennett, Romo, Siltanen and Arthor, 1973; Theorell, 1986; Dang and Aggarwal, 1995). Extra-organisational stressors have rarely been included in research investigations of stress and work (Bhagat, 1983; Matteson and Ivancevich, 1987). The area of stress is multi-factorial, requiring that one focuses on more than one stressor at a time, While linkages between stress and negative health outcomes have been documented extensively, little attention has been paid in the identification of factors that might have moderated the effects of stress. Some research has been carried out in organisations on the dire consequences of stress manifestations and to explain the varying stress-health relationship (Pestonjee, 1992). In the present study, Type A behaviour pattern has been examined as a factor that moderate the source of stress and influence its outcomes.

Perhaps the most widely discussed personal characteristic contributing stress at work in recent years has been the Type A versus Type B differentiation (Ivancevich and Matteson, 1988; Taylor and Cooper, 1989; Howard, Cunningham and Rechnitzer, 1986; Pestonjee and Singh, 1988; Jamal, 1990; Jamal and Baha, 1991; Spector and O'Connell, 1994). Two, cardiologists, Friedman and Rosenman (1974), developed this construct.

The Type A style of behaviour is characterized by some or all of the following traits: competitiveness, intense striving for achievement, easily provoked hostility, a sense of urgency, quick actions, impatience, explosive speech and a general appearance of tension. People who have opposite style of behaviour, who are more relaxed and easy going are defined as Type B (Friedman, 1969; Jenkins, 1978; Matthews and Haynes, 1986). Research has indicated that the conditions most responsible for facilitating Type A behaviour are those encountered in the working environment (Howard *et al* 1975). The available studies have indicated the Type A behaviour pattern is related to many different organisational variables including job stressors (e.g. work overload, role conflict or lack or autonomy) and job strains (e.g. job dissatisfaction, work anxiety and somatic complaints (e.g. Taylor and Cooper, 1989; Jamal, 1990, Spector, 1992). However, these studies are mainly conducted on western samples and the paucity of empirical studies relating Type A and Type B differences especially among Indian employees is clearly evident. There exists a large number of empirical studies indicating Type a and Type B differences in cardiovascular, neuroendoerine, psychosocial and work related variables

The Type A style of behaviour is characterized by some or all of the following traits: competitiveness, intense striving for achievement, easily provoked hostility, a sense of urgency, quick actions, impatience, explosive speech and a general appearance of tension.

(Howard, Cunningham and Rechnitzer, 1986; Lee and Gillin, 1989; Friedman and Booth-Kewley, 1988; Krantz, Contrada, Hill and Friedler, 1988). However, research on Type A behaviour pattern as a potential correlate of mediating stress-health relationship is quite limited both in Indian and Western studies. Only limited attention has been devoted to examine how stress and Type A behaviour jointly affect employee's health and well-being (Jamal, 1990). The present study focuses on:

- The effects of organisational (work-related) and extra-organisational (non work-related) stress on health outcomes.
- The effect of Type A behaviour pattern on organisational and extra-organisational stress and health outcomes.
- The moderating effect of Type A behaviour pattern on stress and health relationship.

The conceptual model for the study is presented in Fig. 1, and is derived from the general models of work-non-work stress proposed by Cooper and Marshall (1976) and Matteson and Ivancevich (1987). As indicated in Fig. 1, organisational stresses (role overload, role ambiguity, role conflict and overall job stress), and extra-organisational stress (number of stressful life events and life stress) are hypothesized to be associated with health outcomes as indexed by coronary risk indicator, psychosomatic health complaints and pathogenic health habits as well as moderate the relationship of organisations and extra-organisational stress variables with health outcomes. The following hypotheses were tested in the study:

- Organisational stress variables will be positively related to health outcomes.
- Extra-organisational stress variables will be positively related to health outcomes.
- Employees with dominant Type A behaviour pattern will score higher on organisational and extra-organisational stress and health outcomes in comparison to Type B employees.

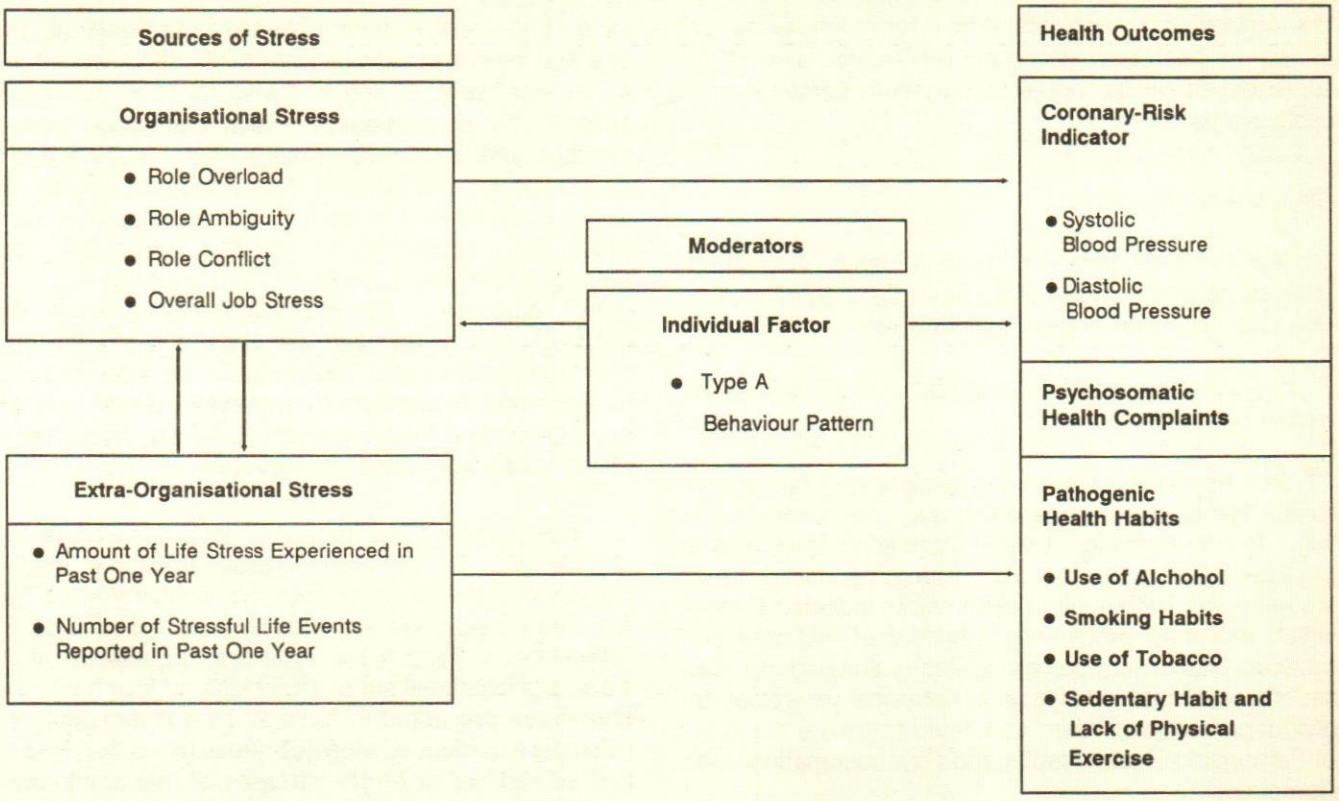

Fig. 1. Systematic Model of the Proposed Study

- Type A behaviour pattern will be an important moderator of stress (both organisational and extra-organisational) and health outcomes relationships. That is, Type A employees with high stress will be more seriously affected than Type B employees in similar situations.

Methods

Research Setting and Subjects

The present study conducted on randomly selected and representative sample of 200 male managers (including top, middle and front level categories) working in the Diesel Locomotive Works (DLW) Varanasi (India). Data were obtained on the basis of the responses of the managerial personnel by means of a structured questionnaire. In some cases subjects were verbally explained the instructions by the investigator. The subjects were allowed to take their own time to complete the questionnaire. Blood pressures were measured in the silent room and in a single sitting, with the help of Sphygmomanometer and Stethoscope. The participants were middle age (M = 47.82, S.D. = 7.29) managerial employees.

Measures

Occupational Stress Index (OSI)

Occupational Stress Index (OSI) has been developed by Srivastava and Singh (1981) to assess work related sources of stress. The OSI purports to measure the extent of employees perceived stress arising from various constituent and conditions of their job. The reliability coefficient of OSI ascertained by split-half method and chronbach's alpha coefficient for the scale were found to be .935 and .90 respectively. Fifteen items have been used from this scale to tap three job stresses namely role overload, role ambiguity and role conflict. Overall job stress measure involves the total scores of role overload, role ambiguity and role conflict.

Presumptive Stressful Life Events Scale (PSLE)

For the measurement of extra-organisational (non-work) sources of stress, Presumptive Stressful Life Events Scale (PSLE., Singh, Kaur and Kaur, 1983) has been used in a modified form by the researcher. There are 51 items in the scale. The individual has to report the number of stressful life event experienced in past one year and also he had to rate each event on 5-point rating scale (very high to very low) so that

the amount of perceived stress for each event occurred in past one year can be known. The stress score based on individual respondents perceptions of each events.

Jenkins Activity Survey

For the assessment of Type A behaviour pattern, Jenkins Activity Survey (JAS., Form C-1979) was used. This is a self-report screening instrument of 52 items.

Psychosomatic Health Complaints and Pathogenic Health Habits

Psychosomatic Health Complaints and Pathogenic Health Habits were assessed through two short checklists. Psychosomatic Health Complaints included 8 physical troubles like disturbed sleep, headache, upset stomach etc. Pathogenic health habits included 5 items which indicated employees' quantity of alchohol and tobacco intake, number of cigarettes smoked per day, sedentary habits and lack of physical exercise. Individuals responses were combined to create the index of Pathogenic Health Habits and Psychosomatic Health Complaints.

Results

The correlations between the measures of predictor variables and criterion variables are presented in Table 1. Role overload is significantly positively related only with psychosomatic health complaints and pathogenic health habits. Thus, results reported in Table 1 partially supported hypothesis I, as out of possible 16 inter-correlations between organisational stresses and health outcomes only 5 (31.25%) were found to be significant. It also indicates that the out of possible 8 inter-correlations between extra-organisational stresses and health outcomes 4 (50%) were found to be significant. The amount of life stress was significantly positively related to health outcomes, systolic blood pressure, psychosomatic health complaints and pathogenic health complaints and pathogenic health habits. Number of stressful life events is significantly positively related only with psychosomatic health complaints and pathogenic health habits. Number of stressful life events is significantly positively related only with psycho-somatic health complaints. Thus, hypothesis II of the study was partially supported.

In order to test hypothesis III, managers were divided on the JAS (1979) Type A scale from the median. Managers above the median were considered as Type A's, and those below the median were called Type B's. Differences in Type A and Type B in organisational and extra-organisational stress variables and four health outcomes are presented in Table 2. Type A managers significantly experienced more job stress ($F = 5.847$, $P < .05$) and scored higher on the stresses of role ambiguity ($F = 4.69$, $P < .05$) and role conflict ($F = 3.892$, $P < .05$), in comparison to Type B managers. Type A managers significantly showed higher systolic blood pressure ($F = 4.114$, $P < .05$) and diastolic blood pressure ($F = 10.28$, $P < .01$), in comparison to Type B managers. No significant differences were noted between Type A and Type B managers on role overload, amount of life stress, number of stressful life events, psychosomatic health complaints and pathogenic health habits. Thus, the results reported in Table 2 partially supported the

Table 1: Inter-Correlations Among Study Variables (N = 200)

S.No.	Variables	1	2	3	4	5	6	7	8	9	10	11
1.	Role Overload	1.000										
2.	Role Ambiguity	0.362**	1.000									
3.	Role Conflict	0.489**	0.461**	1.000								
4.	Job Stress (overall)	0.850**	0.704**	.799**	1.000							
5.	Number of Stressful Life Events	0.161*	0.145*	.141*	.186**	1.000						
6.	Amount of Life Stress	0.224**	0.200**	.231**	.276**	.939**	1.000					
7.	Type A Behaviour Pattern	0.261**	0.164**	.257**	.294**	.032	.116	1.000				
8.	Systolic Blood Pressure	0.040	0.024	.028	.039	.060	.140*	.175*	1.000			
9.	Diastolic Blood Pressure	–0.015	0.086	–.014	.015	.030	.091	.185**	.645**	1.000		
10.	Psychosomatic Health Complaints	0.208**	0.089	.310**	.260**	.211**	.311**	.193**	.296**	.141*	1.000	
11.	Pathogenic Health Habits	0.099	0.038	.146*	.140*	.101	.185**	.187**	.184**	.059	.279**	1.000

* $P < .05$

** $P < .01$

hypothesis III. However, the support of hypothesis III was more clear for job stresses and coronary risk indicators.

Table 2: Comparison of Type A and Type B Managerial Personnel on Organisational and Extra-Organisational Stress Variables and Criterion Variables

S.No.	Variables	Type A (N = 125)	Type B (N = 75)	F-Ratio
1.	Role Overload	20.690	19.533	3.283
2.	Role Ambiguity	10.60	9.813	4.069*
3.	Role Conflict	14.96	14.08	3.892*
4.	Job Stress (Overall)	46.256	43.426	5.847*
5.	Number of Stressful Life Events	5.832	5.786	.0067
6.	Amount of Life Stress	18.952	16.893	1.172
7.	Systolic Blood Pressure	128.488	124.693	4.114*
8.	Diastolic Blood Pressure	86.624	82.907	10.28**
9.	Psychosomatic Health Complaints	5.37	4.69	1.566
10.	Pathogenic Health Habits	6.368	5.706	2.734

* $P < .05$

** $P < .01$

Sub-group analysis was performed to test hypothesis IV which concerned the moderating effect of Type A behaviour pattern in stress-health relationships. The total sample was dichotomized (Type A and Type B) and correlations between stress and health outcome variables were calculated for each group and tested for significance (t-test). The results are recorded in Table 3. Out of possible 24 comparisons in two samples, Type A group (N = 125) and Type B group (N = 75) significant differences were found in 5 (20.83%) of the comparisons, which partially confirmed hypothesis IV. Employees with Type A behaviour pattern had stronger positive correlations and Type B behaviour pattern had stronger negative correlations between stress and health outcome measures. Specifically, Type A behaviour pattern was found to moderated the relationships between:

(i) Psychosomatic health complaints and role overload, role conflict and overall job stress.

(ii) Pathogenic health habits and role ambiguity and overall job stress.

A close examination of the data through sub-group analysis and univariate analysis of variance (F-ratio) revealed that Type A employees experienced more serious dysfunctional consequences of job stress than Type B employees. Psychosomatic health complaints and pathogenic health habits were the two outcome variables more seriously affected by the interaction between the job stress, stresses, (role over load, role ambiguity and conflict) and Type A behaviour. Results also indicate that the relationships between stress and blood pressure (both systolic and diastolic) were unaffected by the role of behaviour pattern.

Contrary to the prediction, there was no evidence that Type A group was more adversely affected by life stress. The relationships between life stress, number of stressful life events and health outcomes were similar (positive correlations) for both Type A and Type B groups (Table 3).

Discussion

The results of the present study indicated that psychosomatic health complaints are related to job stress variables (e.g. role overload and role conflict) are in agreement with the bulk of literature on the topic (Beehr and Newman, 1978; Howard *et al*, 1986; Jamal, 1990; Jamal and Baba, 1991, Steffy, Jones and Noe, 1990). They further indicate significant positive relationship between pathogenic health habits and role conflict and overall job stress. Pathogenic health habits refer to the individuals intake of substances like alcohol, caffeine, tobacco, cigarettes etc. (that if used excessively could be harmful to health) and adopting sedentary habits and lack of physical exercise in their daily routine. The high levels of work related stress can facilitate the tendency of some individuals to drink heavily, engage in excessive smoking and doing less and less physical activity to adopt against the adverse impact of stressful working conditions (Plant, 1979; Margolis Kroes and Quinn 1974; Hendrix, Ovalle and Troxler, 1985). The findings clearly indicate that when individuals perceive their jobs to be psychologically and physically threatening, it is very likely that their health would be adversely affected.

High levels of work related stress can facilitate the tendency of some individuals to drink heavily, engage in excessive smoking and do less and less physical activity to adapt against the adverse impact of stressful working conditions.

The findings of significant positive relationships between amount of life stress and health outcomes, systolic blood pressure, psychosomatic health complaints and pathogenic health habits and between number of

Table 3: Correlations Between Criterion Variables and Organisational and Extra-Organisational Stress for Type A and Type B Groups

S.No.	Variables	Type A Group (N = 125)				Type B Group (N = 75)			
		Systolic Blood Pressure	Diastolic Blood Pressure	Psycho-somatic Health Complaints	Patho-genic Health Habits	Systolic Blood Pressure	Diastolic Blood Pressure	Psycho-somatic Health Complaints	Patho-genic Health Habits
1.	Role Overload	.013	−.019	.318**b	.203**	−.148	−.098	−.056b	−.071
2.	Role Ambiguity	.077	.034	.151	.143a	−.165	.111	−.104	−.148a
3.	Role Conflict	.043	−.041	.434**b	.238**	−.073	−.060	−.030b	.029
4.	Job Stress (Overall)	.099	−.015	.395**b	.249**a	−.161	−.041	−.075b	−.097a
5.	Number of Stressful Life Events	.034	−.026	.173*	.048	.106	.126	.297**	.161
6.	Amount of Life Stress	.127	.013	.296**	.116	.096	.193	.345**	.251**

N = 125, r = .18, * P < .05 r = .23, ** P < .01

N = 75, r = .22 * P < .05 r = .29, ** P < .01

a Difference between Type A and Type B group is significant at .05 (t-test)

b Difference between Type A and Type B group is significant at .01 (t-test)

stressful life events and psychosomatic health complaints are consistent with the findings of Theorell and Rahe (1972), Rahe *et al* (1973) and Theorell (1986). These studies have shown that life events and change, life satisfaction and dissatisfaction are crucially related to coronary heart disease and risk factors. It was further assumed that these stressful life events are associated with intra-individual strains, and both stresses and strains correlate with alterations in individual's physiological balance (e.g. elevated serum cholesterol, high blood pressure etc.) as well as with maladaptive individual responses (e.g. smoking, alcohol and obesity).

The findings of significant differences between Type A and Type B managers on job stress, role ambiguity, role conflict and systolic and diastolic blood pressure are consistent with the literature (Dearborn and Hastings, 1987; Greenglass, 1988; Jamal, 1990). In a study, Hendrix *et al*, (1985) reported that, Type A individuals significantly experienced higher job stress than Type B individuals. Psychophysiological studies have shown that Type A persons display greater cardiovascular (systolic blood pressure and heart rate) responses to certain stimuli than do Type B individuals (Krantz *et al*, 1988; Lee and Gillin, 1989). In a recent study, Spector and O'connell (1994) have reported that Type A behaviour was a significant predictor of job stressors (autonomy, role ambiguity, role conflict, work overload, constraints and interpersonal conflict) and job strains (job satisfaction, work anxiety and somatic complaints).

The results from the subgroup analysis in the present study have shown that Type B employees were found to be "better off" than Type A employees in terms of the adverse consequences of high job stress and stressors. Type A behaviour interacts with the work situation to results in a highly stressed individual. Results further suggest that Type A employees experiencing high job stress adopt pathogenic health habits (excessive use of alcohol and tobacco etc.) against the adverse impact of stressful situations.

Unlike the findings of earlier studies (Howard *et al*, 1986), the findings of the present study indicate that Type A behaviour pattern did not moderate the relationship between work stress, stressors and blood pressure, as the relationship is similar for both Type A and Type B groups.

Contrary to the prediction, there was no evidence that Type A group was more adversely affected by life stress experienced in past one year. The relationship between life stress, number of stressful life events in past one year and health outcomes is similar for both Type A and Type B groups, and this suggests that Type A people are so committed to their job that they often neglect their life outside the work atmosphere. Thus, the findings of the present study add additional support to

The relationship between life stress, number of stressful life events in past one year and health outcomes is similar for both Type A and Type B groups, and this suggests that Type A people are so committed to their job that they often neglect their life.

the notion that the conditions facilitating Type A behaviour are those encountered in the working environment. Type A employees are not only pushed by their personality dispositions to jobs which are fast paced, competitive and challenging, but they probably experience adverse consequences of job stress more severely than other employees. Thus, the results obtained here suggest that management and authorities of such organisations must make their efforts to keep employees free from various organisational stressors and various stress management programmes should be implemented in the working place so that the quality of working life and health of employees can be improved.

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Feature

People's Participation in Watershed Programmes in Dry Regions

N. Rajasekaran

The present study makes an attempt to analyze the role of participation of local resource users in watershed project area and the resultant level of sustainability achieved by studying one watershed each from two diverse agro-climatic situations in Maharashtra. The theoretical and empirical discussions drive home the point that socially acceptable living can be ensured to the majority of the people in the dry region by resorting to watershed development programme. To achieve this end, the healthy participation of all local resource users irrespective of gender and caste is sine qua non. As the benefits of the programme are not tangible in the short run, participation could be ensured only through decentralisation of decision making at the different stages of the programme and through conscientizing them about the long run drought proofing nature of the programme.

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Introduction

Studies on sustainable development clearly indicates that the population pressure and the human interaction with nature are the principal causes for the considerable land degradation process. Hence, the matter of concern rivets on the widening chasm between the degradation process and the natural rejuvenation process. For, this nexus precipitates the deprivation of the indestructible power of the resources and consequently the inter temporal production. The possibility of natural replenishment does not seem to be a stumbling block in the assured irrigated tracts as the campaigners of sustainable agriculture articulate that the expansion in the number of crops grown and the crop rotation can maintain the soil fertility; furthermore, it is feasible to contain the proliferation of pests without extensive use of fertilizers and pesticides (Beus and Dunlap, 1990; Ehrenfeld, 1987). The sustainable agriculturists favour significantly reduced use of synthetic farm chemicals, smaller farm units and appropriate technology to control the degradation process [Rao 1992].

The matter of concern rivets on the widening chasm between the degradation process and the natural rejuvenation process.

The net depletion rate is negative in the dry land region, for the technology induced cropping pattern and ground water exploitation, free riding attitude of the people in sharing the scarce common property resources, and to cap it all the capricious weather contribute evenly to maintain a higher depletion rate. The natural process of rejuvenation is close to impossible due to the caprices of weather and poor economic condition of the majority in the community. Much as it is the situation in

the rainfed areas in most of the developing countries, the problem in India is highly complicated to comprehend due to its diversities in caste, creed and economic condition. The rainfed area constitutes 70 per cent of the total cultivated land in India and nearly 42 per cent of the food production comes from dry land farming (CMIE, 1986). With major share in production and considerable portion of cultivable tract under rainfed cultivation being prone to frequent droughts, the amount of attention paid to accelerate the development activities in the dry region remains cursory.

With major share in production and considerable portion of cultivable tract under rainfed cultivation being prone to frequent droughts, the amount of attention paid to accelerate dry region remains cursory.

Rao (1991) recognised that the approach of the planning process for the development of dry land agriculture should subsume mainly two aspects, namely, (1) conservation and upgradation of the principal resource base, viz., land and (2) policy framework to make dry land agriculture drought proof. Though food security system in India appears to be resilient enough to deal with transient drought situation, production side is not sufficiently drought proof, for which there can only be a long term solution (Ahluwalia, 1991). In line with this, the Eighth Plan identified the significance of watershed development approach to sustain the carrying capacity of land in the dry region.

The sustainability issue is highly complicated in the watershed areas with majority of the people making a hand to mouth existence. The reciprocity to social benefits accrued can be anticipated only when the people are ensured and equipped adequately to make a socially acceptable living. Since the depletion rate is accentuated by the actions of the people depending on it, the accelerated rejuvenation becomes reality but only with the participation of the same people.

The present study makes an attempt to analyze the role of participation of local resource users in watershed project area and the resultant level of sustainability achieved by studying one watershed each from two diverse agro-climatic situations in Maharashtra. The data was collected from two diverse agro climatic zones viz., scarcity zone and transition zone and a representative control region (matching parameters as of project regions) for each of the watersheds. The noticeable difference between the two regions is the activities undertaken as part of the project. Hence, the developments taken place and the improvements in productivity could be totally attributed to the watershed development programme.

The sustainability issue is highly complicated in the watershed areas with majority of the people making a hand to mouth existence. The reciprocity to social benefits accrued can be anticipated only when the people are ensured and equipped adequately to make a socially acceptable living.

Concepts and Methodology

Sustainable development has been defined differently by different authors. While it refers to the minimisation of entropy in the production process according to quantum mechanism principle, it is reworked to ascribe a development which is environmentally non-degrading, technically appropriate, economically viable and socially acceptable (FAO, 1991). Operationally definition of sustained development has been emended to purport the ecological sustainability in the case of renewable resources as managing the environmental resources to ensure the long-term sustainable utilisation of species and eco-systems, minimise survival risk—generally keep open as many future options as possible (Allen, 1980; IUCN, 1980; O'Riordon, 1983; Engels, 1984). The concept of sustainability gradually gets diluted to sustainable utilisation. It is true in the case of dry land region where either the resources are underutilised or overutilised. Whatever it is, ultimately it precipitates survival risks to the species and eco-systems in the region. As the problem is *in situ* and man-made, the people of the region hold the key for dispensing with the problem.

While the concept of participation of the people in the eco-system has not been stressed adequately unlike the sustainability in literature wherein concepts like equity—participation and decentralisation are used interchangeably. But Lele (1991) feels that while participation and decentralisation are equivalent, they can somehow substitute for equity and social justice. Cohen and Uphoff (1980) list four types of participation, viz., in decision making, implementation, benefit distribution and evaluation. This appears to be an operational classification. Nevertheless, the symmetry of participation in all these aspects can bring about expected outcome of an *in situ* development programme.

In the case of watershed programme, an *in situ* development programme, the participation of local people is sine qua non since the different activities implemented on the private lands and public land have to be sustained over a period by the owner of the land in addition to maintaining collectively the works undertaken in common lands. This seems to emphasize the significance of participation for sustainability. As the activities of watershed programme are spread over different reaches like upper, middle and lower, the inter-dependence of beneficiaries in different reaches and spill-over of benefits due to activities are ineluctable and inexorable. Hence, the collective participation of people to avail the benefits optimally is convincingly indispensable and imperative.

In the case of watershed programme, the participation of local people is *sine qua non.*

A better participation can be ascertained at the later stages of the programme only by identifying and designing the programme which is acceptable to the people and environmentally benign. Involving large number of people in the training and designing the implementation process also staves off the formation of factions among the beneficiaries (William Critchley, *et al*, 1992). The farmers generally prefer to treat their own fields before treating common lands though the benefits of treating common land in the watershed region is relatively better (Deshpande and Rajasekaran, 1995; it is also proved in the case of Central Plateau of Burkina Faso, by Wright and Bonkoungou, 1985).

Prudent effort to involve and train the farmers in large number from different reaches in the initial stages obligates the participation of them in the implementation part of the programme. In addition, certainly this creates a conducive atmosphere for adoption of the activities cogently in all the reaches.

Prudent effort to involve and train the farmers in large number from different reaches in the initial stages obligates their participations in implementation.

Over and above, Critchley *et al* (1992) recommends that organising the local resource users for the construction of water harvesting structures and empowering them to decide the treatment and priorities can decidedly buoy them up for sincere implementation. But then do not say markedly the type of group or organisation. Olson (1965) postulated that "unless the number of individuals in a group is quite small, or unless there is coercion or some other device to make individuals act in their common interest, rational, self interested individuals will not act to achieve their common or group interests" (Olson, 1972, also quoted in Katar Singh, 1994).

Results

The proportion of farmers participating in the watershed programme design and implementation depicted in Table 1, points out that the participation is relatively better in the transition zone than in the scarcity zone. This is also true that the differences between the size class of holdings is noticeably lesser in the transition zone watershed areas with the absence of above 4 hectares category of beneficiaries. This seems to be in conformity with both the traditional theory of participation and Olson's theory [Olson, 1965]. Another noticeable feature in the scarcity zone is that the marginal farmers shirk from involving in planning and training or rather they were not given a chance. Perhaps, this entailed the relatively lesser participation in the scarcity zone. Notwithstanding this, the overall participation apears to be encouraging. This could be due to involving a sizeable population in the planning through both RRA and PRA and training from both sexes (Critchley, *et al*. 1992). The participation along with Mitra Kisan and Gopis also lends credence to Olson's 'Sophisticated Variant' of forming appropriate groups to achieve the common end. Above all, the frequent visit of the NWDPRA staff also vouch for better participation by working as a special device to instil confidence in the people about the programme. Resultantly, it engenders overall participation to discuss the common issue of implementing the programme and sustenance aspect of the programme is the common pool resources at the village level meetings. This also upholds the Cohen and Uphoff (1980) views of operationalising the participation. Another issue is the non-separability of benefit distribution from the common pool resources and the consequent contingent valuation to participate in the works on common property resources (Anderson and Runge, 1994). Table 2 clearly establishes that the activities undertaken on the own land pay direct tangible dividends gain priority as against the work carried out on common land to serve common interest. The prioritization irrespective of size group tends towards the own land activities in total (Mosse, 1994). But participation is not just an end in itself, rather it is a means in the case of watershed (Cohen and Uphoff, 1980). As the end is harvesting the

Table 1: Participation of Beneficiaries in Watershed Programme

Participation in Activities	Scarcity Zone					Transition Zone			
	0-1	1-2	2-4	4&<	All	0-1	1-2	2-4	All
1. Planning	25.00	57.14	55.56	52.94	50.00	62.50	66.67	54.55	60.00
2. Training		14.29	24.78	17.65	18.00	31.25	25.00	18.18	24.00
3. Mitra Kisan	75.00	71.43	55.56	41.18	56.00	62.50	58.33	68.18	64.00
4. NWDPRA Staff	87.50	100.00	66.67	52.94	70.00	81.25	83.33	90.91	86.00
5. Village Meet	25.00	42.86	33.33	23.53	30.00	62.50	50.00	68.18	62.00

Source: Deshpande and Rajasekaran (1995)[b].

Note: Figures are in percentage to total beneficiaries in each of the categories.

Table 2: Distribution of Beneficiaries on the Basis of their Participation in Different Activities of Watershed Programmes

Activities	Scarcity Zone					Transition Zone			
	0-1	1-2	2-4	4&<	All	0-1	1-2	2-4	All
1. Bunding	100.00	100.00	94.44	94.12	96.00	100.00	100.00	100.00	100.00
2. Vegetative Bunds	87.50	100.00	100.00	94.12	96.00	68.75	100.00	95.46	88.00
3. Contour Cultivation	100.00	100.00	100.00	100.00	100.00	87.50	100.00	100.00	96.00
4. Planting Trees	75.00	28.57	66.67	47.06	56.00	18.75	50.00	54.55	42.00
5. Pasture Land	25.00	–	27.78	23.53	22.00	–	–	13.64	6.00

Source: Deshpande and Rajasekaran (1995)[b].

Note: Percentages are to the total beneficiaries in each category.

rain water and conservation of moisture, participation in any prioritization is not a panacea. The tendency towards free riding, contingent valuation of others contribution and prisoner' dilemma situation precipitate the lower participation in planting trees and pasture due to non-separability of both cost and benefits. Appealingly in the scarcity zone, the participation of marginal farmers is laudable in common land whereas it is negligible in the transition zone. Perhaps, the possible reason could be due to the larger dependence of marginal farmers on common land for their livelihood and for their stock of ruminants in the scarcity zone.

The tendency towards free riding, contingent valuation of others' contribution and prisoner' dilemma situation precipitate the lower participation in planting trees and pasture due to non-separability of both cost and benefits.

The distribution of these improvement or tangible benefits is analyzed in Table 3 by looking at the agricultural income for each households and yield per hectare in the project area in comparison with control region. The agricultural income both per hectare and per household registers a noticeably higher value in both

Table 3: Per Hectare and Per Household Income from Agriculture for both Beneficiaries and Non-beneficiaries in the Watershed Regions

Size Class	Scarcity Zone		Transition Zone	
	Bene-ficiaries	Non-bene-ficiaries	Bene-ficiaries	Non- bene-ficiaries
Per Hectare				
0-1	8683.95	2218.75	5028.72	6041.67
1-2	5161.48	3384.38	6354.03	5372.50
2-4	4696.79	3049.14	8462.22	6983.29
4&>	4017.32	3151.28	NA	2603.26
All Size	4625.31	3125.95	7529.99	5609.57
Per Household				
0-1	11093.75	2366.67	4158.13	4833.33
1-2	10787.50	7735.71	8996.25	7814.55
2-4	13252.78	8812.00	21897.91	15461.00
4&>	22331.25	24580.00	NA	23950.00
All Size	15418.00	10890.80	13124.78	11160.80

Source: Rajasekaran and Deshpande (1996)

the project regions. In the per hectare income while scarcity zone supports the negative relationship between land size and productivity, the transition zone establishes a positive relationship between the size of land and income. The per household income in the table refers to the distribution of benefits. It manifests that the programme in the scarcity region has mitigated the inequality. While the difference between the lowest land size group and the highest is negligible in the project area, it is almost ten times between the same categories in the control region of the scarcity zone. In the transition zone, it does not make much difference between the project region and control region. However, the disparity between the different size categories remains considerably higher for both beneficiaries and the non-beneficiaries. The relevance of the programme for the development of the scarcity zone which forms considerable area in Maharashtra is also emphasized.

Table 4: Impact of Conservation Measures on Reducing the Land Degradation Process (As felt by the beneficiaries)

Activities	Scarcity Zone		Transition Zone	
	Sig	Mode	Sig	Mode
1. Bunding activity				
a. moisture retention	32	68	42	56
b. reducing run-off and soil loss	32	68	32	64
2. Vegetative bunds/keyline reduction in soil loss and run-off as well as increase in water table	98	–	90	–
3. Contour cultivation				
a. moisture conservation	58	42	50	46
b. reducing soil loss	60	40	50	46
c. ease in intercultivation	44	46	42	52

Note: While 'sig' refers to significant impact, 'mode' refers to moderate impact.

Figures are in percentages to total beneficiaries.

Only positive responses were considered. Hence, the total may not add upto 100 per cent.

Besides the social sustainability, the programme made inroads in improving the targeted environmental aspects too. The changes in the environmental parameters presented in Table 4 expound that from a third to a second observed a noticeable change in moisture retention, soil loss and water conservation due to all the activities. The others perceived some change in the region. This substantiates that the improvement in production and income is increasingly due to all the project. Hence, similar to other developments, the environmental development path is also set to motion in the dry region. More so, the investment from the Government and the participation from the people assisted to make a positive investment for the future generation considerable tangible benefits in accordance with both Ramsey Rule and Chakravarty's hypothesis.

Conclusions

As a long term drought proof measure, the watershed development approach has been identified to sustain the carrying capacity of land in the dry region and also to ascertain a socially acceptable living to the people in the region. This may be possible by ensuring ecological and social sustainabilities, which in turn could be achieved only through participation of people at different stages of programme implementation. The interesting observations of the study are listed as follows.

Theoretically, it was observed that due to the non-separability of the cost and benefits of the programme, the contingent valuation of others contribution in the working of watershed activities causes concern to the overall participation and sustainability of the programme. Not withstanding this, the programme could be made successful by involving the local resource users in the different stages of the programme viz., formulation, implementation, maintenance and evaluation. In addition, making small working groups with a charismatic leader to lead can bring out better results.

The empirical results indicated that imparting training to 'Mitra Kisan' and 'Gopis' from both genders can entail the formation of Olson's 'sophisticated variant' type of groups to achieve wholesome participation of local resource users from both the genders. The prioritization of the users irrespective of size groups tends towards activities undertaken in own land.

The resource fragile regions beseech the present generation to discount consumption of the resources and make considerable investment in the degrading natural resources to sustain the indestructible powers. This can shift the development path upwards in the dry region to a socially acceptable norm by both increasing the production and by reducing the inequality in the distribution of income.

The theoretical and empirical discussions drive home the point that socially acceptable living can be ascertained to the majority of the people in the dry region by resorting to watershed development programme. To achieve this end, the healthy participation of all local resource users irrespective of gender

Socially acceptable living can be ascertained to the majority of the people in the dry region by resorting to watershed development programme.

and caste is *sin qua non*. As the benefits of the programme is not tangible in the short run, participation could be ensured only through decentralisation of decision making at the different stages of the programme and through conscientizing them about the long run drought proofing nature of the programme.

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Feature

Cotton Production in India: Performance, Prospects and Constraints

Vijay P. Sharma

In India 20 per cent industrial output comes from cotton/textile sector, which employs over 60 million people in growth and processing of the material. Production of cotton depends on several factors like land allocation, price for produce, irrigation, rainfall etc. The present paper analyses these factors in Indian scenario and in particular growth instability behaviour of cotton acreage, production and yield, consumption of cotton etc. Projected growth of cotton demand is arrived at through regression analysis.

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In many developing countries, cotton is an important agricultural commodity, providing a significant contribution to farm income and export earnings. In India, over 60 million people derive income from the cotton /textile sector (Bell and Gillham, 1989) and Indian textile industry accounts for 20-per cent of industrial output and contributes nearly one-third of the total exports. No crop competes with cotton's potential for value added in processing (Hitchings, 1984). Despite having largest area (85,000 ha) under cultivation, India ranks fifth in cotton production, which has been erratic over the years. The yield per hectare is only 290 kg against 550 kg in Pakistan, 1500 kg in Israel and a world average of 603 kg (Damani, 1996). India has the second largest spinning capacity of 31 million spindles (China topping with 40 million spindles).

Cotton, one of the most important commercial crops in India is grown all over the country but its production is concentrated mainly in nine states, namely, Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu – these states together account for about for about 99 per cent of the total area under cotton. India is the only country in the world that grows all the four cultivated cotton species, viz., *G. hirsutum, G. arboreum, G. herbaceum and G. barbadense.* On the basis of agro-climatic conditions the country is divided into three major cotton growing zones, the *Northern* comprising the states of Punjab, Haryana and Rajasthan, accounting for about 1663 thousand ha, the Central consisting of Gujarat, Madhya Pradesh and Maharashtra, the major cotton producing region, accounting for 4267 thousand ha and the *Southern* comprising of Andhra Pradesh, Karnataka and Tamil Nadu, accounting for about 1644 thousand ha.

Government interventions (price or stabilization) influence domestic production, domestic textile industry and the international cotton, yarn and textile markets. In India, Cotton Corporation of India (CCI) primarily

canalises the imports and exports of cotton and acts as an agent of Government of India to maintain stability in the cotton market through its market operations including price support operations. Besides CCI, State Co-operative Cotton Federations also are associated with the marketing of cotton in their respective states. In Maharashtra, a scheme of monopoly procurement of cotton is in operation, under which farmers have only one choice with regard to sale of produce, i.e., to Maharashtra State Co-operative Cotton Growers' Marketing Federation.

Production of cotton depends on a number of factors like farmers' decision to allocate land, the expected price for the produce, availability of improved seed and irrigation, rainfall, prices of fertilisers and pesticides, and relative profitability of cotton vis-á-vis competing crops. There have been considerable year to year fluctuations in acreage production and prices of cotton and these fluctuations have far reaching effects on farm income levels. Fluctuations in cotton acreage are caused by variations in the prices of cotton vis-á-vis competing crops, weather conditions, availability of irrigation, marketing of produce and the risks arising from the price and yield variations. There is, therefore, obvious need to determine the impact of these factors on cotton acreage.

There have been considerable year to year fluctuations in acreage production and prices of cotton and these fluctuations have far reaching effects on farm income levels.

The present paper analyses the growth instability behaviour cotton acreage, production and yield and impact of different factors on the acreage, yield and consumption of cotton in India. The specific objectives of the study are (i) to study the growth and instability pattern in area, production and yield of cotton; (ii) to analyse the cotton demand, supply, trade and consumption situation in the country, and (iii) to examine the acreage response of various factors influencing the decisions regarding allocation of land to cotton and impact of these factors on crop yields.

Data Sources and Methodology

The study is based on secondary data covering the period 1950-51 to 1995-96 in case of all India and 1970-71 to 1994-95 in case of states. The study period has been divided into two sub-periods, namely Period I from 1971-72 to 1980-81 and Period II from 1980-81

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to 1994-95. Nine major cotton growing states which altogether account for about 99 per cent of India's cotton acreage and production are included. In order to organise the discussion of the state level results and also to trace the regional patterns, the states are classified in 3 major regional groups:

North : Punjab Haryana and Rajasthan

Central : Gujarat, Madhya Pradesh and Maharashtra

South : Andhra Pradesh, Karnataka and Tamil Nadu

The data on area, production, yield, irrigated area, farm harvest prices, rainfall, cotton imports, exports, mill consumption, etc., were compiled from various issues of Estimates of Area and Production of Principal Crops in India, Indian Agriculture in Brief, Economic Survey (Government of India), "Fertilizer Statistics" (FAI), "Handbook of Statistics on Cotton Textile Industry" (ICMF), and "India's Agricultural Sector: A Compendium of Statistics" (CMIE, 1996).

The growth performance of cotton in all regions of the country, that is, the annual compound growth rates have been calculated by fitting the trend Eqn. 1 to the time series of three-year averages of area, production and yield per ha.

$$Y = AB^t \qquad \ldots(1)$$

Herein, Y's are the triennial averages of area, production and yield per ha, t is the time variable The use of three year moving average series of area, production and yield, instead of the original series may reduce considerably the influence of extreme variations in climatic factors on the estimates of growth rates. Furthermore, for verification of existence of statistically significant acceleration or deceleration in growth rates of area, production and yield, 't' statistic has been used for estimating the significance of difference between the means of two independent samples.

For analysing the components of change in the average production of cotton, a decomposition proce-

dure is used (Hazel, 1982, 1984, 1985). Let P denote production, A, the area sown and Y, yields. Also, letting subscripts i to denote states, the total production is:

$$P = \sum_{i=1}^{n} E(A_i Y_i) \quad \ldots(2)$$

Average Production is:

$$E(P_i) = \sum_{i=1}^{n} E(A_i Y_i) = \sum_{i=1}^{n} [A Y + \text{Cov}(A,Y)] \quad \ldots(3)$$

where A and Y denote mean values of area and yield. The decomposition analysis partitions the changes in $E(P)$ between Period I and Period II into constituent parts. This involves decomposing the changes in Eqn. (2) with the help of Eqn. (3) and then summing up the changes in different components over states. Thus from Eqn. (3) and ignoring the state subscripts, average production in the second period is:

$$E(P_2) = A_2 Y_2 + \text{Cov}(A_2, Y_2) \quad \ldots(4)$$

Each variable in the second period can be expressed as its counterpart in the first plus the changes in variable between the two. Eqn. (4) therefore can be rewritten as:

$$E(P_2) = (A_1 + \Delta A)(Y - \Delta Y) + \text{Cov}(A_1 Y_1) + \Delta \text{Cov}(A Y) \quad \ldots(4a)$$

The change in average production is then obtained from $\Delta E(P) = E(P_1) - E(P_2)$.

There are sources of change in $\Delta E(P)$. Two parts, $A_1 \Delta Y$ and $Y_1 \Delta A$ arise from changes in the mean yield and the mean area. These pure effects arise even in the absence of other sources of change.

Several studies attempted to estimate the demand for cotton and a wide range of approaches have been used. Donald *et al* (1963), Dudley (1974), Magleby and Missaien (1977) and Thigpen (1978) estimated the demand for cotton as a function of real income, lagged prices and per capita income. Many researchers have used adaptive expectations models to estimate the equations. Studies that have used this approach include Adams and Behrman (1976), Ecevit (1978), Mues and Simmons (1986), Coleman and Thigpen (1990).

In this paper, the share of cotton in total use is estimated initially as a function of the prices of cotton and the price of non-cotton cloth. This model was not successful with either one or both the variables insignificant or the low value of r^2. This may be due to multicollinearity between cotton and non-cotton cloth prices. Therefore, the equation explaining the cotton share of total fibre use was estimated as a function ratio of price of cotton and non-cotton cloth and cotton share in the lagged period. The cotton share equation was of the form:

$$\text{Ln COTSHARE} = a_0 + a_1 \text{Ln}(P_{cot}/P_{noncot} + a_2 \text{Ln COTSHARE}(-1) \quad \ldots(5)$$

where,

COTSHARE = Cotton share of total fibre use

COTSHARE (–1) = Cotton share of total fibre use in the lagged year

P_{cot} = Price of cotton cloth (Rs/mt)

P_{noncot} = Price of non-cotton cloth (Rs/mt)

Ln = Indicates variable transformed into logarithms.

a_0 is the intercept and a_1 and a_2 are the parameter estimates to be estimated.

Per capita total fibre and cotton use were also estimated as the function of per capita gross domestic product (GDP). The functional form is:

$$\text{PCTFU} = a_0 + a_1 \text{Ln PCGDP} + a_2 \text{TIME}$$

$$\text{PCCOTU} = a_0 + a_1 \text{Ln PCGDP} + a_2 \text{TIME}$$

where,

PCTFU = Per capita total fibre use (kg)

PCCOTU = Per capita cotton use (kg)

PCGDP = Per capita Gross Domestic Product (Rs)

TIME = Time Variable

Finally the price and income elasticities of total fibre and cotton use have been computed. The acreage response functions in the present paper have been estimated using Nerlovian adjustment lag model as the basic framework of the analysis. The general form of the model is as follows:

$$\text{(i) Linear: } A_t^* = \alpha_0 + \alpha_1 P_e + \sum_{i=2}^{n} \alpha_{i-1} X_{i-1} + U_t \quad \ldots(7a)$$

$$A_t - A_{t-1} = \kappa (A_t^* - A_{t-1}), \; 0 < \kappa < 1 \quad \ldots(7b)$$

$$\text{(ii) Log-linear: } A_t^* = \alpha_0 P_e^{\alpha_1} \prod_{i=2}^{n} X_{i-1}^{\alpha_i - 1} U_t \quad \ldots(7c)$$

$$\frac{A_t}{A_{t-1}} = \left(\frac{A_t^*}{A_{t-1}}\right)^{\kappa} \qquad \ldots(7d)$$

where κ is the coefficient of adjustment representing the proportion of adjustment towards equilibrium which occurs in one time period, A_t is the desired acreage under cotton in period t; P_e is the expected price of cotton and X represents the shifter variable.

Now by substituting the values in equation (7b), the reduced form can be shown as:

$$A_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 A_{t-1} + U_t\,, \qquad \ldots(8)$$

where $\beta_0 = \alpha_0 \kappa; \beta_1 = \alpha_1 \kappa; \beta_2 = (1-\kappa)$

Equation (8) is the computational equation, the parameters of which are estimated by Ordinary Least Square (OLS) method under the usual assumptions in linear as well as log-linear forms. Of the two functional forms, log-linear model was selected for the interpretation of results considering the values of R^2 and significance of estimates.

Using the adjustment lag model as the basic frame of analysis, the area of response equations in the study were estimated with the help of following model:

$$\begin{aligned}\text{Ln At} &= \beta_0 + \beta_1 \text{ Ln } RP_{t-1} + \beta_2 + \text{Ln } A_{t-1} + \\ &\beta_3 \text{ Ln } RY_{t-1} + \beta_4 \text{ Ln NI } A_t + \beta_5 \text{ Ln PSOR} + \\ &+ \beta_6 \text{ Ln CV } P_{cot} + \beta_7 \text{ Ln CV } Y_{cot} + V_t \qquad \ldots(9)\end{aligned}$$

where,

A_t = Actual area planted under cotton (percentage to net sown area)

A_{t-1} = One year lagged acreage under cotton

RP_{t-1} = Relative price of cotton with respect to the price of competing crop

RY_{t-1} = Relative yield of cotton with respect to yield of competing crop

NIA = Net irrigated area (percentage to net sown area)

PSOR = Rainfall during pre-sowing season of cotton in mm

CVP_{cot} = Coefficient of variation of the preceding three years' price of cotton

CVY_{cot} = Coefficient of variation of the preceding three years' yield of cotton

The acreage response equations were estimated for the major cotton growing states using the time series data for the years 1972-73 to 1992-93. In the case of double log function regression, coefficients of independent variables themselves represent the short run elasticities. The long-run elasticity of acreage with respect to different price and non-price variables has been calculated by dividing the short-run elasticity with the coefficient of area adjustment (κ).

The two major estimation problems associated with the use of time series data are multicollinearity and autocorrelation. The former one was tested by zero order correlation matrix and variables causing multicollinearity were dropped through step-wise regression analysis. The lagged model suffers from serial dependence. This violates the basic tenets of OLS independence of error residuals and results in biased estimates of regression coefficients. Since Durbin-Watson 'd' statistic is inappropriate in a model which includes the lagged values of dependent variable among the explanatory variables in supply function, the Durbin 'h' statistic, appropriate for testing autocorrelation in the lagged models has been computed as follows (Johnston, 1988):

$$h = r\sqrt{\frac{n}{1 - n \text{ var } (\beta_2)}} \sim N\,(0,1) \qquad \ldots(10)$$

where $r = (1-d/2)$

d = computed Durbin-Watson 'd' statistic

n = sample size and

var (β_2) is the estimated sampling variance of the coefficient A_{t-1} in the OLS regression equation.

The test breaks down if it should happen that $n.\text{var}\,(\beta_2) \geq 1$. For such cases, the d-statistic was employed to check the incidence of serial correlation. The constraints limiting the cotton yield are fertilizer use, irrigation, rainfall, good quality seed, and insect-pest and disease control measures. In order to ascertain the impact of important variables on the growth of crop yields, multiple regression equation of the following form has been fitted to state level data relating to the period 1970-71 to 1992-93:

$$Y_t = \gamma_0 \text{ FERT}^{\gamma_1} \text{ IRRI}^{\gamma_2} \text{ RAIN}^{\gamma_3} \qquad \ldots(11)$$

Where Y_t is cotton yield (kg/ha); FERT is the fertilizer consumption ($N+P+K$) in kg/ha; IRRI is the irrigated area under cotton (per cent); RAIN is the rainfall received during the crop growth period in mm and γ's

are the parameters to be estimated. OLS method has been used to estimate the equations.

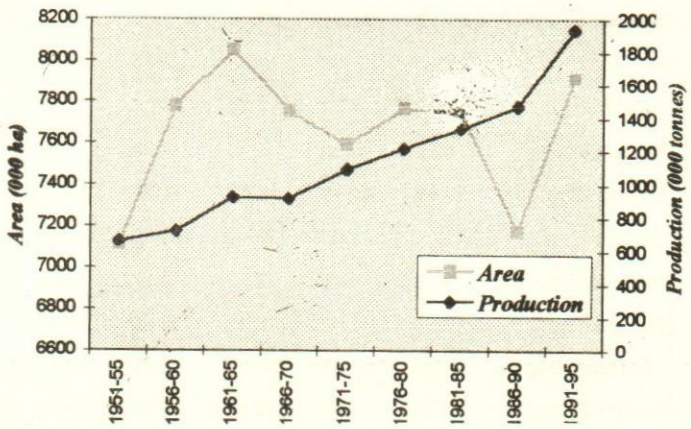


Fig. 1. Trends in Area and Production of Cotton in India

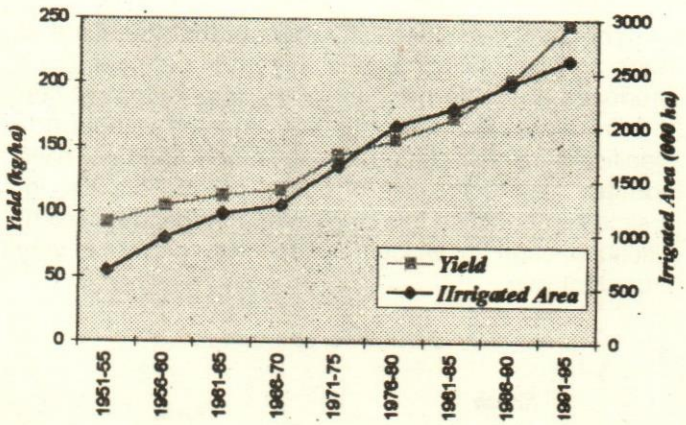


Fig. 2. Trends in Yield and Irrigated Area under Cotton

Table 1: Production, Acreage, Yield and Irrigated Area of Cotton in India-Five Year Averages from 1951 to 1995

Year	Production ('000 Tonnes)	Area ('000 Hectares)	Yield (Kg/Ha)	Irrigated Area ('000 Ha)
1951-55	659	7107	92	657
1956-60	716	7780	105	964
1961-65	918	8051	113	1189
1966-70	912	7753	117	1268
1971-75	1091	7592	144	1628
1976-80	1214	7764	156	2006
1981-85	1334	7754	173	2170
1986-90	1471	7176	203	2392
1991-95	1938	7913	245	2617

Performance of Cotton Subsector

India ranks first in cotton acreage and contributes nearly 23 per cent of the world cotton area but the average yields are about half of the world average. Cotton production in India increased steadily from an average of 659 thousand tonnes during the period 1951-55 to about 1938 thousand tonnes during the period 1991-95. The area under cotton increased from 7107 thousand ha to about 7913 thousand ha during the same periods. The rapid and considerable rise in cotton production since the early 1950s has resulted mainly from increased yields which rose from 92 kg/ha in 1951-55 to 245 kg/ha in 1991-95, an increase of about 266 per cent (Table 1). Despite this increase, average yields in the country are only 50 per cent of the world average. The yield of irrigated cotton in 1992-93 was 570 kg/ha compared to 130 kg/ha for rain-fed cotton (Gillham, *et al*, 1995).

In these five decades (1951-91) the cotton crop also faced a number of vagaries of weather, insects, pests and diseases but due to well established research system, the overall performance improved with a number of new varieties, availability of quality inputs, appropriate plant protection measures, government support price policy. The increase in cotton acreage arose from improvement in irrigation facilities while the yield increases were mainly from improved crop varieties, crop protection and higher fertiliser use. The area under irrigation for cotton increased from 657 thousand ha in 1951-56 to 2671 thousand ha in 1991-95, an increase of about 398 per cent.

The increase in cotton acreage arose from improvement in irrigation facilities while the yield increases were mainly from improved crop varieties, crop protection and higher fertiliser use.

Areas of Production

Although cotton, one of the most important commercial crops in India, is grown all over the country, there are nine major cotton growing states which contribute more than 99 per cent of total area and production of cotton in country.

In 1971-75, the share of acreage in north zone was 13.48 per cent, which increased to 21.94 per cent in 1991-94. However, in the central region, the share of cotton acreage declined from 64.06 per cent in 1971-75 to 56.32 in 1991-94 (Table 2).

Table 2: Five-Year Average Acreage of Cotton as Percentage of the Indian Total Acreage

State	1971-75	1976-80	1981-85	1986-90	1991-94
Northern Region	**13.48**	**15.93**	**17.48**	**18.56**	**21.94**
Punjab	6.45	7.83	8.16	8.92	8.75
Haryana	3.13	3.57	4.49	5.67	6.89
Rajasthan	3.90	4.53	4.83	4.97	6.30
Central Region	**64.06**	**62.19**	**60.52**	**60.31**	**56.32**
Gujarat	22.94	22.70	18.97	15.82	14.70
Madhya Pradesh	8.64	8.36	7.38	7.56	7.00
Maharashtra	32.48	31.13	34.17	36.93	34.62
Southern Region	**21.48**	**21.12**	**21.23**	**19.48**	**21.17**
Andhra Pradesh	4.46	4.73	6.08	7.99	9.68
Karnataka	13.16	12.75	12.30	8.19	8.02
Tamil Nadu	3.86	3.64	2.85	3.31	3.46
All India	100.00	100.00	100.00	100.00	100.00

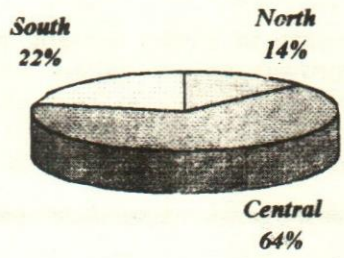
Table 3: Five-Year Average Production of Cotton as Percentage of the Indian Total Production

State	1971-75	1976-80	1981-85	1986-90	1991-94
Northern Region	**29.58**	**31.44**	**30.40**	**39.80**	**40.03**
Punjab	17.33	17.58	15.03	22.35	19.53
Haryana	7.11	7.54	8.94	10.37	11.97
Rajasthan	5.14	6.33	6.43	7.08	8.53
Central Region	**50.69**	**47.49**	**45.60**	**37.76**	**35.87**
Gujarat	28.50	25.95	23.46	15.60	15.12
Madhya Pradesh	5.06	4.16	3.73	3.77	3.26
Maharashtra	17.13	17.38	18.41	18.39	17.49
Southern Region	**18.68**	**20.35**	**23.27**	**21.81**	**23.65**
Andhra Pradesh	3.68	4.87	10.12	8.48	11.53
Karnataka	9.26	9.56	8.64	8.08	7.86
Tamil Nadu	5.74	5.92	4.50	5.25	4.25
All India	100.00	100.00	100.00	100.00	100.00

In 1971-75, Central zone produced about 51 per cent of the total Indian cotton production (Table 3). The share of crop grown in north and south zone was 29.58 and 18.68 per cent, respectively. Small amounts accounting for only one per cent of the crop, were grown in other states. However, in 1991-94, the share of north zone in total production increased to about 40 per cent, while that of central region declined to around 36 per cent.

The above results clearly indicate that the share of north zone in total acreage is only 21.94 per cent, but it produced about 40 per cent of the total output of cotton. In this zone the crop is fully irrigated without any significant rainfall during seasons and farmers have adopted new techniques of cotton production. The increase in production has been due to tremendous intensification effort in which research has played a very important role.

(a) Acreage Per cent 1971-75



(b) Acreage Per cent 1991-94

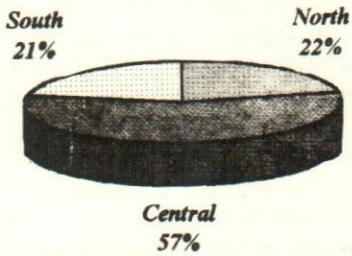
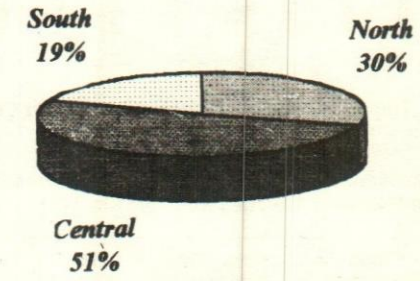


Fig. 3. Indian Cotton Acreage by State as Per cent of the Total Five-Year Averages from 1971 to 1994.

(a) Production Per cent 1971-75



(b) Production Per cent 1991-94

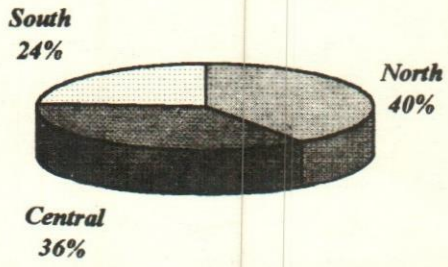


Fig. 4. Indian Cotton Production by State as Per cent of the total Five Year Averages from 1971 to 1994.

By contrast, in central and southern regions cotton is mainly dependent on rainfall with varying amounts of supplementary irrigation. About 13 per cent of the area in the central region and 18 per cent in southern region receive supplementary irrigation.

Growth Rates

Growth rates have been estimated by using exponential function on the time series data on production, area and yield of cotton in different regions in India as well as the country as a whole. The results are presented in Table 4 in respect of production, area and yield at national level. The cotton production at national level increased at an annual compound growth rate of 2.45 per cent (significant at 1 per cent level) over 45 years from 1951-52 to 1995-96. Comparison of growth rates during different sub-periods shows that cotton production was stagnant during the sixties and the same have grown at the rate of 2.93 per cent per annum during seventies, 2.23 per cent in the eighties and 4.07 per cent in the period 1991-92 to 1995-96. Acreage of cotton grew at the rate of 3.31 per cent per annum during the 50s and 3.76 per cent in 90s. While the acreage under cotton remained stagnant during the 60s and 70s and declined significantly (1.44 per cent/annum) during the eighties as e result of these the overall rate growth in area is found to be stagnant during 1951-52 to 1995-96 period.

Table 4: Compound growth rates of Production, Area and Yield of cotton in India during 1951-52 to 1995-96

	Annual Compound Growth Rates (%/annum)					
	1951-52 to 1960-61	1961-62 to 1970-71	1971-72 to 1980-81	1981-82 to 1990-91	1991-92 to 1995-96	1951-52 to 1995-96
Production	5.29*	0.76	2.93*	2.23*	4.07*	2.45*
Area	3.31*	–0.10	0.30	–1.44*	1.39*	0.13
Yield	1.87*	0.92	2.66*	3.63*	2.56*	2.34*

* : Significant at one per cent level of significance

The yield of cotton during 1951-52 to 1995-96 increased at a compound growth rate of 2.34 per cent per annum. However, the cotton yield remained stagnant during 1960s and 1990s. Analysis of data in sub-periods showed that moderately high growth rate of area, production and yield of cotton took place in 1950s. It has also been noted that the sharp rise in cotton production during the fifties was associated with greater increase in area. In 1970s the area, production and yield of cotton remained stagnant. The trend analysis for the period 1971-72 to 1980-81 revealed that the acceleration in cotton production was mainly due to significant increase in crop yield. During 1980's, though the growth rate of area was negative, the positive growth rate of yield had offset the negative impact of area.

The estimates of growth rates in respect of production, area and yield are presented in Tables 5, 6 and 7, respectively. Between the three main cotton producing regions of the country, the central region shows relatively poorest rate of growth (0.70 per cent). The growth rates of cotton production accelerated for Punjab, Haryana, Madhya Pradesh and Tamil Nadu from Period I to II. Gujarat recorded a zero growth rate during period II. However, Madhya Pradesh which witnessed a negative growth rate of (–1.80 per cent) in production in period I switched to a positive and significant growth rate of 2.27 per cent in period II. On the whole, the growth rate in cotton production at the national level accelerated from 2.93 per cent per annum in period I to 3.26 per cent in period II with an overall growth rate of 2.62 per cent in 25 years period from 1971-72 to 1994-95. The growth rate in production was negative (–1.10 per cent) for Gujarat only.

Table 5: State-wise Compound Rates Cotton Production in India; 1971-72 to 1994-95

States	Compound Growth Rates (%/annum)			Significance of difference between
	1971-72 to 1980-81	1980-1981 to 1994-95	1971-72 to 1994-95	1971-80 and 1980-94
Northern Region	4.07*	5.95*	4.33*	A (2.5655)*
Punjab	3.19*	5.75*	3.57*	A (3.2687)*
Haryana	3.98*	6.19*	5.39*	A (2.7056)*
Rajasthan	6.82*	6.02*	4.97*	D (0.6733)
Central Region	1.47*	0.75	0.70**	A (0.6960)
Gujarat	0.36	–1.41	–1.10*	–
Madhya Pradesh	–1.80*	2.27	0.53*	A (5.5906)*
Maharashtra	4.31*	2.73*	2.97*	D (0.9974)
Southern Region	5.46*	3.87*	3.91*	D (1.4064)***
Andhra Pradesh	13.13*	5.36*	9.46*	D (2.1322)**
Karnataka	4.60*	2.67*	1.82*	D (1.3050)
Tamil Nadu	2.42	2.92*	1.27*	A (0.2328)
All India	2.93*	3.26*	2.62*	A (0.4804)

A : Acceleration; D: Deceleration; *, ** and *** : significant at 1, 5 and 10 per cent level, respectively.

The growth rates of area under cotton accelerated for Haryana and Andhra Pradesh only in period I. The growth rates of area under cotton decelerated for Rajasthan. The negative growth rate of area got sharpened for Madhya Pradesh and changed from zero to negative for Gujarat. The area under cotton remained stagnant during both the periods for Maharashtra, Karnataka and Tamil Nadu.

Table 6: State-wise Compound Growth Rates Cotton Acreage in India; 1971-72 to 1994-95

States	Compound Growth Rates (%/annum)			Significance of difference between
	1971-72 to 1980-81	1980-1981 to 1994-95	1971-72 to 1994-95	1971-80 and 1980-94
Northern Region	3.83*	1.84*	2.30*	D (3.4990)*
Punjab	4.29*	0.35	1.43*	D (6.1336)*
Haryana	3.25*	4.19*	4.07*	D (1.5909)***
Rajasthan	3.52*	1.81*	1.98*	D (1.6245)***
Central Region	–0.42	1.22*	–0.77*	D (4.7298)
Gujarat	–0.05	–3.34*	–2.69*	D (5.6188)*
Madhya Pradesh	–0.77*	–1.17*	–1.26*	D (0.7765)
Maharashtra	0.58*	–0.15	0.43*	–
Southern Region	0.30	–0.63*	–0.38	–
Andhra Pradesh	2.13*	4.72*	4.15*	A (3.1218)*
Karnataka	1.01	–4.76	–2.96*	–
Tamil Nadu	–0.83	0.85	–0.83*	–
All India	0.30*	–0.52**	–0.17	D (0.4954)

A: Acceleration; D: Deceleration; ** and ***: significant at 1, 5 and 10 per cent level, respectively.

On the whole, it can be observed that the area under cotton increased significantly in all the states of northern region, Maharashtra in central and Andhra Pradesh in southern zone. The growth rates of yield which were significantly positive only for Haryana, Rajasthan, Maharashtra, Andhra Pradesh and Karnataka during period I turned significantly positive for all the states in period II. The yield growth rate was negative during Period I for Punjab and zero for Madhya Pradesh. Highest and positively significant growth rate

Table 7: State-wise Compound Growth Rates of Cotton Yield in India; 1971-72 to 1994-95

States	Compound Growth Rates (%/annum)			Significance of difference between
	1971-72 to 1980-81	1980-1981 to 1994-95	1971-72 to 1994-95	1971-80 and 1980-94
Northern Region	0.54*	3.76*	2.00*	A (7.1151)*
Punjab	–1.05*	5.89*	2.19*	A (7..7662)*
Haryana	5.89***	1.58*	1.10*	A (1.4864)***
Rajasthan	3.27*	4.18*	2.94*	A (1.1630)***
Central Region	1.07*	2.81*	1.95*	A (2.0447)**
Gujarat	0.49	1.91***	1.54*	A (1.005)
Madhya Pradesh	–0.95	4.57*	2.25*	A (4.9279)*
Maharashtra	4.73*	2.92*	2.54*	D (1.2030)
Southern Region	4.27*	2.98*	3.51*	D (1.5031)***
Andhra Pradesh	10.15*	1.66*	5.28*	D (2.7828)*
Karnataka	4.56*	7.81*	4.97*	D (2.1881)**
Tamil Nadu	1.61	1.41*	1.71*	D (0.1825)
All India	2.66*	3.80*	2.80*	A (2.6362)*

A: Acceleration; D: Deceleration; *, ** and ***: significant at 1, 5 and 10 per cent level, respectively.

was observed in yield in Andhra Pradesh which was 10.15 per cent followed by Maharashtra (4.73 per cent) and Karnataka (4.56 per cent) during period 1971-72 to 1980-81. During period II, highest and significantly positive growth rate in yeild was observed for Karnataka (7.81 per cent), followed by Punjab (5.89 per cent) and Madhya Pradesh (4.57 per cent).

From the above results it can be observed that the growth rate of cotton production in India has accelerated and the increase in growth rate is mainly due to increase in yield. However, in northern region increase in area also contributed to the increased production.

Trends in Mean and Instability in Production, Area and Yield

The nature of instability in area, production and

yield of cotton has been examined here by working out co-efficient of variation (CV) for the detrended data separately for two periods. The area and yield were detrended using the formula:

$$Z_t = a + bt + e_t \quad \ldots(12)$$

where, Z_t denotes dependent variable (area/yield), t is the time, e_t is random residual with zero mean and variance σ^2, a is intercept and b is the parameter to be estimated. After determining the residuals (e_t) are centred on mean value of area and yield (Z) for each period, resulting in detrended time series data, $Z = e_t + Z$.

Time series on detrended production is then calculated as the product of detrended area and yield. Average quantities of cotton production and coefficient of variations are estimated for different regions/states for the period I and period II. Further percentage changes in the mean values and coefficient of variation (CV) between Period I and Period II for cotton production, area and yield are also computed.

Table 8: Changes in Mean and Variability of Cotton Production in India: 1971-72 to 1980-81 (Period I) and 1980-81 to 1994-95 (Period II)

States	Production ('000 tons)			Coefficient of variation (%)		
	Period I	Period II	% Change	Period I	Period II	% Change
Northern Region	345.2	553.3	60.86	11.47	15.09	31.56
Punjab	195.5	283.5	45.01	11.45	21.87	91.00
Haryana	84.2	160.1	90.14	11.93	14.92	25.01
Rajasthan	65.6	111.8	70.43	20.30	24.01	18.28
Central Region	544.9	600.8	10.26	12.53	27.07	116.04
Gujarat	302.2	270.4	-10.52	15.25	31.57	107.01
Madhya Pradesh	49.8	53.9	8.23	22.37	41.25	84.40
Maharashtra	192.8	276.6	43.46	25.37	25.77	1.58
Southern Region	22.5	349.4	57.74	18.51	13.73	-25.82
Andhra Pradesh	53.7	156.9	192.18	33.76	23.53	-30.30
Karnataka	104.2	122.3	17.37	23.20	20.00	-13.79
Tamil Nadu	63.6	70.2	10.38	28.22	20.55	-27.18
All India	1121.4	2524.5	35.05	12.31	16.61	34.93

It is seen that all states witnessed an acceleration in the cotton production in period II, except Gujarat which recorded a decline in production (Table 8). The increase in cotton production was as high as 192.18 per cent for Andhra Pradesh, followed by Haryana (90.14 per cent) and Rajasthan (70.45 per cent).

The results also show that coefficient of variation of production is higher in period II at national level. Similarly, coefficients of variation are noted to be higher in all the states of northern and central zones in Period II as compared to Period I. The range of interstate differences in the magnitude of instability for the second period varied from 14.92 per cent in Haryana to 41.25 per cent in Madhya Pradesh. As a matter of fact, central region showed higher magnitude of instability in cotton production compared to southern and northern regions in the second period and between north and south zone, the instability is of higher magnitude in the latter region. The percentage change computed between two periods clearly brings out that instability has considerably increased in Period II over Period I. The percentage increase in average cotton production was around 35 per cent at national level and ranged between 10.38 and 192.18 per cent in different states.

Table 9: Changes in average area under cotton and coefficient of variation in India: 1971-72 to 1980-81 (Period I) and 1980-81 to 1994-95 (Period II)

States	Average Area ('000 ha)			Coefficient of variation (%)		
	Period I	Period II	% Change	Period I	Period II	% Change
Northern Region	1175.3	1477.2	25.69	10.59	8.51	-19.64
Punjab	570.5	643.1	12.72	10.60	11.96	12.83
Haryana	268.3	429.1	59.93	10.40	8.03	-22.79
Rajasthan	336.5	404.6	20.24	15.89	11.78	-25.86
Central Region	4805.3	4446.1	-7.47	3.53	5.15	45.89
Gujarat	1747.6	1245.8	-28.71	5.96	14.23	138.76
Madhya Pradesh	641.3	546.9	-14.72	6.68	6.94	3.89
Maharashtra	2416.4	2653.4	9.81	7.84	3.32	-57.65
Southern Region	1632.1	1556.5	-4.63	9.55	12.40	29.84
Andhra Pradesh	361.3	598.7	65.71	13.67	9.21	-32.62
Karnataka	992.2	716.6	-27.78	9.70	20.18	108.04
Tamil Nadu	278.6	241.2	-13.42	16.56	9.73	-41.24
All India	7678.2	7529.4	-1.94	4.25	5.45	28.23

From the above results it appears the relatively large average production increase of cotton was accompanied by higher instability in its production in northern and central regions. Further in general, low irrigated and

low rainfall states like Gujarat, Madhya Pradesh and Maharashtra registered relatively higher magnitude of instability than other states having good irrigation facilities like Punjab, Haryana and Rajasthan.

Coefficient of variation was also computed in respect of acreage under cotton from detrended series of area for period I and period II. The results presented in Table 9 show that the area under cotton declined by 1.94 per cent or by 148.8 thousand ha. between two periods at national level. The area under cotton witnessed a deceleration in most of states of central and southern region excepting Maharashtra, while the cotton area increased modestly in all the states of northern region between the two periods. The coefficient of variation increased from 4.25 per cent to 5.45 per cent between two periods at national level. Acreage variability increased for Punjab, Gujarat, Madhya Pradesh and Tamil Nadu. The coefficient of variation varied from 3.32 per cent in Maharashtra to as high as 20.18 per cent in Karnataka in period II.

Table 10: Changes in the mean and variability of Cotton Yield in India by States; 1971-1980 to 1980-1994

States	Yield (kg/ha)			Coefficient of variation (%)		
	Period I	Period II	% Change	Period I	Period II	% Change
Northern Region	292	359	22.94	4.32	10.18	135.64
Punjab	353	445	26.06	8.25	19.89	141.09
Haryana	321	362	12.77	6.05	13.87	129.26
Rajasthan	202	271	34.16	11.25	22.10	96.44
Central Region	112	144	28.57	10.96	28.83	163.05
Gujarat	174	215	23.56	12.23	28.44	132.54
Madhya Pradesh	80	113	41.25	21.71	54.27	149.98
Maharashtra	84	105	25.00	16.85	31.08	84.45
Southern Region	163	244	49.69	6.22	10.65	71.22
Andhra Pradesh	145	255	75.86	18.06	28.35	56.98
Karnataka	109	182	66.97	16.13	20.13	24.80
Tamil Nadu	236	295	25.00	14.33	15.29	6.70
All India	150	201	34.00	7.13	12.73	78.54

Table 10 shows the changes in the mean variability of cotton yield between the periods 1971-72 to 1980-81 to 1994-95 by regions/states. Between these two periods, the average yield of cotton in the country as a whole increased from 150 kg/ha to 201 kg/ha, thereby showing and increase of around 34 per cent. The increase in cotton yield was highest (75.86 per cent) in case of Andhra Pradesh, followed by Karnataka (66.97 per cent) and Madhya Pradesh (41.25 per cent). However, the average yield of cotton was highest in Punjab in both the periods. The results clearly indicate that there is a sizeable increase in the levels of cotton yield between the two periods. It is also seen that the variability of yield, as measured by coefficient of variation, is noticeably higher in period II at the national level as well as in case of northern and central regions.

Components of Change in Cotton Production

Table 11 shows the results from decomposing the changes in average cotton production for the states/regions. Yield improvements were more important in expanding the production of cotton at the national and regional level. At national level, increases in mean yields account for about 106 per cent of the increase in total cotton production and the contribution of area was negative. The components of change in mean production of cotton by states show that in the northern region, both the components (area and yield) were important in accounting for growth in cotton production. The increase in average yield was the most important source of increase in production in Punjab and Rajasthan whereas increase in area was the predominant source of increase in production for Haryana state. In case of central and southern zones (except Andhra Pradesh), increase in per hectare yield was the only source of increased production, whereas the contribution of area was negative. The increase in average yield was more than adequate to compensate the loss in area of these crops, average production thereby increasing.

The components of change in mean production of cotton, by states show that in the northern region, both the components (area and yield) were important in accounting for growth in cotton production.

Irrigation

This is of major importance in explaining increasing cotton production in the country, either by expanding the area under cotton in arid and semi-arid regions or by increasing supplementary irrigations under rainfed conditions. India irrigates most of the cotton (97.35 per cent) grown in northern zone whereas 13 per cent of the crop in central region and about 20 per cent in the

southern region receive supplementary irrigation. The extent and dependence of irrigation in cotton in different states/regions in shown in Table 12.

Table 11: Components of change in the Average Production of Cotton in India, 1971-80 to 1980-84

States	Change in per cent			
	Mean yield	Mean area	Area yield covariance	Interaction term
Northern Region	35.98	50.06	2.95	10.58
Punjab	48.68	40.54	1.94	8.83
Haryana	14.64	73.51	2.94	8.91
Rajasthan	50.76	34.41	2.95	11.88
Central Region	166.42	–50.14	–4.43	–11.84
Gujarat	168.11	–220.40	–3.10	–44.61
Madhya Pradesh	369.62	–198.11	–18.54	–52.96
Maharashtra	97.73	1.87	–0.11	0.51
Southern Region	115.40	–9.80	–0.91	–4.69
Andhra Pradesh	42.04	29.64	1.95	26.37
Karnataka	432.52	–163.45	–63.19	–105.88
Tamil Nadu	592.54	–386.19	–15.30	–91.05
All India	105.95	–3.88	–0.76	–1.31

At the national level, average irrigated area under cotton increased by around 29 per cent in period II over period I. By and large similar picture is found in all the states except Gujarat and Tamil Nadu which recorded a decline in irrigated area under cotton. The extent of irrigated area under cotton varies from 3.02 per cent in Maharashtra to 99.20 per cent in Punjab in second period. On the whole average irrigated area under cotton recorded impressive increase in all the states except Gujarat and Tamil Nadu, as well as at national level. Not unexpectedly the higher the proportion of crop irrigated in a country the higher is the yield. On the national level the mean yields of rainfed and irrigated cotton are 130 and 570 kg/ha, respectively. This is also reflected in the yields at the state level. However the higher yield associated with irrigation cannot be attributed to irrigation alone but also to higher technological inputs like fertilisers and pesticides.

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Table 12: Average irrigated area under cotton and changes in irrigated area in different states.

States	Average area irrigated in 000 ha.		Per cent change between
	1971-80	1991-92	1971-80 & 1981-92
Northern Region	1090.7 (92.61)	1428.9 (97.35)	31.01
Punjab	561.1 (98.32)	652.3 (99.20)	16.25
Haryana	263.3 (98.13)	411.3 (98.59)	56.21
Rajasthan	266.4 (78.63)	365.4 (78.63)	37.16
Central Region	573.6 (11.93)	587.9 (13.21)	2.49
Gujarat	663.2 (26.54)	414.7 (34.21)	–10.47
Madhya Pradesh	30.5 (4.80)	92.6 (16.79)	203.61
Maharashtra	80.0 (3.27)	80.6 (3.02)	0.75
Southern Region	213.2 (12.08)	305.7 (12.90)	43.39
Andhra Pradesh	27.3 (7.47)	71.6 (20.39)	162.27
Karnataka	70.3 (7.10)	136.8 (41.16)	94.59
Tamil Nadu	115.6 (41.21)	97.4 (20.05)	–15.74
India	1817.4 (23.60)	2337.0 (31.28)	28.59

Figures in parentheses show the percentage of cotton area under irrigation

Consumption of Cotton

Table 13 provides data on past trends of total fibre use, cotton textile use, cotton mill consumption, production and trade in India.

Domestic Market

Cotton textile use in the country has been steadily rising. Total cotton use reached 1655 thousand tons in 1986-90 from 1217 thousand tons in 1971-75. Per capita availability of cotton dropped from 2.11 kg in 1971-75 to 1.90 kg in 1981-85, and is likely to stabilise at this level.

Table 13: Cotton Supply, Consumption and Trade in India

	1961-65	1966-70	1971-75	1976-80	1981-85	1986-90	1991-95
Area (000 ha)	8051	7753	7592	7764	7754	7176	7913
Yield (kg/ha)	113	117	144	156	173	203	245
Production# (000 tons)	993	1005	1162	1240	1536	1835	2191
Imports (000 tons)	135.7	135.3	58.7	43.0	4.2	18.1	43.0
Exports (000 tons)	48.6	38.2	44.9	50.2	69.4	138.9	93.8
Mill Consumption (000 tons)	1067	1095	1208	1205	1362	1696	1970
Total Cotton use (000 tons)	na	na	1217	1227	1370	1655	na
Per Capita Cotton availability (kg)	na	na	2.11	1.90	1.90	2.10	na
Total Fibre use (000 tons)	na	na	1297	1401	1557	1881	na
Cotton share (%)	na	na	93.9	87.5	87.9	88.0	na

na : data not available, # : These estimates are traded estimates derived by the Cotton Advisory Board and differ from the official estimates of production recorded by the Directorate of Economics and Statistics, Department of Agriculture and Co-operation, Ministry of Agriculture

Competition from Manmade Fibres

Cotton's proportion of fibres consumed in the country has been declining gradually after mid-seventies, but still accounted for around 88 per cent in 1991-95. Primary reliance will continue to be placed on cotton but the share taken by man-made fibres will gradually rise in the country.

Trade in Textiles

India is one of the major exporters of cotton textiles in the world, but these exports are only a small percentage of output because of a huge domestic demand. The country was net importer of cotton but shifted to net exporter in 1976-80. In the mid-seventies India was net exporting around 7 thousand tonnes of raw cotton but the net exports could expand significantly to around 121 thousand tonnes in 1986-90 and again declined to 50.8 thousand tonnes in 1991-95 period. Imports are expected to be negligible.

India is one of the major exporters of cotton textiles in the world, but these exports are only a small percentage of output because of a huge domestic demand.

Mill Consumption

Raw cotton consumption in mills increased from 1067 thousand tonnes in 1961-65 to 1970 thousand tonnes in 1991-95 period (Fig. 4). The number of cotton spinning spindles has also been gradually rising. With the rising domestic demands and increasing net exports of cotton goods the raw cotton mill consumption is expected to increase in the coming years.

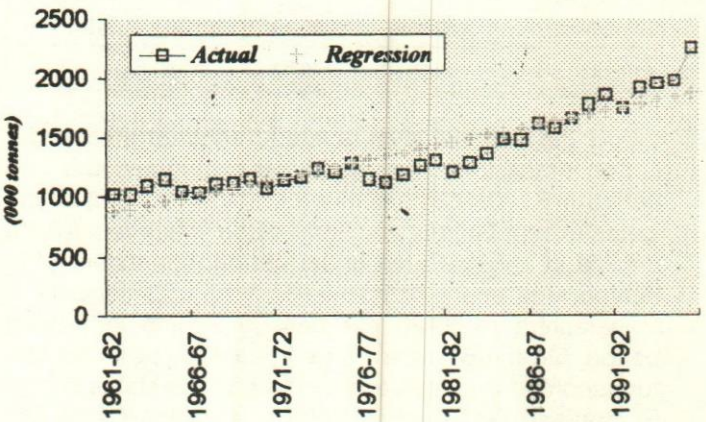

Fig 4. Cotton Consumption in India

Supply of Raw Cotton

India has the largest area under cotton in the world, but the yields are among the lowest. Cotton area has declined slightly from 8051 thousand ha in 1961-65 to 7913 thousand ha in 1991-95. However, yields are trending upward as a result of increased irrigation, fertiliser, better varieties, insect-pest and disease control measures. Production of raw cotton rose from some 993 thousand tonnes in 1961-65 to 2191 thousand tonnes in 1991-95.

Table 14: Estimated Acreage Response Equations for Cotton, 1971- 1992

States	Regression coefficients									
	Constant	A_{t-1}	NIA	PSOR	RP_{t-1}	RY_{t-1}	CV FHP_{cot}	CV Y_{cot}	R^2	D-W h-statistics
Punjab	–3.8021	0.1109 (0.1865)	1.5663*** (0.4279)	0.1409 (0.1481)	0.0872** (0.0413)	–0.0163 (0.0831)	0.0678 (0.0616)	–0.0699 (0.0355)	0.82	–1.0926
Haryana	–1.4260	0.8610*** (0.2866)	0.3314** (0.1949)	0.0585 (0.1765)	0.3474 (0.1896)	–0.0670 (0.3650)	–0.1091 (0.0779)	–0.0985 (0.1119)	0.84	–1.0582^{NSC}
Rajasthan	–0.1802	0.1937 (0.2076)	0.5571* (3.000)	–0.2909 (0.1925)	0.0947** (0.0463)	–0.0662 (0.0446)	–0.0365 (0.0339)	0.1341 (0.0893)	0.66	0.7024^{NSC}
Gujarat	3.0128	0.3669 (0.2705)	0.5276** (0.2431)	0.0521*** (0.0245)	0.0962*** (0.0178)	0.0360 (0.1209)	–0.0035 (0.0352)	–0.0356** (0.0132)	0.82	–2.0735^{d}
Madhya Pradesh	2.0381	0.4954** (0.2341)	–0.1689* (0.0931)	0.1408** (0.0527)	0.0929 (0.0982)	0.1055 (0.0774)	–0.0082 (0.0511)	–0.0293 (0.0393)	0.78	1.7974^{d}
Maharashtra	3.0255	0.2060 (0.2208)	–0.0042 (0.1459)	0.1410 (0.1449)	0.1796*** (0.0570)	0.0195 (0.0568)	–0.0304** (0.0134)	–0.0133 (0.0244)	0.76	2.0127^{d} (NSC)
Andhra Pradesh	–2.1132	0.4685** (0.2472)	1.0937*** (0.6223)	–0.2007 (0.2138)	0.05561** (0.2234)	0.0231 (0.1294)	–0.0843* (0.0425)	–0.0499 (0.0936)	0.84	1.9661^{d} (NSC)
Karnataka	–2.1152	0.6588*** (0.2083)	–0.4367 (0.4343)	0.3897*** (0.2051)	0.5086*** (0.1702)	0.0198 (0.1902)	0.0392 (0.0686)	0.2295 (0.2264)	0.87	–1.0220^{NSC}
Tamil Nadu	1.4402	0.0984*** (0.0199)	–0.1289 (0.6126)	–0.0053 (0.1128)	0.4374*** (0.1546)	0.0531 (0.1593)	0.0355 (0.0333)	–0.0264 (0.0586)	0.59	–1.2033^{NSC}

Figures within parentheses are standard errors of regression coefficients

***, ** and *: Significant at 1 per cent, 5 per cent and 10 per cent level, respectively.

India has the largest area under cotton in the world, but the yields are among the lowest.

Cotton Demand

Cotton Share Equation

In this equation the cotton share of total fibre use was estimated as a function of the ratio of price of cotton and non-cotton textiles. The equation is estimated from 1971 to 1989. These periods were chosen on the basis of data availability. The estimated cotton share equation along with selected diagnostics (i.e., *t*-values, in parentheses) is presented below:

$$\text{Ln COTSHARE} = -0.0036 - \underset{(4.94)}{0.0636}\ \text{Ln}\ P_{COT}/P_{POLYS} + \underset{(1.56)}{}$$

$$0.9815\ \text{Ln COTSHARE}\ (-1) \qquad \ldots(13a)$$

$$R^2 = 0.76 \qquad \ldots(13b)$$

where R^2 is Coefficient of multiple determination.

The equation explaining the cotton share of total fibre use fitted the data better with variables converted into logarithms. The ratio of cotton and polyester prices gave as elasticity estimate of 0.0636 but was non significant. It indicates that consumption of cotton in the country is not responsive to price changes. The lagged consumption of cotton captured the strong trend in consumption which appeared in the equation with a coefficient of 0.9815 (significant at 1 per cent level). The fit of the equation was also satisfactory. The cotton share lagged one year variable was included in the model because there has been a steady decline in the share of cotton in total fibre consumption during the regression period, which was not price related but this trend was due to technological improvements in the manufactured fibres industry.

Per capita Total Fibre and Cotton Use Equations

This was estimated as a function of per capita gross domestic product (GDP). Trend variable was also included to provide more reliable estimates of the elasticity of total fibre/cotton use with respect to income and the inclusion of this improved the statistical fit of the equation. The semi-log functional firm gave the best fit. The estimates of total fiber and cotton use equations are presented in the following equations (*t* values are in parentheses):

$$\text{PCTFU} = -2.4431 + \underset{(1.86)}{0.4906}\ \text{Ln PCGDP} - \underset{(2.38)}{0.0841}\ \text{Time} \qquad \ldots(14a)$$

$$R^2 = 0.69 \qquad \ldots(14b)$$

The estimated coefficient of gross domestic product gave an income elasticity of 0.22 when calculated at the mean of total fibre use. These estimates are comparable with the elasticities obtained from previous studies of Coleman and Thigpen (1991). The estimated equation for per capita cotton consumption is:

$$PCCU = -4.7147 + 0.8275 \text{ Ln PCGDP} - 0.0841 \text{ Time} \quad \ldots(15a)$$
$$(2.37) \qquad (2.37)$$

$$R^2 = 0.66 \quad \ldots(15b)$$

The equation explaining per capita cotton use in the country contained the logarithm of per capita gross domestic product and the time variable. The coefficient of the income variable was significant and resulted in income elasticity estimate of 0.42 which is comparable with the elasticity estimate by Thigpen (1978) for the developing countries.

Acreage and Yield Response Functions

Acreage Response Functions

These functions provides useful information on the extent of farmers' response to price and other factors. The estimated area response functions have been presented in Table 14. The log linear form of the function was found to be consistently superior to the linear form both in terms of proper sign and significance the coefficients and overall explanatory power.

The elasticity estimates of lagged cotton acreage were found to be consistently positive and significant in all the states except Rajasthan, Gujarat and Maharashtra. The value of coefficients of this variable varied from 0.0984 in Tamil Nadu indicating a higher rate of adjustment to 0.8610 in Haryana, indicating a comparatively low rate of adjustment.

Lagged Relative Price and Yield

Analysis of the data show that relative price of cotton with respect to competing crops has shown significant positive impact on acreage under cotton in all the states except Madhya Pradesh where it was non-significant. The short-run elasticity of cotton with respect to relative price variable was ranging from 0.0872 in case of Punjab to 0.5501 in Andhra Pradesh. This shows that an increase in area under cotton was observed due to an increase in the relative yield of cotton with respect to its competing crops.

Again the relative yield of cotton vis-à-vis competing crops has shown insignificant relationship with area under cotton in majority of the states excepting Punjab, Haryana and Rajasthan. Comparing the yield and price variables, it appears that farmers seem to be influenced less by the past yields but more by the prices

Risk Factors

Agricultural production is generally subjected to two major sources of risk-one arising from variability in prices and the other in yields. The relative incidence of these variables may differ among regions. In majority of the states considered in the analysis, risk arising due to variations in relative farm harvest prices and relative yield of cotton showed a insignificant negative impact on the area under cotton. The regression coefficient will respect to variability in relative farm harvest prices was significant in Maharashtra and Andhra Pradesh only. The risk arising due to yield in cotton has shown significant negative impact on cotton acreage in Gujarat State.

Agricultural production is generally subjected to two major sources of risk-one arising from variability in prices and the other in yields. The relative incidence of these variables may differ among regions.

The above results clearly indicated that of all the variables relative farm harvest prices emerged as the strongest factor in determining the cotton acreage in most of the cotton growing states in the country.

Acreage Adjustment Coefficients and Elasticities

The estimated coefficient of adjustment and long run elasticities of acreage with respect to price and non-price factors are presented in Table 15.

The coefficient adjustment for Tamilnadu was found highest (0.9016), which implies that the desired adjustment in acreage were most rapidly made and that price inducement operated rather quickly. The lowest rate of acreage adjustment coefficient was observed in case of Haryana indicating that acreage was influenced more by technological and institutional rigidities. The elasticities of acreage with respect to farm harvest price in the long run showed wide variations among the states.

Yield Response Functions

Cotton production fluctuates due to a multitude of factors including environmental conditions in the major cotton producing states. Seasonal variations in the yield

are largely the result of environmental factors of time of planning, seasonal distribution, and harvest conditions and non-environmental factors like fertiliser and pesticide consumption, irrigation and availability of good quality seed. The estimated equations for cotton yields were estimated using OLS method for the period 1970-71 and 1992-93 and are presented in Table 16.

Table 15: Coefficient of Adjustment and Long-run Elasticities of Cotton Acreage with respect to Price and Non-price Factors

States	Long-run elasticities with respect to				
	Coefficient of adjustment	Relative Price	Relative Yield	Irrigation	Rainfall
Punjab	0.8891	0.0981	-0.0183^{ns}	1.7616	-0.1585^{ns}
Haryana	0.1390	2.4992^{ns}	-0.4820^{ns}	2.3841	0.1137^{ns}
Rajasthan	0.8063	0.1174	-0.0821^{ns}	0.6909	-0.3607^{ns}
Gujarat	0.6331	0.1519	0.0569	0.8333	0.0823
Madhya Pradesh	0.5046	0.1841^{ns}	0.2091	-0.3347	0.2790
Maharashtra	0.7940	0.2262	0.0245^{ns}	-0.0053^{ns}	0.1776^{ns}
Andhra Pradesh	0.5315	1.0462	0.0435^{ns}	2.0577	-0.3776^{ns}
Karnataka	0.3412	1.4906	0.0580^{ns}	1.2799^{ns}	1.1421
Tamil Nadu	0.9016	0.4851	0.0589^{ns}	-0.1430^{ns}	-0.0059^{ns}

ns : Non-significant

Table 16: Estimated Yield Response Functions for Cotton: 1970-71 to 1992-93

States	Intercept	Regression coefficients of			R^2
		Fertiliser	Irrigation	Rainfall	
Punjab	5.6772	0.1810 (0.1168)	–	-0.0873 (0.1764)	0.52
Haryana	– 13.7829	0.0631 (0.0503)	4.2479* (2.3368)	-0.0193 (0.0963)	0.59
Rajasthan	3.2511	0.4221** (0.1748)	-0.2329 (0.8603)	0.3708* (0.2026)	0.46
Gujarat	6.8817	0.4750*** (0.1780)	-1.1391 (0.7644)	0.0772 (0.2905)	0.67
Madhya Pradesh	5.3575	0.2332 (0.1954)	-0.0556 (0.2332)	-0.2014 (0.2723)	0.78
Maharashtra	5.3514	0.4342*** (0.1260)	0.0937 (0.1566)	0.3610* (0.2066)	0.69
Andhra Pradesh	3.8150	0.5117*** (0.1864)	0.2128* (0.1268)	-0.1766 (0.4103)	0.51
Karnataka	2.9723	0.0610 (0.2277)	0.4977** (0.1939)	0.0677 (0.2807)	0.79
Tamil Nadu	2.5589	0.2677*** (0.0706)	0.2005* (0.1083)	0.1989* (0.1093)	0.78
India	5.2513	0.3786*** (0.1387)	0.1296 (0.0739)	0.1563 (0.1676)	0.73

In order to examine the problem of multicollinearity, zero order correlation matrices were worked out. From these matrices it was observed that there is no problem of multicollinearity in all the cases. Of all the variables, fertiliser consumption emerged as the most important factor in determining the yield variation.

Conclusions

The present study reveals that the cotton production in India grew at an average annual growth rate of 2.37 per cent between 1951-52 and 1995-96, largely as a result of improved yields. This growth has been accompanied by an increase in variability of production. The coefficient of variation of cotton production was 10.31 per cent in 1971-72 to 1980-81 and increased to 12.61 per cent during 1981-82 and 1994-95.

The inter-state comparisons also revealed significant differentials in growth rates. Growth rates of cotton production accelerated for Punjab, Haryana, Madhya Pradesh, Tamil Nadu and at national level. The break-up of increase in cotton production into its components revealed that yield was the major factor for increase in cotton production in all the states except Haryana where area was the predominant source of increased production during 1971-72 to 1994-95. This reflect of rapid growth of irrigation facilities, availability of good quality inputs, appropriate plant protection measures and suitable varieties with desired characteristics. The main cotton producing areas of India can be grouped into three regions, North, Central and South. In 1971-75, the share of crop grown in each of these regions was 51, 29.6 and 18.7 per cent, respectively. Only small amounts, accounting for less than one per cent of crop is grown in other states.

The use of total cotton textiles in the country has been steadily rising but the per capita availability of cotton and share of cotton in total fibre use has been declining gradually after the mid-seventies. The country was net importer of cotton but shifted to net exporter in 1976-80 period. The domestic consumption in the country has been high as India has the second largest spinning capacity of 31 million spindles.

The use of total cotton textiles in the country has been steadily rising but the per capita availability of cotton and share of cotton in total fibre use has been declining gradually after the mid-seventies.

The results of cotton share equations indicated that consumption of cotton in the country was not much responsive to the prices but the lagged consumption of cotton captured the strong trend in consumption which indicated that decline in share of cotton was not price related but was due to technological improvements in the manufactured fibres industry. Per capita total fibre and cotton use equations revealed that per capita gross domestic product has a positive and significant impact on the per capita total fibre and cotton use. The income elasticity estimate was 0.22 for total fibre use and 0.48 for cotton use.

The acreage response functions indicated that on the whole price and non-price factors, viz., irrigation, rainfall, relative yield have strategic role in acreage allocation decisions. Rainfall has significant influence on the acreage in rainfed areas. Comparing all the price and non-price factors it seems that farmers appear to be influenced less by non-price factors but more by the relative farm harvest prices.

Yield behaviour of cotton was found to be sensitive to various factors viz., fertiliser, irrigation and rainfall during crop growth period. Fertiliser exerted the strongest influence on the cotton yield in majority of the states. The expected role of irrigation was found in most of the states, indicating a crucial role of irrigation in determining cotton yield.

Stability in cotton production is essential for continued and steady progress of cotton economy of the country. If cotton cultivation is to be promoted on a sustainable basis, the farmers will have to be assured of not only remunerative and stable prices but also of stable crop yields. Appropriate policies, therefore, need to focus on (i) favourable pricing policy by taking into account the prices of competing crops, (ii) creating efficient input supply system and introducing crop insurance scheme to counter the influence of vagaries of nature, (iii) developing better irrigation facilities especially in central and southern regions, and (iv) developing suitable insect, pect and disease resistant varieties to fit in different eco-systems.

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Feature

A Quantitative Analysis of Demand for Tractors in Punjab

Meena Sharma & D.K. Grover

Statistical analysis for demand for tractors in Punjab has been carried out for three time periods ranging 1974 to 1995. In particular, the regression analysis indicated that in period I, cropping intensity and cultivated area were significant factors influencing the demand. But during the period II and period III the significance of different variables in determining tractorisation experienced some change and credit availability, demand for tractors in previous year and area under high-yielding varieties also came out with positive and significant coefficients alongwith cropping intensity and cultivated area. The demand projections indicated that the future demand for tractors in Punjab would be 4,14,115 and 9,90,435 tractors in the years 1997-98 and 2024-25 respectively and the corresponding required supply was worked as 4,22,397 and 10,10,244 tractors.

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Introduction

The technology breakthrough, which came in India and more particularly in Punjab agriculture since the mid sixties was mainly in terms of evolution of high-yielding varieties, increased use of fertilizers, expansion of pesticides etc. However, it has also been widely recognized that mechanisation in general and tractorisation in particular has played a revolutionary role in modernisation of Punjab agriculture. Timely performance of all the farm operations became essential to derive maximum benefits from these expensive inputs.

Still tractorisation has been controversial issue with regard to its impact on production, productivity, human employment and more importantly regarding the economic rationale of investment in farm machinery. A brief review of literature on the issue highlighted that some studies concluded that tractorisation has displaced human labour and created unemployment while others (Kahlon, 1976; Singh and Miglani, 1976; Lal *et al*, 1976) showed that tractorisation shifted cropping pattern in favour of more intensive crops, therefore, the increase in productivity was attributed, to a large extent, to the use of tractors till mid seventies. But in the recent past (Mandar, 1987) the use of tractors became irrational in Punjab agriculture due to over investment in farm machinery in relation to farm size. The number of tractors in the state has been increasing significantly year after year during the last over two decades. The number of tractors in Punjab which was only 55,327 in 1975-76 increased to 1,18,845 in 1980-81 and 3,24,350 during 1992-93 sharing about 29.3 per cent in 1975-76, 27.8 per cent in 1980-81 and 21.4 per cent in 1992-93 of the total tractor population in the country. Therefore, it becomes imperative to examine the factors responsible for this consistent increase in the number of tractors in Punjab. So the present study focuses on:

- to analyse the growth and distributional pattern of tractors in Punjab;

- to study the factors influencing the demand for tractors in the state; and
- to estimate the future demand and required supply of tractors in Punjab state

Methodology

To accomplish the objectives of the study the secondary data on different variables such as number of tractors, cultivated area, irrigated area, cropping pattern, area under high-yielding varieties, prices of major agricultural commodities such as paddy, wheat and cotton and credit availability for purchase of tractor were obtained from the published issues of Statistical Abstract of Punjab and the Economic Surveys etc. The data on prices of tractors were taken from the firm Punjab Tractor Limited, Chandigarh.

The compound growth rates were worked out for three time periods viz. period I (1974-75 to 1983-84), period II (1984-85 to 1994- 95) and period III (1974-75 to 1994-95) to analyse the growth and distributional pattern of tractors in Punjab. Multiple regression analysis (both linear and log linear) was carried out separately for the periods, 1965-66 to 1980-81, 1981-82 to 1995-96 and overall to identify the factors affecting demand for tractors in the state. The log linear function was found to be the best fit and was ultimately selected for the discussion of results. The form and the variables identified for analysis were as follows:

$$\log Y = \log a + b_1 \log X_1 + b_2 \log X_2 + ... b_9 \log X_9$$

where

Y = number of tractors demanded

a = constant term

$b_1, b_2 ..... b_9$ = Elasticities with respect to different explanatory variables

$X_1, X_2 ..... X_9$ = Explanatory variables

The explanatory variables tried in the form of various combinations in the different demand models were:

X_1 : Cropping intensity

X_2 : Price of tractor (in real terms)

X_3 : Number of tractors financed

X_4 : Net irrigated area

X_5 : Cultivated area

X_6 : Cropping pattern (area under paddy and wheat as %age to total cropped area)

X_7 : Weighted average price of Agricultural crops (paddy, wheat and cotton)

X_8 : Area under high-yielding varieties

X_9 : Demand for tractors in previous year (which covers in a way the effect of social status and demonstration involved in purchasing a tractor). This variable has been included amongst the explanatory variables with the hypothesis that the number of tractors purchased in a particular village/locality in current year may have positive impact on the demand for tractors in succeeding year, by way of tempting other neighbourers/relatives to purchase a tractor too.

After the quantification of variables which affected the demand for tractors in Punjab, the future demand for tractors, based on demand model of period II was estimated. The projected level of demand for tractors was subject to various assumptions and these have been elaborated in the concerned sections.

Results and Discussions

The results have been discussed under following 3 heads: (i) Growth and distributional pattern of tractors, (ii) Determinants of demand for tractors and (iii) Estimation of future demand and required supply of tractors.

Growth and Distributional Pattern of Tractors

The compound growth rates of tractors in different districts of Punjab have been worked out and indicated in Table 1. It can be seen from the table that the annual compound growth rate of tractors in Punjab was 16.56 per cent during the period I (1974-75 to 1983-84) and it declined to 5.95 per cent in period II (1984-85 to 1996-97). The overall rate of growth over the span 1974-75 to 1996-97 was observed to be 9.0 per cent per annum.

The district-wise position revealed that during period I, the highest rate of growth was attained by Sangrur district (32.46 per cent) followed by Faridkot (32.22 per cent) and Ferozepur (29.10 per cent). The lowest rate of growth was recorded by Hoshiarpur district (8.87 per cent). In period II, Rupnagar district witnessed highest growth rate of 8.78 per cent followed by Sangrur (8.67 per cent) and Faridkot (7.93 per cent). While Patiala showed the lowest growth rate of 4.33 per cent per annum. The overall growth rate was maximum in Sangrur district (16.51 per cent) followed by Faridkot (14.08 per cent) and Rupnagar (11.97 per cent) and the minimum growth rate was observed for Jalandhar (7.44 per cent).

Table 1: Compound Growth Rates of Tractors in Different Districts of Punjab

District	Period I (1974-75 - 1983-84)	Period II (1984-85 - 1996-97)	Overall (1974-75 - 1996-97)
Gurdaspur	15.18*** (1.64)	4.65*** (0.50)	10.74*** (0.74)
Amritsar	21.40*** (1.57)	5.51*** (0.28)	11.67*** (0.87)
Kapurthala	9.86*** (1.42)	4.40*** (0.27)	8.45*** (0.50)
Jalandhar	11.13*** (0.56)	5.01*** (0.23)	7.44*** (0.34)
Hoshiarpur	8.87*** (0.24)	5.83*** (0.22)	7.46*** (0.41)
Rupnagar	14.70*** (0.10)	8.78*** (0.38)	11.97*** (0.41)
Ludhiana	11.33*** (0.77)	4.74*** (0.22)	7.55*** (0.38)
Ferozepur	29.10*** (3.07)	4.75*** (0.20)	11.29*** (1.29)
Faridkot	32.22*** (5.46)	7.93*** (0.10)	14.08*** (1.46)
Bathinda	9.92*** (0.22)	6.93*** (0.18)	7.59*** (0.17)
Sangrur	32.46*** (1.48)	8.67*** (0.49)	16.51*** (1.23)
Patiala	15.29*** (0.60)	4.33*** (0.22)	8.60*** (0.59)
Punjab State	16.56*** (0.32)	5.95*** (0.15)	9.80*** (0.55)

Figures in the parentheses are standard error
*** : Significant at 0.1 per cent level

Thus the foremost point which was observed from this description was that all those districts, where there was less number of tractors in the base period, exhibited higher rate of growth. Another point that emerged from the above analysis was that growth rates of tractors showed a decline in all the districts in period II as compared to period I. The higher growth rates during this period (period I) may be ascribed to the 'technological revolution' which initiated in mid-sixties and the higher rate of growth of tractors in this period (during seventies and mid eighties) was in quick response to the increased power requirements which were consequence of intensive cultivation and amazing increase in the cropping intensity.

Thus the foremost point which was observed from this description was that all those districts, where there was less number of tractors in the base period, exhibited higher rate of growth. Another point that emerged from the above analysis was that growth rates of tractors showed a decline in all the districts.

Distribution of tractors: The district-wise position of tractor population alongwith the percentage share of each district in total tractor population in the state has been presented in Table 2. The number of tractors which was only 55,327 recorded a phenomenal rise (during the period 1975-1996) to 3,71,720 tractors. The inter-district analysis of distributional pattern brought out that the districts namely Bathinda, Ludhiana, Patiala, Jalandhar and Ferozepur occupied first five positions and these districts collectively constituted about 70 per cent of the total tractor population in the state during the period 1975-76. In 1995-96, more than 70 per cent of the total tractor population of state was concentrated in the districts of Ferozepur, Bathinda, Faridkot, Sangrur, Ludhiana and Patiala.

Table 2: Distribution of Tractors in Different Districts of Punjab at Different Points of Time

(Number)

District	1975-76	1985-86	1995-96
Gurdaspur	1,960 (3.54)	8,368 (4.01)	12,842 (3.45)
Amritsar	3,267 (5.90)	19,421 (9.31)	33,066 (8.90)
Kapurthala	2,709 (4.90)	7,956 (3.81)	12,432 (3.34)
Jalandhar	6,183 (11.18)	15,809 (7.58)	25,586 (6.88)
Hoshiarpur	3,361 (6.07)	7,816 (3.75)	13,846 (3.72)
Rupnagar	1,043 (1.89)	4,087 (1.96)	9,285 (2.50)
Ludhiana	9,191 (16.61)	24,416 (11.70)	38,375 (10.33)
Ferozepur	4,021 (7.27)	32,037 (15.36)	51,000 (13.72)
Faridkot	3,448 (6.23)	21,440 (10.28)	45,242 (12.17)
Bathinda	11,752 (21.24)	26,078 (12.50)	50,807 (13.67)
Sangrur	1,846 (3.34)	18,818 (9.02)	43,628 (11.74)
Patiala	6,546 (11.83)	22,368 (10.72)	35,611 (9.58)
Punjab State	55,327 (100.00)	2,08,614 (100.00)	3,71,720 (100.00)

Figures in the parentheses are percentages to the total tractors in the State.

The foregoing analysis indicated that tractors in the state were concentrated in the districts of Ferozepur,

Table 3: District-wise Density of Tractorisation in Punjab at Different Points of Time

Number of tractors/thousand hectares of

District	1975-76					1986-87					1995-96				
	Net area sown	Total cropped area	Net irrigated area	Gross irrigated area	Area under HYV	Net area sown	Total cropped area	Net irrigated area	Gross irrigated area	Area under HYV	Net area sown	Total cropped area	Net irrigated area	Gross irrigated area	Area under HYV
Gurdaspur	7.60	4.76	11.63	7.32	10.32	34.90	19.51	49.08	25.73	27.28	45.70	25.38	61.53	27.78	31.25
Amritsar	8.00	5.19	8.55	5.42	9.25	48.87	29.07	50.14	29.56	37.25	75.15	40.13	75.12	40.28	51.99
Kapurthala	20.37	15.84	25.06	18.45	27.64	64.22	37.53	65.48	38.74	44.01	85.74	44.88	81.25	44.93	58.09
Jalandhar	21.10	13.80	24.45	15.92	25.66	56.20	29.28	57.99	29.80	45.26	76.83	44.42	78.05	46.37	54.91
Hoshiarpur	13.23	8.80	31.01	24.99	29.23	33.63	21.35	63.11	37.64	52.32	65.93	37.32	91.88	53.65	52.65
Rupnagar	8.41	5.27	21.20	13.27	20.45	35.08	22.69	59.31	38.39	38.98	64.46	39.12	76.15	53.63	46.35
Ludhiana	28.46	16.99	32.72	19.31	32.94	78.00	42.57	79.14	42.94	54.09	125.14	57.76	113.83	64.59	70.24
Ferozepur	8.29	5.66	10.87	8.45	10.87	66.89	38.90	70.31	40.05	55.76	103.28	54.43	103.28	54.91	82.79
Faridkot	6.56	4.77	7.92	5.60	12.01	42.97	25.37	46.49	26.56	41.55	93.28	48.96	97.84	52.72	92.71
Bathinda	23.00	16.32	34.65	21.40	60.58	54.25	33.39	65.46	37.32	72.09	102.64	58.00	105.69	59.43	109.73
Sangrur	4.07	2.57	4.97	2.94	5.46	46.09	24.93	46.93	25.15	33.22	95.09	49.85	95.09	50.40	60.60
Patiala	16.83	10.70	19.45	23.16	14.21	61.96	33.77	70.65	37.08	41.96	129.29	67.15	134.86	73.92	78.62
Punjab State	13.31	8.83	17.57	11.19	19.40	52.94	30.45	59.77	33.29	44.15	89.40	48.24	94.03	50.79	66.76

Table 4: Results of Regression Equations Developed for Factors Affecting Demand for Tractors in Punjab

Eq. No.	Period	Intercept	CI	RP	NTF	NIA	CA	CP (%Age)	PAP	HYV	D_{t-1}	R^2
1.	I (1965-66 - 1980-81)	-68.07	6.81*** (1.08)	0.35NS (0.38)	-0.13NS (0.09)	1.75NS (0.54)	3.38*** (9.16)	-	-	-	-	0.9901***
2.	II (1981-82 - 1995-96)	-25.59	1.73** (0.48)	-0.01NS (0.19)	0.04** (0.01)	0.42NS (0.26)	2.29* (1.11)	-0.35NS (0.36)	-0.01NS (0.07)	-	0.70*** (0.11)	0.9934***
3.	III (1965-66 - 1995-96)	-18.35	0.60* (0.30)	0.05NS (0.06)	0.04** (0.01)	-0.20NS (0.21)	2.05** (0.90)	-0.06NS (0.12)	-0.03NS (0.07)	0.20*** (0.05)	0.83*** (0.04)	0.9944***

***: Significant at 1 per cent level **: Significant at 5 per cent level

*: Significant at 10 per cent level NS: Non significant

Figures in parentheses are standard error of the associated coefficients.

CI: Cropping Intensity RP: Real price of tractor

NTF: Number of tractors financed NIA: Net irrigated area

CA: Cultivated area CP (%age): Cropping pattern

PAP: Price of agricultural products HYV: Area under high-yielding varieties

D_{t-1}: Demand for tractors in previous year

Bathinda, Jalandhar, Ludhiana, Sangrur and Patiala, whereas Rupnagar, Gurdaspur and Hoshiarpur districts had relatively low percentage share in total tractor population of the state. Since the geographical size of the districts varies from one to another, the density of tractors was worked out to have a comparative picture of different districts with regard to the degree of tractorisation.

The tractor population per thousand hectares of net area sown, total cropped area, net irrigated area, gross irrigated area and area under high yielding variety seeds has been presented in Table 3. It is clear from the table that tractor density i.e. tractor population per thousand hectares of net area sown in the state which was 13.31 in 1975-76, increased rapidly to 89.40 in 1995-96. The inter-district analysis showed during 1975-76, the tractor population per thousand hectares of net area sown was found to be the highest in Ludhiana with 28.46 tractors followed by Bathinda with 23 tractors and Jalandhar

with 21.10 tractors. The tractor density was the lowest in Sangrur (4.07 tractors). During the period 1986-87, Ludhiana district again showed the highest tractor density. It was 78 tractors per thousand hectares of net area sown. Ferozepur and Kapurthala districts were next to Ludhiana district with 66.89 and 64.22 tractors respectively. The tractor density was the lowest in Hoshiarpur district with 33.63 tractors.

In the period 1995-96, the highest tractor density was noticed in Patiala (129.29 tractors per thousand hectares of net area sown). Ludhiana and Ferozepur districts were next to Patiala with 125.14 and 103.23 tractors respectively. The tractor density was the lowest in Gurdaspur being 45.70 tractors per thousand hectares of net area sown.

The analysis led to the conclusion that although the role of other factors cannot be ruled out but it was higher cropping intensity (obviously higher levels of irrigation facilities also) which contributed remarkable towards the higher level of concentration of tractors in these districts.

Determinants of Demand for Tractors

Further, a number of regression equations taking various combinations of explanatory variables were tried for all the three time periods i.e. period I (1965-66 to 1980-81), period Ii (1981-82 to 1995-96) and period III (1965-66 to 1995-96) separately were considered. Equations 1-3 for periods I to III which was best fit in terms of coefficient of multiple determination, signs of variables and level of significance was selected. The results of these equations have been presented in Table 4.

Period I

Among five explanatory variables which were taken in Eq. (1), cropping intensity and cultivated area were found to be significant variables affecting the number of tractors demanded in period I. The value of coefficient of multiple determination (R^2) showed that a sizable proportion (99 per cent) of the total variation in the demand for tractors during this period was explained by all the independent variables taken together.

The elasticity of demand for tractors with respect to cropping intensity was 6.81, which was found to be statistically significant at 1 per cent probability level thereby indicated that increase in cropping intensity contributed significantly and positively towards the demand for tractors in the state i.e. with 1 per cent increase in the cropping intensity, the demand for tractors would increase by 6.81 per cent. The coefficient of cultivated area (3.38) was found to be statistically significant at 1 per cent probability level. This implied that with 1 per cent increase in the cultivated area, the demand for tractors would increase by 3.38 per cent.

The elasticity of demand for tractors with respect to cropping intensity, which was found to be statistically significant at 1 per cent probability level, indicated that increase in cropping intensity contributed significantly and positively towards the demand for tractors in the state.

Period II

Equation 2 showed that the variables like cropping intensity, credit availability in terms of number of tractors financed, cultivated area and demand for tractors in previous year influenced the demand for tractors significantly. The elasticity of demand for tractors with respect to cropping intensity was 1.73, significant at 5 per cent probability level. Thus it revealed that with 1 per cent increase in the cropping intensity, the demand for tractors would increase by 1.73 per cent. The regression coefficient of number of tractors financed (0.04) was found to be statistically significant at 5 per cent level. The elasticity signified that 1 per cent increase in the number of tractors financed would result in increasing the demand for tractors by 0.04 per cent.

The coefficient of lagged demand for tractors was 0.70 and statistically significant at 1 per cent level. The positive sign of the regression coefficient showed that current year demand for tractors was positively and significantly influenced by demand for tractors in the previous year i.e. 1 per cent increase in the demand for tractors in current year would increase the demand by 0.70 per cent in the succeeding year.

The elasticity of demand for tractors with respect to cultivated area (2.29) was significant at 10 per cent level which mean that with 1 per cent increase in cultivated area the demand for tractors increased by 2.29 per cent.

Importance of variables over time

A comprehensive view of above mentioned regression equations for period I and period II clearly expounded the changing significance of different factors, determining the demand for tractor overtime. To sum up the foregoing discussion, it could be inferred that cropping intensity and cultivated area were significant factors that influenced the demand for tractors in period I in

the state. It might be due to the fact that during early 1970's a great stress was laid on the encourage farm production and this goal was achieved by intensive cultivation enhancing the cropping intensity significantly..

The role of other factors such as credit was not apparent during the first period. It might be due to the reason that tractor population increased at tremendous pace although very little credit facilities were available for the purchase of tractors during the period 1965-66 to 1980-81.

During period II, the significance of different variables in determining tractorisation experienced some change. It is seen from the table 4 that elasticity of demand for tractors with respect to cropping intensity declined from 6.81 in period I to 1.73 in period II. Similar was the case with respect to cultivated area where it declined from 3.38 in period I to 2.29 in period II. Although there is no denying the fact that cropping intensity and cultivated area did remain significant variables in period II (1981-82 to 1995-96) also yet importance of these two factors in determining demand for tractors was relatively more in period I as compared to period II. The coefficient of number of tractors financed which was negative and non significant in period I emerged out as positive and significant coefficient indicating that credit facilities for the purchase of tractor has largely influenced the investment in tractors.

Another factor which had a direct bearing on the demand for tractors in Punjab during the period II was lagged demand for tractors. A strong and positive association between demand for tractors in current year and demand for tractors in previous year was observed, thereby confirming the fact that social considerations in owning the tractor led to increased demand for tractors in the state as more and more farmers were tempted to purchase the tractor under the demonstration effect.

Period III

From Eq. 3, it is seen that cropping intensity, number of tractors financed, cultivated area, demand for tractors in previous year and area under high-yielding variety seeds had been responsible for increased demand for tractors in Punjab.

The elasticity coefficient of cropping intensity (0.60) was found to be significant at 10 per cent level. This indicated that 1 per cent increase in cropping intensity would lead to 0.6 per cent increase in the demand for tractors. Likewise, the elasticity of tractorisation with respect to number of tractors financed (0.04) was significant at 5 per cent probability level. Thus it revealed that 1 per cent increase in the number of tractors would result in raising the demand for tractors by 0.04 per cent. The coefficient of cultivated area (2.05) was significant at 5 per cent probability level which signified that with 1 per cent increase in cultivated area, the demand would increase by more than 2 per cent. The regression coefficient of lagged demand for tractors was found to be 0.83, statistically significant at 1 per cent level. It indicated that higher the demand for tractors in a current year, higher would be the demand for tractors in successive year i.e. 1 per cent increase in the number of tractors in a particular year would lead to 0.8 per cent increase in the number of tractors in the succeeding year. The coefficient of area under high-yielding varieties was also significant at 1 per cent level, the elasticity being 0.20, revealed that with 1 per cent increase in area under high-yielding variety seeds, the demand for tractors in the state would increase by 0.2 per cent.

So an important conclusion that emerged out of this analysis is that in the initial stage of tractorisation (during 1965-66 to 1980-81) cropping intensity and cultivated area were the only significant factors determining the demand for tractors in Punjab. However, the role of other variables was not apparent. But, of late, (during 1981-82 to 1995-96) credit availability and social factors involved in owning tractor also came out to be important variables alongwith cropping intensity and the cultivated area. It is general observation in Punjab that various financial institutions are providing more and more credit facilities for making investment in the tractors irrespective of the volume of business. So farmers are purchasing tractor widely not only out of their farming necessities but also because tractor has become a status symbol for the farming community.

An important conclusion that emerges out of this analysis is that in the initial stage of tractorisation cropping intensity and cultivated area were the only significant factors determining the demand for tractors in Punjab.

Demand Projections of Tractors

For projecting the demand for tractors more realistically, the demand model of period II (1981-82 to 1995-96) was considered. The explanatory variables included in the function were: cropping intensity (CI) real price of tractor (RP), number of tractors financed (NTF), net irrigated area (NIA), cultivated area (CA), cropping pattern [CP (%age)], price of agricultural products (PAP) and demand for tractors in the pre-

vious year (D_{t-1}) Thus the demand model formulated was:

$$D_T = f (CI, NTF, NIA CA, CP (\%age), PAP, D_{t-1})$$

where

D_T = Demand for tractors

To project the future demand for tractors with a fair degree of accuracy each included variable was predicted under a set of alternative assumptions.

The Assumptions

Cropping intensity

It is obvious that cropping intensity cannot increase endlessly and one would expect the cropping intensity to have maximum limit and stabilise ultimately. So cropping intensity was assumed to be increased with the annual increment of 0.86 and it would be 210 per cent in the year 2025.

Real price

The real price of tractor increased at the rate of 0.56 per cent during period II and the same growth rate was assumed to be prevailing in future too. As various financial institutions are adopting liberal credit policy for sanctioning the loan for the purchase of tractor so it was assumed that number of tractors financed would become 1.5 times more in the year 2025 as compared to 1995-96.

Cultivated area

Owing to limited possibilities of extending the cultivated area, it was assumed that it would increase at the same rate of growth (0.05 per cent) as observed in period II upto the year 2025 and would be 4,338 thousand hectares in the year 2025.

Net irrigated area

In Punjab about 94 per cent of cultivated area is already under irrigation and there is hardly any scope of further increase in the area under irrigation. So it could safely be assumed that net irrigated area would remain same i.e. 94 per cent of the cultivated area and it would become 4,083 thousand hectares in the year 2025.

Cropping pattern

About 70 per cent of the total cropped area is under paddy and wheat. There are very less chances of bringing more area under these crops, as crop diversification is being suggested by agricultural scientists in Punjab. So it was assumed that maximum of 70 per cent of area can be under these crops in future too.

Price of agricultural products

It was assumed that the price of agricultural products (paddy, cotton, wheat) will grow at the same rate during the projection period as observed in period II.

Fitness of model

The fitness of econometric model formulated to carry out predictions was verified on the actual data of different explanatory variables and the values were predicted for six years i.e. 1989-90 to 1995-96.

Table 5: Actual and Estimated Demand for Tractors in Punjab 1989- 96

(Number)

Year	Actual demand	Estimated demand based on Log-Linear Regression	Errors in estimation (per cent)
1989-90	2,68,511	265,481	–1.13
1990-91	2,89,064	2,86,044	–1.04
1991-92	3,07,002	3,09,001	0.65
1992-93	3,24,350	3,18,348	–1.85
1993-94	3,38,494	3,39,388	0.26
1994-95	3,54,378	3,49,724	–1.31
1995-96	3,71,720	3,67,655	–1.09

Actual and predicted values of demand for tractors in the state have been presented in Table 5. It may be observed from the table that maximum prediction error was 1.85 only, so it became quite evident that model was best fitted and it could be used for projection of demand for tractors.

Estimation of future demand and required supply

To obtain the required supply of tractors in the state the expected error of prediction i.e. 2 per cent was added to the projected demand for tractors. The projected values of demand for tractors and corresponding required supply based on these projections at 5 year's gap have been shown in Table 6 whereas the projections for all the years i.e. 1996-97 to 2024-25 have been given in Appendix I. According to the estimates the future demand for tractors in Punjab is expected to be 4,14,115 and 9,90,435 tractors in the years 1997-98

and 2024-25 respectively. The corresponding required supply was worked as 4,22,397 and 10,10,244 tractors in the years 1997-98 and 2024-25.

Table 6: Projected Demand for Tractors and Required Supply of Tractors in Punjab

Year	Projected demand for tractors	Required supply
1996-1997	3,93,132	4,00,995
2001-2002	4,81,133	4,90,756
2006-2007	5,71,432	5,82,861
2011-2012	6,69,241	6,82,626
2016-2017	7,75,218	7,90,722
2021-2022	9,08,818	9,26,994
2024-2025	9,90,435	10,10,244

Conclusions

The study revealed that the annual compound growth rate of tractors in Punjab which was 16.56 per cent in period I (1974-75 to 1983-84) declined to 5.95 per cent per annum in period II (1984-85 to 1996-97). The overall growth rate was observed to be 9.8 per cent per annum. Sangrur district recorded the highest rate of growth (32.46 per cent) in period I whereas in period II the rate of growth was maximum in Rupnagar (8.78 per cent). The overall rate of growth was maximum in Sangrur (16.51 per cent). The tractor population per thousand hectares of net area sown in different districts varied between 46 to 129 tractors in Gurdaspur and Patiala districts respectively. The regression analysis indicated that in period I, cropping intensity and cultivated area were significant factors which influenced the demand for tractors in Punjab positively. But during the period II and period III the significance of different variables in determining tractorisation experienced some change and credit availability, demand for tractors in previous year and area under high-yielding varieties also came out with positive and significant coefficients alongwith cropping intensity that the future demand for tractors in Punjab would be 4,14,115 and 9,90,435 tractors in the years 1997-98 and 2024-25 respectively and the corresponding required supply was worked as 4,22,397 and 10,10,244 tractors.

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Appendix I

Projected Demand for Tractors and Required Supply of Tractors in Punjab

(Number)

Year	Projected demand	Required supply
1996-1997	3,93,132	4,00,995
1997-1998	4,14,115	4,22,397
1998-1999	4,33,610	4,42,282
1999-2000	4,48,606	4,57,578
2000-2001	4,64,121	4,73,403
2001-2002	4,81,133	4,90,756
2002-2003	4,98,271	5,08,236
2003-2004	5,16,536	5,26,867
2004-2005	5,35,470	5,46,179
2005-2006	5,55,653	5,66,766
2006-2007	5,71,432	5,82,861
2007-2008	5,87,658	5,99,411
2008-2009	6,06,160	6,18,283
2009-2010	6,26,497	6,39,027
2010-2011	6,46,870	6,59,807
2011-2012	6,69,241	6,82,626
2012-2013	6,92,387	7,06,235
2013-2014	7,10,625	7,24,838
2014-2015	7,30,073	7,44,674
2015-2016	7,51,104	7,66,126
2016-2017	7,75,218	7,90,722
2017-2018	8,01,227	8,17,252
2018-2019	8,28,109	8,44,671
2019-2020	8,56,235	8,73,360
2020-2021	8,86,379	9,04,107
2021-2022	9,08,818	9,26,994
2022-2023	9,34,624	9,53,316
2023-2024	9,60,203	9,79,407
2024-2025	9,90,435	10,10,244

□

Feature

Regional Disparity in Agricultural Productivity in the State of West Bengal

Utpal Kumar De

Agricultural development in the post-Green Revolution period in West Bengal is marked by manyfold increase in production and productivity. The growth is also accompanied by a move towards high productive and/or profitable crops. However, the growth is not uniform all over the districts and crops. Here an inter-district and inter-crop analysis has been done to unearth the regional pattern of productivity growth of different crops in West Bengal for the four chosen years 1970-71, 1978-79, 1985-86 and 1993-94. The analysis in general has revealed a divergent pattern of crops growth among the districts. Inter-district variation in composite productivity indices has increased in general over the years. However, disparities in the yield have decreased for products like boro rice, wheat and pulses.

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Introduction

In India the production and productivity of different crops, in terms of yield per unit of area has increased manyfold during the post-Green Revolution period. This is true of West Bengal. Increasing use of high yielding varieties seeds, irrigation, modern technology and other improved practices has brought a remarkable change in agricultural productivity. Different districts of West Bengal displayed different patterns of growth in yield of different crops which reflects the impact of the differences in humidity, temperature, quality of soil, etc. Water logging problem in general and the differences in the rate of growth of use of high yielding seeds, expansion of irrigation, adoption or diffusion of modern technology in particular have a role to play in disparities. Institutional changes are also not ignorable. Inter-crop variation in growth of productivity or yield is also significant. In this paper nature of such changes have been examined during the period (1970-94) for four specific base years: 1970-71, 1978-79, 1985-86 and 1993-94[1].

Different districts of West Bengal displayed different patterns of growth in yield of different crops which reflects the impact of the differences in humidity, temperature, quality of soil, etc.

For the purpose of analysis, yield of major crops like

1. Though Green-Revolution in India has started in mid-sixties, the result of new seed-fertiliser technology was observed in West Bengal during early seventies. Moreover, the period of 25 years is fairly long enough to have a noticeable change and observe the pattern of inter-district changes.

paddy (including aus, aman and boro), wheat, pulses all food crops and non-food crops like jute, potato, oilseed and sugarcane are considered[2]. All these selected crops in aggregate covered 95 per cent or even more of guess cropped Area throughout the entire period.

Methodology

Data on yield of different crops are collected from various issues of Statistical Abstracts in West Bengal and Economic Review, published by Bureau of Applied Economics and statistics, Government of West Bengal. Having collected the data trend equations were fitted of the type $\ln Y = a + bt$ to the yield data of different crops in different districts of West Bengal separately. Where Y represents yield of crop, a the constant intercept and b represents the rate of growth over time, t. From the equation trend values of yield of different crops were estimated for the chosen base years in different districts of West Bengal[3].

A crop yield index or simple yield relatives have been calculated for different crops in different districts as follows:

$C_{ij} = \frac{Y_{ij}}{Y_{io}} \times 100$ where Y_{ij} is the average yield of i^{th} crop in j^{th} district, Y_{io} represents the average yield of i^{th} crop in the state. C_{ij} is the yield relative for i^{th} crop in j^{th} district. In order to have a comparison of different districts a composite productivity index has been constructed for each district separately taking into account the variety of crops and their relative importance in different district in terms of the proportion of area under each crop to total cropped area in each district. Then a composite productivity index (CPI) can be expressed in the following mathematical form:

$$CPI = \sum_{i=1}^{n} \frac{Y_{ij}}{Y_{io}} \cdot \frac{A_{ij}}{A_{oj}} \times 100.$$

where $A_{oj} = \sum_{i=1}^{n} A_{ij}$ and A_{ij}/A_{oj} = proportion of Area under i^{th} crop in j^{th} district. $j = 1,2,....15$. (Kaur and Sethi 1994).

2. Here oilseeds and pulses are considered like single crops through major share of oilseed in West Bengal is that of mustard and to some extent til. Pulses include gram and tur.

3. It is important to note that the year 1978-79 was the year of an important institutional change in West Bengal. In that year land reform measures were introduced rigorously by the then new left-front Government. And after mid-eighties a rapid change of major agricultural crops was noticed.

Observations

Composite productivity indices obtained for different districts in West Bengal are presented in Tables 1 and 2. The result reveals high degree of variation in terms of yield per hectare among the districts. The average yield index (CPI) for districts with respect to all crops ranges from 56.19 to 124.77 per cent during 1970-71, 63.67 to 122.51 during 1978-79, 50.75 to 126.34 in 1985-86 and 46.19 to 129.05 during 1993-94. These indicate that range of inter-district variation in yields has increased over the period which is also indicated by the increasing co-efficient of variation as given in Table 1. From the table it is noticed that Burdwan and Hooghly, the two leading agricultural districts always remain at the top two positions and the districts of Birbhum and Bankura along with the former two are among the top-5 throughout the whole period. Darjeeling, West Dinapur and Cooch-Behar are always at the bottom-5 in the relative rankings.

Burdwan and Hooghly, the two leading agricultural districts always remain at the top two positions and the districts of Birbhum and Bankura along with the former two are among the top-5 throughout the whole period.

A similar yield index or composite productivity index (CPI) has also been constructed for food crops and non-food crops separately for each district. The range of variation of the index for food-crops was from 82.27 to 122.93, 81.61 to 123.64, 74.81 to 129.03 and 65.07 to 131.62 per cent during 1970-71, 1978-79, 1985-86 and 1993-94 respectively. Similar indices for non-food crops varied from 60.04 to 145.67, 56.67 to 137.27, 66.35 to 122.61 and 53.82 to 123.15 per cent during 1970-71, 1978-79, 1985-86 and 1993-94 respectively. It is clear from range and coefficient of variation that inter-district variation in yield for food, non-food crops as well as with respect to all crops have increased over time. The variation is much greater for non-food crops than the food crops. The results on CPI indicate that the inter-district disparity has increased because of the differences in the speed of growth of agriculture in different districts of West Bengal. Remarkable achievement has been found in case of Nadia which has jumped over many other districts. Malda and 24-Parganas have also been able to push up their ranking relegating some other districts downwards. However, the general pattern is that most of the frontier districts always remain at the front and the lower order districts always remain at the lower rung except for a few changes in order. This is clear from the

Table 1: Composite Productivity Index (for all Crops)

1	2	3	4	5	6*	7*	8*	9*
Dist	1970-1	1978-9	1985-6	1993-4	1970-1	1978-9	1985-6	1993-4
Burdwan	124.77	122.51	126.34	129.05	1	1	1	1
Birbhum	116.73	113.42	115.96	114.46	3	3	3	3
Bankura	109.59	107.58	107.53	109.13	4	4	4	5
Midnapore	93.16	93.85	97.76	96.10	7	8	7	8
Howrah	95.78	94.47	91.93	93.33	6	7	9	10
Hooghly	119.50	119.71	120.64	117.93	2	2	2	2
24-Paraganas	90.05	93.31	94.90	97.95	9	9	8	7
Nadia	89.02	97.57	106.02	113.61	10	6	5	4
Murshidabad	101.60	101.05	104.78	107.57	5	5	6	6
West-Dinajpur	76.12	77.98	70.46	64.52	8	13	14	14
Malda	75.76	81.104	84.68	94.54	13	11	10	9
Jalpaiguri	90.80	77.98	70.46	64.52	8	13	14	14
Darjeeling	56.19	63.67	50.75	46.19	15	15	15	15
Cooch-behar	84.23	78.95	74.86	71.81	11	12	13	13
Purulia	66.56	87.87	82.64	77.62	14	10	11	12
Coefficient of variation	20.43	17.32	21.36	23.17				
Rank Correlation	$R_{67} = .89$	$R_{68} = .83$	$R_{69} = .79$	$R_{78} = .97$	$R_{79} = .93$	$R_{89} = .986.$		

* Columns 6, 7, 8 and 9 represent the ranks of column 2, 3, 4 and 5.

Sources: Statistical Abstracts and Economic Review of West Bengal, Bureau of Applied Economics and Statistics, Government of West Bengal, Various issues.

Table 2: Composite Productivity Index (for Food Crops)

1	2	3	4	5	6*	7*	8*	9*
Dist	1970-1	1978-9	1985-6	1993-4	1970-1	1978-9	1985-6	1993-4
Burdwan	122.93	123.64	129.03	131.62	1	1	1	1
Birbhum	119.41	116.22	119.28	117.75	2	2	2	2
Bankura	112.23	110.29	110.90	111.19	4	4	3	5
Midnapore	93.70	93.81	97.24	96.03	9	7	6	9
Howrah	93.31	90.92	90.62	91.34	11	10	9	10
Hooghly	115.20	114.73	83.60	115.41	3	3	12	3
24-Paraganas	89.55	91.45	93.05	96.08	12	9	7	8
Nadia	93.53	102.30	104.43	111.48	10	6	5	4
Murshidabad	106.45	105.32	106.94	110.50	5	5	4	6
West-Dinajpur	82.27	83.78	83.21	83.36	15	13	13	11
Malda	84.91	87.45	92.12	100.99	14	12	8	7
Jalpaiguri	94.49	81.67	74.80	65.57	8	14	15	15
Darjeeling	99.26	87.84	84.51	76.87	6	11	11	13
Cooch-behar	85.87	81.61	77.65	74.59	13	15	14	14
Purulia	98.41	92.26	88.29	81.84	7	8	10	12
Coefficient of variation	12.536	13.456	15.715	18.56				
Rank Correlation	$R_{67} = .814$	$R_{68} = .518$	$R_{69} = .89$	$R_{78} = .80$	$R_{79} = .89$	$R_{89} = .80$		

* Columns 6, 7, 8 and 9 represent the ranks of column 2, 3, 4 and 5.
Source: Same as Table 1a.

Table 3: Composite Productivity Index (for Non-Food Crops)

1	2	3	4	5	6	7	8	9
Dist	1970-1	1978-9	1985-6	1993-4	1970-1	1978-9	1985-6	1993-4
Burdwan	126.08	125.44	122.61	113.46	3	2	1	4
Birbhum	88.091	87.77	95.57	94.35	11	10	9	8
Bankura	99.24	98.70	97.96	98.81	8	8	8	7
Midnapore	106.55	108.15	97.96	98.81	8	8	8	7
Howrah	131.49	114.36	105.35	91.273	2	3	7	9
Hooghly	145.67	137.27	107.65	123.15	1	1	5	1
24-Paraganas	115.03	113.74	111.84	114.14	4	4	4	3
Nadia	92.58	103.34	112.26	122.24	10	7	3	2
Murshidabad	107.89	106.08	106.02	103.69	5	6	6	6
West-Dinajpur	69.77	68.27	67.69	67.31	14	14	14	11
Malda	98.48	87.34	80.89	72.50	9	11	10	10
Jalpaiguri	83.13	73.85	71.11	64.023	13	13	12	12
Darjeeling	60.04	56.67	66.35	53.96	15	15	15	14
Cooch-behar	85.345	74.87	71.03	62.785	12	12	13	13
Purulia	104.083	92.86	80.504	53.823	7	9	11	15
Coefficient of variation	21.868	22.266	19.721	26.908				
Rank Correlation	R_{67} = .96	R_{68} = .76	R_{69} = .636	R_{78} = .882	R_{79} = .79	R_{89} = .882		

* Columns 6, 7, 8 and 9 represent the ranks of column 2, 3, 4 and 5.

Sources: Same as table 1a.

coefficient of correlation between the ranks of different years as represented in Table 3. This is a reflection of their relative advantage and disadvantages with respect to agro-climatic conditions over some other districts.

The CPI results indicate that the inter-district disparity has increased because of the differences in the speed of growth of agriculture in different districts of West Bengal.

Since composite productivity index is derived from the individual crops it is important to know the crops responsible for greater variation in yield among the districts. Inter-district variation of average yield of major crops in West Bengal are presented in Table 4. It is observed that average yield in terms of kg. per hectare has increased for all these crops during the period of discussion. This increase in yield is positively associated with the increase in inter-district variation for aus, aman, rice as a whole and jute on the other hand the growth in yield is accompanied by decrease in variability with respect to boro, wheat, pulses, potato and sugarcane. The maximum variation in yield during all the four discrete years was recorded in case of potato. The coefficient of variation for the crop was 44.90, 40.76, 39.08, 39.14 per cent respectively. Next to potato, variation was higher for aus, which ranges from 32.31 in 1970-71 to 37.25 in 1993-94. Where as the lowest variation was observed in case of pulses for all these years. The coefficient of variation was 12.84, 10.04, 9.6 and 11.83 per cent respectively during 1970-71, 1978-79, 1985-86 and 1993-94.

Now the potential increase in output that could have been achieved in West bengal during 1970-71 and 1993-94 is estimated. This is done by calculating the output of different crops in West Bengal at the rate of highest yield achieved by any of the districts and comparing with the actual output in West Bengal. This type of analysis will help us trace whether the difference between the output of each crop at modal district yield rate and aggregate actual output has decreased over-time or not. If it is found to decrease over time it can be assumed that the difference between modal yield rate and districtwise yield rate has narrowed down over time. The implication is obviously towards the reduction in inter-district disparity of yield of the respective crop. The results have been presented in Table 5. It reveals that the production

Table 4: Variation in Yield of Different Crops among the Districts of West Bengal: 1970-71 to 1993-94

(kg, hec)

Crop	Year	Highest	Lowest	Average	Coeff. of Variation
Aus	1970-71	1613.24	569.63	884.55	32.307
	1978-79	1833.53	695.76	1088.99	32.53
	1985-86	2050.83	823.45	1311.85	34.09
	1993-94	2482.45	905.06	1630.90	37.25
Aman	1970-71	1257.64	767.39	1220.70	15.52
	1978-79	1590.81	1004.86	1216.13	15.42
	1985-86	1962.55	1097.18	1426.05	17.77
	1993-94	2494.89	1137.40	1719.18	22.21
Boro*	1970-71	2881.31	1568.69	2341.44	19.09*
	1978-79	2939.52	1557.57	2483.39	15.46*
	1985-86	3001.90	1547.89	2624.18	13.87
	1993-94	3331.57	1536.91	2807.07	14.86
Rice	1970-71	1380.22	720.54	1019.75	19.79
	1978-79	1713.00	951.84	1253.88	18.90
	1985-86	2069.37	1043.15	1509.26	19.96
	1993-94	2568.30	1094.44	1874.97	23.02
Wheat	1970-71	2275.60	1248.87	1874.83	14.17
	1978-79	2244.86	1398.00	1882.20	11.43
	1985-86	2218.31	1543.02	1894.97	11.43
	1993-94	2334.38	1347.49	1916.69	13.92
Pulses	1970-71	657.21	396.62	475.74	12.84
	1978-79	662.49	442.13	513.03	10.04
	1985-86	667.14	456.92	550.24	9.60
	1993-94	733.33	474.42	597.67	11.83
Oilseed	1970-71	485.89	204.80	319.89	22.66
	1978-79	561.27	309.82	431.70	17.74
	1985-86	762.80	382.22	566.09	18.38
	1993-94	1089.86	455.78	779.72	24.05
Jute**	1970-71	1795.43	750.69	1269.14	21.96
	1978-79	2075.17	895.87	1503.69	23.38
	1985-86	2355.48	1045.76	1749.71	25.75
	1993-94	2809.89	1248.00	2087.88	29.34
Potato	1970-71	18807.29	4324.27	10620.19	44.90
	1978-79	21324.25	5571.39	12691.76	40.76
	1985-86	21324.25	5571.39	12691.76	40.76
	1993-94	23801.67	7008.65	18189.95	39.14
Sugarcane**	1970-71	6797.00	2910.00	4987.13	23.114
	1978-79	6297.00	3900.00	5104.13	15.20
	1985-86**	7618.00	4094.00	5558.19	18.13
	1993-94**	7654.33	3480.33	5570.38	17.001

* and ** represent the number of observations 13 and 14 respectively.

Source: Same as Table 1.

Table 5: Actual Potential Output in West Bengal (Principal Crops)

(in 1000 tonnes)

	Actual Output		Potential Output		Change in Percentage	
Crops	1970-71	1993-94	1970-71	1993-94	1970-71	1993-94
Aus	910.0	908.2	1373.825	927.572	50.97	2.13
Aman	4694.7	7961.2	7681.757	8302.892	63.63	4.29
Boro	525.4	3241.5	585.983	3283.390	9.45	1.29
Rice	6140.1	12110.9	10357.200	12279.800	68.68	1.39
Wheat	868.1	632.1	934.720	796.406	7.67	25.99
Pulses	377.3	170.8	482.710	193.950	27.94	13.55
Oilseed	59.2	415.8	148.600	470.553	151.01	13.17
Jute*	2683.6	5569.0	4774.378	5573.039	77.91	0.07
Potato	929.7	5171.6	1500.295	5321.321	61.37	2.90

* In 100 bales of 180 kg each.

Table 6: Percentage Change in Productivity of Different Crops During 1970-1 to 1993-4 (District-wise)

Dist	Aus	Aman	Boro	Rice	Wheat	Pulses	Oilseed	Jute	Potato
Burdwan	44.48	98.38	2.37	86.08	-17.38	29.38	115.59	91.73	66.25
Birbhum	90.41	60.30	7.64	69.72	14.80	67.02	177.66	88.23	114.60
Bankura	149.78	60.98	63.59	90.41	11.42	8.14	176.03	96.19	98.46
Midnapore	90.41	65.48	22.43	90.41	-14.08	62.09	128.88	97.87	112.27
Howrah	150.35	57.32	10.65	86.08	-33.9	18.02	27.02	29.38	116.58
Hooghly	81.43	77.71	-6.45	62.09	-11.27	13.79	178.94	51.63	43.49
24-Paraganas	139.65	78.94	3.75	90.41	21.59	21.59	271.0	49.56	67.01
Nadia	111.17	175.11	7.14	194.76	-3.83	24.42	351.1	106.37	45.82
Murshidabad	52.68	103.07	49.56	108.76	13.75	2.33	134.2	77.71	27.61
West-Dinajpur	87.80	66.63	14.80	90.41	10.65	16.13	145.79	66.25	42.18
Malda	53.74	100.75	56.24	118.58	24.42	48.83	121.12	21.03	117.08
Jalpaiguri	38.31	10.91	NA	14.80	0.69	40.23	222.67	23.57	111.17
Darjeeling	51.29	28.20	NA	23.00	38.31	4.81	102.61	59.51	142.42
Cooch-behar	77.72	30.88	70.11	48.87	-11.48	38.31	65.87	31.78	135.82
Purulia	28.79	40.23	-2.03	123.67	16.93	11.42	90.85	NA	-13.09
West Bengal	71.29	69.45	12.58	86.08	2.80	24.42	187.40	68.17	72.48

Source: Same as Table 1.

could be increased in case of all the selected crops. The potential increase in almost all crops has declined since 1970-71 to 1993-94 except wheat where it output per hectare of almost all individual crops since 1970-71. However, the composite productivity index (CPI) that represents combined impact of yield and area distribution shows a trend of increasing variation and thus exhibits the increasing variation of acreage distribution.

Having examined the potential variation in output, further investigation has been made into the productivity change of different crops in different districts during the same period of time. Table 6 reveals the divergent trend in productivity growth. The trend was positive for all crops in all districts except boro in Hooghly and Purulia, potato in Purulia and wheat in Burdwan, Midnapore, Howrah, Hooghly, Nadia and Cooch-Behar Where it was negative. For the West Bengal as a whole highest rate of growth of yield was noticed for oilseed (187.4 per cent) and lowest for wheat (2.8 per cent). Percentage rate of growth

Table 7: Changes in Area, Production and Yield of Principal Crops in West Bengal (In Percentage)

Crops	1970-73	1977-80	1984-87	1991-94	1970/73-77/80	1977/80-84/87	1984/87-91/94	1970/71-91/94
	Area ('000 hectares)				Change in Area (percentage)			
Aus	807.93	710.40	583.97	537.50	–12.07	–17.80	–7.96	–33.47
Aman	3946.33	3986.40	4079.63	4278.93	1.02	2.34	4.89	8.43
Boro	284.53	334.80	554.13	946.70	17.67	65.51	70.84	232.72
Rice	5005.47	5031.60	5217.73	5763.13	0.52	3.70	10.45	15.14
Wheat	383.60	503.77	346.23	275.70	31.32	–31.27	–20.37	–28.13
Pulses	604.07	561.57	417.40	271.63	–7.04	–25.67	–34.92	–55.03
Oilseed	175.77	229.07	395.70	542.60	30.32	72.74	37.12	208.70
Jute	411.83	506.93	594.33	513.97	23.09	17.24	–13.52	24.80
Potato	71.20	131.97	153.43	2226.90	85.35	16.26	47.89	218.68
Sugarcane	34.90	30.93	12.93	14.23	–11.38	–58.20	10.05	–59.23
	Production ('000 kg)				Change in Production (percentage)			
Aus	890.57	617.20	637.10	900.83	30.70	3.22	41.4	1.51
Aman	4497.80	5127.53	5959.73	8043.00	14.00	16.23	34.96	78.82
Boro	732.77	941.97	1585.33	2893.00	28.55	68.30	82.49	294.80
Rice	6121.27	6686.03	8182.17	11836.83	9.23	22.38	44.67	93.37
Wheat	825.77	934.23	744.50	592.30	13.13	–20.31	–20.44	–28.27
Pulses	326.37	302.03	228.40	181.57	–7.46	–24.38	–20.5	–44.37
Jute	2955.00	3789.00	5558.00	5762.97	28.22	46.69	3.69	95.02
Potato	979.43	2116.50	3145.17	4964.53	116.10	48.60	57.85	406.88
Sugarcane	179.20	186.80	77.97	80.00	4.24	–58.26	2.6	–55.36
	Yield (kg/hectare)				Change in Yield (percentage)			
Aus	1104	865	1093	1676	–21.65	26.36	53.34	51.81
Aman	1140	1286	1461	1880	12.81	13.61	28.68	64.91
Boro	2905	2799	2838	3052	–3.65	1.37	7.54	5.06
Rice	1223	1328	1568	2054	8.59	18.07	30.99	6.79
Wheat	2154	1858	2185	2155	–13.74	17.60	–1.37	0.05
Pulses	539	538	593	668	–0.19	10.22	12.65	23.93
Jute	1290	1344	1667	2020	4.19	24.03	21.18	56.59
Potato	13790	16232	20490	21923	17.71	26.23	6.99	58.98
Sugarcane	5121	5617	5044	5584	9.69	7.60	–7.61	9.04

Source: Same as Table 1.

of yield of rice, pulses, jute and potato were 86.08, 24.42, 68.17 and 72.48 respectively. Among the districts highest percentage increase in rice was noticed in Nadia (194.76), wheat in Darjeeling (38.31), pulses in Birbhum (67.02), oilseed and jute in Nadia (351.1 and 106.37) and potato in Darjeeling (142.42). In case of rice it was noticed that aus, aman and boro registered highest yield growth rate in the districts of Howrah (150.35), Nadia (175.11) and Cooch-behar (70.11) respectively.

Table 7 presents the per centage growth of area, production and yield of principal crops in West Bengal during different sub-periods and the whole period. Highest rate of growth in terms of area was noticed for boro rice (232.72%). Production and yield growth was highest in case of oilseed (584.52 and 121.47 per cent). Lowest acreage growth was noticed for sugarcane (–59.23%), production growth was also negative in case of sugarcane (–55.36%) and yield for wheat

(.05%), Oilseed, potato and boro rice have grown on a vigorous scale in terms of production and acreage. Growth of oilseed was highest for potato during 1970/73-1977/80, and for boro rice the third period, 1984-87 to 1991-94. But productivity growth for boro was not significant though it was significant for oilseed and potato throughout the whole period.

Conclusions

The forgoing analysis revealed the divergent pattern of yield growth among the district and crops over the years. Inter-district variation in composite productivity indices have increased. However, disparities in yield have decreased for boro rice, wheat, pulses, potato and sugarcane though it has increased in case of other crops. Productivity of different crops have increased differently in different districts according to the suitability to agro-climatic condition of the respective regions. The acreage growth is more inclined towards high yield growing crops. The analysis also reveals that better selection of crops, better input management and reduction in regional disparity of yield by raising yield of low yield districts can raise the output of all crops. Though productivity has increased for almost all crops but it is not uniformly. Yield of boro rice and other summer crops can be raised by better irrigation management, raising power supply to agriculture and extending the same to remote areas and withering other hindrances. Productivity growth also needs supply of more and more productive seeds and better crop protective measures which again requires policy intervention to promote research and development activities. Specialisation of crops according to the suitability of crops to the respective region is more encouraging during the period of heavy commercialisation.

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Feature

Sensitivity Analysis of the Crops of Karnataka State

K.P. Aswatha Reddy & Lalith Achoth

Irrigation is not only a crucial input for agricultural development, but also facilitates efficient use of other inputs resulting in higher cropping intensity and increased productivity. The canals and tanks are the major sources of surface irrigation. Wells and borewells are the source of groundwater irrigation. Tanks, a common feature in the cultural landscape of peninsular India, are irrigating one-third of the total paddy area in the states of Andhra Pradesh, Karnataka and Tamil Nadu. But tank irrigation decreased considerably since 1965. Consequently, sensitivity analysis irrigation models has been carried out to see what changes in the prices of the products are allowable in order to retain the same levels. It is seen that sensitivity analysis of the solution of the linear programming models is fairly high in all the three upper middle and lower reaches. A through review of the cropping pattern suggests the type of economic incentives needed to facilitate the adoption of a more sustainable cropping pattern through better price realisation or increased productivity could facilitate a greater adoption even when more credit is provided. The major constraints faced in Tank Irrigation Management are inadequate field channels, poor maintenance of tank, inadequate capital share in maintenance of tank and inequitable distribution of water.

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Introduction

Irrigation has become *sin qua* of agriculture and rural development in India. Without adequate and timely water supplies, the potential of high yielding varieties, fertilizers, pesticides and other improved cultivation techniques cannot be realized. The major sources of irrigation are tanks, canals and wells. Tanks constitute the oldest means of providing irrigation water. During and before the 1950's tank irrigation accounted for 47 per cent of the total irrigated area. After 1965 this proportion began declining as there has been a spurt in the share of canals and wells. The present paper has focused upon the sensitivity analysis of the irrigation models carried out to see what changes in the prices of the products are allowable in order to retain the same solution in the tank command area as previously.

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Materials and Methods

The study was undertaken in the Gundamagere Irrigation Tank, Doddaballapur Taluk, Bangalore Rural District of Karnataka state during 1994 based on a sample of 90 farmers drawn equally from the upper, middle and lower reaches of the tank command. The tank has a command area of 1005 acres and catchment area of 16.05 sq. miles each reach was defined as follows.

Upper reach up to 1050 metres

Middle reach up to 1051 to 2100 metres

Lower reach up to 2101 to 3150 metres (all distances are measured radially from the tank)

Linear programming technique has been employed to workout the maximum attainable returns by the optimum allocation of various available resources.

In mathematical form of one year (two season), the linear programming model can be formulated in the following way:

$$\text{Maximize } Z = \sum_{j=1}^{n} C_j X_j$$

subject to following constraints

$$\sum_{j=1}^{n} a_{ij} \quad X_j \leq b_i \ (j=1,2,.....k) \qquad (1)$$

$$\sum_{j=1}^{n} a_{ij} \quad X_j \geq b_i \ (j = 1,2,.....m) \ X_j \geq 0 \qquad (2)$$

Where Z = Net return from all crop activities included in the model.

C_j = Net returns from jth activity measured in rupees per acre of land

X_j = The level of jth activity in acres

a_{ij} = Quantity of ith input required per unit of jth activity

b_i = Quantity available of the ith resource.

The objective function for the model in this study is to maximize the annual net farm return from crop subject to the resource constraints specified in the model.

Results and Discussion

Upper Reach

From Table 1 it is noted that the profit (without credit situation) from X_1 activity (Ragi Kharif tank irrigated sandyloam soil) can increase upto 6.70 per cent and decrease upto 4.77 per cent, and in this range the optimum solution is unchanged. Similarly, the gross margin of X_2 activity (Kharif tank irrigated red soil) can also increase by 6.56 per cent which then decreased by 8.16

Table 1: Sensitivity Analysis-Upper Reach

Activity	Without Credit			With Restricted Credit		
	Net Returns	Allowable Increase (%)	Allowable Decrease (%)	Net Returns	Allowable Increase (%)	Allowable Increase (%)
Ragi KTS (X_1)	2548	6.70	40.77	2548	Infinity	7.50
Maize KTR (X_2)	5370	6.56	8.56	5370	Infinity	3.63
Maize KTB (X_3)	4971	Infinity	99.72	4971	Infinity	3.62
Redgram KTS (X_4)	4418	17.33	Infinity	4418	41.96	Infinity
Redgram KTB (X_5)	4186	61.52	Infinity	4186	42.49	Infinity
Redgram KDS (X_6)	2596	72.70	Infinity	2596	Infinity	20.76
Ragi KDS (X_7)	516	48.41	Infinity	516	298.64	Infinity
Paddy KWIS (X_8)	4085	27.52	Infinity	4085	Infinity	8.27
Groundnut RTIS (X_9)	2529	24.52	Infinity	2529	24.51	Infinity
Groundnut RTIB (X_{10})	2188	35.37	Infinity	2188	35.37	Infinity
Groundnut RTIB (X_{11})	1681	211.24	Infinity	1681	211.24	Infinity
Sunflower RTIS (X_{12})	4438	Infinity	56.98	4438	Infinity	56.98
Sunflower RTIB (X_{13})	5150	Infinity	42.49	5150	Infinity	42.48
Sunflower RTIR (X_{14})	6913	Infinity	24.32	6913	Infinity	24.31

*** Note:** X_1 - Ragi Kharif tank irrigated Sandyloam Soil
X_2 - Maize Kharif tank irrigated Red Soil
X_3 - Maize Kharif tank irrigated Black Soil
X_4 - Redgram Kharif tank irrigated Sandyloam Soil
X_5 - Redgram Kharif tank irrigated Black Soil
X_6 - Dry land Sandyloam Soil
X_7 - Ragi Kharif Dry land Sandyloam Soil
X_8 - Paddy Kharif Well irrigated Sandyloam Soil
X_9 - Groundnut Rabi tank irrigated Sandyloam Soil
X_{10} - Groundnut Rabi tank irrigated Black Soil
X_{11} - Groundnut Rabi tank irrigated Red Soil
X_{12} - Sunflower Rabi tank irrigated Sandyloam Soil
X_{13} - Sunflower Rabi tank irrigated Black Soil
X_{14} - Sunflower Rabi tank irrigated Red Soil

Table 2: Sensitivity Analysis-Hidden Reach

Activity	Without Credit			With Restricted Credit		
	Net Returns	Allowable Increase (%)	Allowable Decrease (%)	Net Returns	Allowable Increase (%)	Allowable Decrease (%)
Ragi KTS (X_1)	1819	79.19	Infinity	1819	37.40	Infinity
Maize KTR (X_2)	5520	74.55	98.38	5520	Infinity	59.03
Maize KTB (X_3)	5865	98.55	Infinity	5865	Infinity	60.01
Redgram KTS (X_4)	2187	311.12	Infinity	2187	191.19	Infinity
Redgram KTB (X_5)	3393	136.78	Infinity	3393	125.94	Infinity
Redgram KDS (X_6)	3156	80.81	Infinity	3156	75.53	99.13
Ragi KDS (X_7)	2216	Infinity	Infinity	2216	98.76	65.15
Paddy KWIS (X_8)	5475	30.62	Infinity	5475	96.99	73.79
Groundnut RTIS (X_9)	3159	48.84	Infinity	3159	48.44	Infinity
Groundnut RTIB (X_{10})	1591	101.89	Infinity	1591	101.89	Infinity
Groundnut RTIB (X_{11})	1919	124.65	Infinity	1919	124.65	Infinity
Sunflower RTIS (X_{12})	4775	Infinity	66.16	4775	Infinity	66.16
Sunflower RTIB (X_{13})	4803	Infinity	33.13	4803	Infinity	33.13
Sunflower RTIR (X_{14})	6230	Infinity	30.80	6230	Infinity	30.80

Note: As in Table 1.

Table 3: Sensitivity Analysis-Lower Reach

Activity	Without Credit			With Restricted Credit		
	Net Returns	Allowable Increase (%)	Allowable Decrease (%)	Net Returns	Allowable Increase (%)	Allowable Decrease (%)
Ragi KTS (X_1)	1990	36.80	Infinity	1990	88.49	Infinity
Maize KTR (X_2)	5111	95.35	94.33	5111	Infinity	37.64
Maize KTB (X_3)	5473	Infinity	95.55	5473	Infinity	35.95
Redgram KTS (X_4)	4454	50.03	Infinity	4454	87.24	99.28
Redgram KTB (X_5)	4860	47.03	Infinity	4860	60.88	Infinity
Redgram KDS (X_6)	2755	93.99	Infinity	2755	94.77	99.70
Ragi KDS (X_7)	1835	58.25	6.85	1835	99.56	92.15
Paddy KWIS (X_8)	3606	65.75	Infinity	3606	98.79	93.03
Groundnut RTIS (X_9)	2604	8.60	Infinity	2604	20.19	Infinity
Groundnut RTIB (X_{10})	2570	12.64	Infinity	2570	144.16	Infinity
Groundnut RTIB (X_{11})	1816	9.20	Infinity	1816	1.59	Infinity
Sunflower RTIS (X_{12})	5432	Infinity	47.93	5432	99.41	89.59
Sunflower RTIB (X_{13})	5465	Infinity	47.02	5465	Infinity	–
Sunflower RTIR (X_{14})	5306	Infinity	34.22	5306	Infinity	91.83

Note: As in Table 1.

per cent from the current value and the optimum solution will not be changed. These two activities are highly sensitive enterprises. It is interesting to note that a 17.33 per cent increase in redgram margin in required to make it compete with ragi in sandyloam soils in tank irrigated lands during the kharif season whereas it has to increase by 61.52 per cent in black soil to compete with maize. This can be accomplished either through a higher realization or an increase in the yield. The latter appears to be a more dependable wayout.

It is interesting to note that a 17.33 per cent increase in redgram margin in required to make it compete with ragi in sandyloam soils in tank irrigated lands during the kharif season whereas it has to increase by 61.52 per cent in black soil to compete with maize.

With restricted credit situation, the highly sensitive activities are:

X_1 = (Ragi Kharif tank irrigated sandyloam)

X_2 = (Maize Kharif tank irrigated red soil)

X_3 = (Maize Kharif tank irrigated black soil)

X_8 = (Paddy kharif well irrigated sandyloam)

Herein decreases in gross margin of less than 10 per cent will change in the recommendation of the models. In the other activities an increased of more than 15 per cent is required to alter the solution. Thus it could be concluded that, the stability of the solution of the linear programming models in the upper reach in with restricted credit is fairly high.

Middle Reach

Without credit situation, the gross margin from X_1 activity can increase upto 79.19 per cent (Table 2). The Activities increased by more than 100 per cent where X_4 (311.12%), X_5 (136.78), X_{10} (101.98%) and X_{11} (124.65%). Thus it could be seen from that the stability of activities is fairly high. There are no sensitive enterprises in without credit situation, i.e., the increase or decrease of the net return within 15 per cent of their current value. A similar situation was observed in case of with restricted credit situation.

Lower Reach

In without credit situation (Table 3), the increase or decrease of 15 per cent in the gross margin of the activities will change the recommendation of the model. The variable likely to be affected are X_7 (6.85%), X_9 (8.60%), X_{10} (12.64%) and X_{11} (9.2%).

In with restricted credit situation in the activities in which an increase or decrease within 15 per cent that alter the final solution are X_{11} (1.59%) and X_{13} (15%). Groundnut and Redgram are crops where improvement in productivity could facilitate a greater adoption even when more credit is provided.

Nearly 40 per cent of the sample farmers expressed about the poor maintenance of the tank. About 55 per cent of the sample farmer felt that capital was inadequate to maintain tank. About 55 per cent of the farmers were of the opinion that labour available was inadequate in maintenance of the tank.

Conclusions

It could be concluded that Sensitivity Analysis of the solution of the Linear programming model is fairly high in all the three reaches. Groundnut and redgram are crops where improvement in productivity could facilitate a greater adoption even when more credit is provided.

The major constraints faced in Tank Irrigation Management were inadequate field channel, poor maintenance of tank, inadequate capital share I maintenance of tank and inadequate distribution of water.

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Book Reviews

Economic Reform and Global Change, *by I.G. Patel,* Macmillan India Limited, New Delhi, 1998, p. 328, Price Rs. 280.

To read 'Economic Reform and Global Change' by I.G. Patel is not just an intellectually rewarding experience; it was for me at any rate an experience which left a sense that economics is worth doing after all. And not just some mess called 'Indian economics' but the real full-blooded business of tangling with the world economy. And worth doing not just as social service but because if you think of it, we have, even as of now, clear ideas on most of the economic problems that haunt us. Mr. Patel has shared with his audience a grand vision, and I for one am lucky to have had access to it.

Any writing on matters economic by Mr. Patel would have deserved our attention purely on the basis of his credentials as an economic adviser which are staggering. Mr. Patel has been an economist with the Government of India for the greater part of his career. He was Finance Secretary by the time he was forty three and subsequently Governor or the Reserve Bank of India. Before and after the latter appointment he has held significant appointments on the world stage. First, he was Deputy Administrator of the UNDP, the only reason for the secondary position being that it is politically determined that the top slot goes to a citizen of the United States. Next, after retirement from the service of the Government of India, he served as an educational administrator, heading first the Indian Institute of Management at Ahmedabad and subsequently the London School of Economics. And now as crowning glory for one involved in public affairs, I.G. Patel is a member of the Global Commission on Governance. It is important to highlight these achievements, for in an unfortunate turn since the attainment of Independence, there has developed in India an unabashed privileging of lucre over accomplishment. In such a milieu, the achievements of Mr. Patel need to be pointed out to the commercial classes who need to be reminded that even after fifty years of protection barely a handful of India's products can compete on world markets. On the other hand, a significant number of Indian professionals bestride the international arena.

The book under review comprises sixteen essays, being lectures delivered on various occasions. And these are no ordinary lectures. For a sample, you may have the Fifteenth Govind Vallabh Pant lecture delivered in New Delhi, the LSE Centenary Lecture delivered in London and the Asian Development Lecture delivered in Manila. These have been arranged under the five sections 'Economics in a Changing World', 'Economic Reform in India', 'Prospects for the Indian Economy', 'Education and Development', and 'Global Change'. Of these, the essays contained under the first three headings are easily the best. In any case they contain the bulk of the total. On education and global change, Mr. Patel has many interesting things to say but is unable to maintain the seamless flow and relentless brilliance to which we get accustomed by the time that we are halfway through the book. But even these essays are at least as good as the curate's egg which, recall, was good in parts.

Two themes run through Mr. Patel's writing. These are 'why we need to reform in India' and 'how to make sense of inequality on a global scale'. On economic reforms in India the author is categorically affirmative. He concludes, with hindsight, that the detailed planning of output is overambitious and the Indian experience with controls is to be interpreted not only as these having failed to deliver growth but having by now been captured by vested interests. Mr. Patel upholds the decision to delicence industry and urges the rationalisation of budgetary subsidies and the privatisation of the banking sector. However, he is not an admirer of what has been referred to as the 'Washington Consensus'. Mr. Patel questions seriously the overemphasis on fiscal deficits while pointing to the principle that Revenue deficits (a recent Indian disease) must be avoided at all costs for they imply government dissaving. Taking resolutely what I would refer to as the 'public finance perspective' on fiscal deficits, the author proposes that if we are to use any single category at all, it ought to be the public (in India inclusive of States?) revenue deficit

or surplus"...corrected, if you like, by incorporating the accounts of the public enterprises." (p. 129). On the use of the fiscal deficit as an instrument of macro management there are some interesting observations from the author. Regarding inflation he believes – entirely appropriately – that money is merely the medium and focussing attention on this variable can divert attention from the underlying forces. Now then "...concepts like budgetary deficits, however defined and however important, should be used with care and not as simple or single yardsticks" (p. 129). On the proposition that external deficits are to be controlled by reining-in the fiscal deficit, he makes the eminently sensible observation that "...we have to operate particularly on import intensive expenditures whether on revenue or on the capital account. No single indicator can thus replace detained analysis" (p. 129).

Of particular value is I.G. Patel's analysis of the impact of controls on the wider front of Indian political life. He believes that economic controls have encouraged the wielding of power without accountability by politicians and bureaucrats linking this development to the rise of Indira Gandhi and the political culture that this unleashed. One gathers from the writing that he believes that the area where political decisions have dominated most is banking and finance including insurance. For purely economic reasons, Mr. Patel is for the large scale privatisation of commercial banks and for throwing open the insurance sector to foreign competition. Given his experience, this advice is to be taken seriously. In a racy essay being originally a lecture delivered in honour of H.M. Patel and therefore appropriately entitled 'Ministers, civil servants and experts', he names and gives instances of how in the heyday of socialist rhetoric, the state apparatus in India was used to further individual gain of industrialists and the political ambition of politicians. We are then presented with an outstanding political argument for an end to the licence-permit-clearance Raj, the freeing of millions of Indians from the exercise of "arbitrary power". This advice from an economist who has served the government of India most of his life adds an entirely new and absolutely relevant dimension to the debate about economic reforms in India. Mr. Patel argues that freedom from the exercise of arbitrary power is the very rationale for Indian independence. Alas in independent India this has mostly been overlooked.

The second theme in this collection is the distribution of power at the global level. Mr. Patel shows a deep understanding of the evaluation of the international economic order and the power equations that underlie this development. Upon members of the Third World, he urges a full-blooded participation in world for all, even if the power lies with the members of the first world. This would be of interest to Indian opponents of participation in the World Trade Organisation which, it is pointed out here, is the only world body where the principle of "one member, one vote" applies. This principle comes into effect only after the rules have been agreed upon and the rules themselves are arrived at through consensus. And even though in the process the rich pull out all stops to ensure that their view prevails, Mr. Patel argues that nevertheless it is important to be part of international agreements. This is entirely correct. Upon members of the first world, he urges something else. Rather than focus on some concept of international equity, a sort of *ad hominem* argument is made. This works as follows: where one finds oneself – as a Swedish engineer of a Malawian peasant, say (the examples are mine) – is an accident of birth and this by itself a sound case for the redistribution of income internationally. This is the only argument that will work once the guilt of colonial rule vanishes, as it soon will. Moreover, it immediately opens up the possible reality of one being born in rich Indian families, thus destroying any putative argument for treating all Indians as deserving of handouts from the West.

Mr. Patel's view of equity and fairness on a global scale is not confined to considerations of a redistribution of income. It is brought very effectively into play when discussing two contemporary questions. The first has to do with free capital mobility. Here Patel has used every occasion in world fora to point out that while western governments join international organisations in pressing for free capital flows into developing countries they actively discourage any reverse flow in terms of even a temporary migration of highly skilled workers from the developing economies. It is striking that not a single Indian politician has dared to express this view in an international forum of any significance. On environmental issues, Mr. Patel's position is clearly outlined in his response to the concerns expressed that the developing countries spoil it for the rest of the world as it were. His argument is that the West cannot expect India and China to reduce usage of their only abundant resource, coal, without being compensated for the loss in income that would result. I wish though he had turned his attention to the situation in India where a continuing environmental degradation cannot be rationalised so easily in terms of its positive impact on the distribution of income. For in India it is the rich who pollute most and a disproportionate share of growth goes to them. One can think of many instances where large sections of the poor may be, on balance, better off without such growth.

Even as I conclude I shall quibble. The title of the volume is inappropriate. This is not so because so few of the essays in the collection refer to the global situation, but because 'global change' characterises poorly

what is happening on the world scene. Is there a change sweeping the world uniformly or is there a pressure to make the world in the Anglo-Saxon mode represented by the 'American way' of life, for which read 'corporate capitalism'? Surely there is a sort of editorial responsibility to be invoked here, which 'Macmillan' may please note. Be that as it may, if there is an argument for why India needs economic reform you are more likely to find it here than in the hectoring reports of the government or in the shallow outpourings of zealots. I.G. Patel speaks as an Indian citizen of the world, educated, travelled, learned about economic theory and seasoned by the experience of policy making. This is easily the best writing on the subject that I have read.

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Management Parables *by Moid Siddiqui,* Prism Books Pvt. Ltd., Bangalore, 1997, p. 232, Price Rs. 350.

The book on review is more or less a narration of the personal experiences of the author spread over more than two decades as a HRD professional in various organisations. Human behaviour is not always the same so that a concept is formed within which things would happen. Behaviour tends to change from place to place and from time to time. HRD person has to come across such a wide variety of events that he himself get molded into a monk. The author narrates his interactions with those kind of people who contribute to his transformation over the time. Though the author does not put it in so many words that he himself is a monk in the arena of HRD, his way of handling and his accrued wisdom which he puts in the form of moral of each parable shows he himself has been transformed into a monk.

In the foreword to the book provided by the distinguished social scientist, Abid Hussain, it is stated "material well being should be the byproduct of success, brought about by a strong sense of ethics". He quotes the words from the former CEO, Hewlett Packard, "core values do not change, but practices might". The book has been written in the form of parables. The back cover of the book contains a brief biography of the author. It is seen that seven of these parables have been already published by American society for training and development in their journal which is highly commendable. Further, the author is perhaps the first Indian who has published in the ASTD journal. It is indeed a wise attempt to observe and search for the greater wisdom from each and every happening which we normally tend to pass. The author has searched for this wisdom which had made him not only a poet manager but also a HRD monk. The book starts with a Lao Tsu quote, 'Knowing ignorance is strength, Ignoring knowledge is sickness". Author tells us who is a management monk. He goes on building the book with a lot of quotations by famous personalities, management gurus and philosophers like Tom Peters, Winston Churchill and like.

At the end of each parable the author's wisdom blooms. This he gives in the form of moral of the story. "Life is distinct from the game of cards. One need not keep his cards too close to this chest to win in life", is the moral the got after undergoing through a lot of woes attending interviews for a job and getting selected after showing a lot of transparency in an interview. The author asked the interview chairman as to which school of thought, the interview board belonged to, so that he could answer accordingly. This, the author narrates in a parable. Author says "the magnanimity of management lies in compassion. It is noble to err on the side of mercy" at the end of one of the parables. When he was asked to take holy disciplinary action against an erring cook in one of his assignments, he found that some holy methods are much more effective than mechanical legal proceedings. Another wisdom is that "Discipline is not the management's monopoly alone. Union can also franchise it". This is relevant even in the present industrial atmosphere. By keeping in touch with the basics, a professional won't become obsolete. Once a manager lost his basics, he is no more wanted in his field. Again, generally speaking, every one has to work with certain basic values irrespective of the path chosen. Basic values never change in any circumstances. Successful managers are made from their staunch adherence to their basic values.

The author gained valuable experiences as a HRD man. Some of the prophetic messages he got from them are mentioned here in his own words. "Don't forget little kindness, don't remember small faults", "Unusual situations can be dealt only with unusual decisions. One can't fish a whale by an angling rod", "It is not preaching but making sincere gestures of sacrifice that makes a leader great", "To make headway, one must improve one's head", "Managing is different from interfering – Push less, open and be aware, don't dominate, manifest", "Ambiguity and brevity provide clarity by unfolding deeper wisdom & intuition", "The solution that worked yesterday is only slightly appropriate today and will be irrelevant tomorrow", "Ocean is the greatest body of water because it lies below all the rivers and streams and is open to them all" and "Better the best by creating a problem".

The author gives an insight as to how to deal with the people with a humane touch even if it is necessary to force a change in the existing rules of the book. As the author rightly puts it "only they will survive into future, who know how to change". A worthy book for all aspiring professionals.

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Total Quality – Excellence through Organisation-wide Transformation, *by Bharat Wakhlu*, Wheeler Publishing, New Delhi, 1998, p. xv + 272 (includes Index), Price Rs. 380.

In current times, when businesses are regularly evolving in quest of attaining newer heights in excellence for surpassing the competition, the quality issues have come to be addressed as a significant component of their over-all management strategies. From an economical control of quality orientation, now the focus has gradually shifted to economical generation of quality in the first place. More than an aspect of mere technology, it is now formally taken to include also the legitimate most demanding aspects of commerce, psychology and sociology combined, as are expounded in the treatment of the theme in this book, over its ten chapters, grouped in three parts from Introduction through Actualization, to cautioning against Pitfalls in Operationalizing Total Quality.

In the first three introductory chapters, to set the perspective right, the text coverage extends from defining quality and total quality, through strategic decision making about the starting mark and the direction of moves, to following a model for total quality measured by customer delight and satisfaction, and operationalised by integrated customer focused enablers of outstanding leadership, capable products and processes, systems and procedures, people power and continuous improvement with respect to the benchmarking data. This sets the mode and tone for Part Two of the book dealing with actualizing Total Quality in its next six captivating chapters.

Starting point of actualising total quality is given (in chapter 4) as its having an obsessive customer orientation. Every process owner upstream, till the one serving the end customer, ought to work for materialising the requirement of their individual immediate customers, and customer opinion need be the measure for judging success of an endeavour. Author sounds the caution that "The achievement of total quality cannot be possible unless the customers' value expectations from the firm are met to their satisfaction. Only when the value expectations of customers are met in the most appropriate manner, and better than any other firm that may be trying to service the same market, can beneficial results of total quality be expected to emerge". Each link in the value generation chain performs the quality way when their people are encouraged to be creative and risk-taking and also when they identify themselves with the 'larger picture' – what the organisation is aiming at in the long run. The final requirement is about measuring customer satisfaction by establishing suitable indicators. From the traditional texts, where quality remained defined as absence of defects and measured as how much of it remained not-done in a produce, here comes in consonance with new thinking on quality a notable departure with author's revelations that opposite of customer 'dissatisfaction' cannot necessarily signify 'customer satisfaction'.

Outstanding leadership and supportive management practices (in chapter 5) are the vital corner stones for institutionalising and providing support for total quality. Leadership is contrasted from management. It has to create a vision for the future, encourage breaking away from 'business as usual' syndrome support risk-taking and learning of empowered people from errors that occur while reaching out with fearless autonomy to cumulate the firm's creativity for giving its very best to the customers, and exemplify these with personal practice by the leadership of what the preach, to ensure a doubtless credibility and enhanced level of trust. Motivation needs to be raised to the level of inspiration for the functionaries to get their full potential released for total quality.

Superior products, services and processes (in chapter 6) are taken as the means of competitive advantage for total quality firms which seek to consistently satisfy their customers. It should begin with strategic choice of niche markets and the related customers. Firm's competitive advantage can be maintained by having the focus right, creating differentiation and erecting entry barriers for competitors by designing profitable product-process combinations with appropriate engineering for quality. Information sharing should be free and purposefully networked in and outside the firm, which is essential for benchmarking as well as for holistic treatment of quality. Outside vendor supply, as a significant contributor to firm's quality pursuits, needs to be made flexible and reliable in an atmosphere of partnership and mutual trust, such that both sense their win together, not one at the cost of the other. Complimentary to above, for delivering least cost maximum value to customers, the world class manufacturing standard finally requires the expenditure of resources on all non-

value adding work to be minimised and the quality be shared by both the provider and the recipient.

Chapter 7 is on assuring quality through superior systems. An enabling organisation structure is the hallmark of an effective system where quicker decisions can be taken nearer to the event and with clearer identification of who must do what. Good system should have the in-built control mechanism to enable taking timely corrective and preventive actions. Standardise, Do, Check, Act (SDCA) cycle would help secure such a system. ISO 9000 as a quality system standard has been adopted as national standard by most countries the world over. Author's discussions here relate to its 1994 version of activity orientation. Now the 1997 version is about to be released where the emphasis is to shift on various business processes as performance units. This chapter will then have to be read with that new version to set the reference frame in line. With benchmarking of critical processes, this would give to systematise the basic organisational platform to deal with the total quality initiatives therefrom such that it enables the desired transformations to take place and targets become increasingly realisable.

Unleashing the power of people at all levels (as in chapter 8) can only achieve the desired quality transformation in organisations. With competent employees committed to firm's tasks, a business can aim to produce excellence. Their developments within are, therefore, the vital musts.

Essence of total quality is captured (in chapter 9) as making a habit of continuous improvement over that which exists. One needs to remain awake here to the cost of poor quality (COPQ) and act for their minimisation. There appears to exist, however, a stopping rule in this which must be guarded against consciously. A point of contrast in COPQ is to learn that by weighing the several costs of failures vis-a-vis of acceptable quality (defective), beyond which it may seen uneconomical to improve any more. In summary, organisations should approach continuous improvement in an utmost systematic and methodical way with the help of good team-work and incremental approach, at times with project-by-project fashion. Performance learning in organisational parlance has been mostly studied so far in limited terms of gross time-efficiency on tasks over subsequent periods, or as volume-experience. Aspects of quality learning, or how an organisation really acquires the excellence-experience and retains this learning within the organisation, remained conspicuous in the deliberations more by implication than by overt handling.

At the end, author lists (in chapter 10) some pitfalls in operationalising total quality. It would be a non-starter for those lacking in strategic thinking and going superficial in search of short-term wonders with blinkers on. It will not work as long as 'they' do, until 'we' take charge and assume responsibility for the result. It is neither a training programme nor an activity parallel to other 'normal' tasks. Author concludes with the assertions that total quality always requires direct top management involvement and a practical translation of adopting those decisions about how a business ought to conduct itself for success.

The book is refreshingly not a load of heavy theory or of intricate technical expositions. It essentially takes the reader on a guided tour to revisit the basics of business in a delightful (total qualitic) captivation. The book is well illustrated and well manufactured too. The present title under review thus happens to be a welcome addition to the growing concerned literature on the subject from these timely points of view of quality practice. Ideas presented by the author here are quite illuminating and easily understandable. Adopted scheme of elucidation is largely generalistic and is fully power-packed to initiate any practising manager into the quality faith. Even activists would derive several special triggers out of it, as of getting a potential tool-box for reviewing their business thrusts. In nut-shell, this text answers the several current mind-occupying aspects of desirable quality practice questions in terms of some viable ground-level action maps for carrying forward an organisation into increasingly higher orbits of performance. Readers of this book will definitely derive positive satisfaction out of it. Managers, consultants, academics, and students of total quality alike, will find it beneficial to have this book handy on their bookshelves or libraries. It will certainly be a recommended reading for organisations desirous of improving their lot from whatever level they now find themselves in.

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Key Management Ratios *by Ciaran Walsh,* Macmillan India Ltd., 1997, p. 347, Price Rs. 195.

Business ratios help in gaining an insight into the state of health of a company in the same fashion as temperature and pressure are used to understand the health of a human body. But what sets this book apart from most books on Corporate Finance is its lucid treatment of the subject including pictorial representation of ratios and their relationship with each other. Key issues in any business are Assets, Profits, Growth and Cash

Flow, which are intricately linked. A right balance between these variables determines the corporate value. The highlight of this book is the author's ability to connect various financial parameters and present a holistic picture from which a complete map of corporate financial health can be drawn. Each of the concepts is presented from both Assets as well as Liabilities point of view. For example, Working Capital can be looked upon as Current Assets minus Current Liabilities. Another way of looking at it is—all the long-term funds, which are not locked, in Fixed Assets.

The book has been divided into five parts: (1) introductory to explain terms like cash flow, profit and loss and balance sheet; (2) Operating Finance and relationships between balance sheet and profit & loss account; (3) Cash flow cycle; (4) factors determining the corporate values and (5) operational aspects of a company:

Data from 4 markets viz. UK, JAPAN, EU and US and four different sectors viz. Textiles, Food, Engineering and Stores has been selected from 200 companies for analysis and discussion. The data reveals that food sector in USA has delivered very high returns of about of 25% on equity. It is also noted that in this sector, companies have bought back the highest amount of their own shares which indicates that these companies have had difficulty in finding new avenues for their enormous cash flow that will fetch them similarly high level of returns.

The author has used many financial jargons such as the term"overtrading" to describe a situation where there are not sufficient funds in the company to carry the level of existing business. It means that the company has either grown too fast or is underfunded in the first place. The symptoms show up as a constant shortage of cash to meet day-to-day needs. One would need to inject long term funds to rectify such a situation.

Performance ratios defined in the 2nd part relate a value from the profit/loss account to a value in the balance sheet. A certain logic has to be followed in deciding on any particular ratio—if the value from the balance sheet includes loans, then the profit and loss value should include the corresponding interest charge and vice versa. Cash flow cycle, and importance of corporate liquidity,—ratios measure liquidity on the health of the company are discussed in the next chapter. Cash flow through an organisation can be compared with the flow of blood through the body. If the cash flow is disrupted, it can cause serious trouble even leading to the closure of the company. There are two aspects of measuring liquidity—long and short term. An optimum balance should exist between long term assets and funds. Long term assets in a company should be matched by corresponding long term liabilities.

In the fourth part, various ratios have been defined to measure corporate earning and how they affect the same. A model has been used to derive relationship between Return on Total Assets and Return on Equity. Here, the author has emphasized the need of having growth equilibrium which is defined as that rate of growth, that can be sustained by its operating cash flow. The companies which cannot find avenues to register this level of growth will accumulate cash which is then used to either acquire new companies or buy back their own shares.

In the fifth part concerning operational aspects of a Company, forms the basis of day to day decision making. Product is a potent driver of profit. It must be identified, understood by all and positively managed to achieve maximum potential. Another important aspect of management decision making is product and project appraisal and being able to identify and evaluate profitable ventures to invest in. Step-by-step guidance has been given while explaining the complex concept of project appraisal. A new chapter, has been added the present edition, on Shareholder Value Added (SVA). The traditional accounting approaches have always relied on the historic costs while value is determined by future cash flows rather than historic profit or balance sheet calculations. The concept of value added determines how much value is being added by the business in terms of future cash flows. Values are created when IRR of the funds invested in a company exceeds weighted average cost of capital.

Finally, the author has discussed the issues debated currently in financial circles, like pensions, deferred taxes, scrip issue, leases, revaluation of fixed assets etc. Also given is a glossary of financial terms, which a student of finance and also practising managers will find useful. Owing to a very simplified approach towards the complex subject of Ratio Analysis, makes it very easy for a novice to understand but at the same time it puts limitations to the subject coverage. Although practising professionals will find examples from industry useful, the book should also serve well as a valuable foundation for a finance student.

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Development Planning in India: Exploring an Alternate Approach *by Kamal Nayan Kabra*, p. 251.

The book highlights the controversy about the effectiveness of planned economic development versus market mechanism for addressing the socio-economic problems of the Third Word Countries. The author is of the opinion that the present form of the planning frame is inadequate and ineffective. In this chapters the author formulates a skelton of his ideas. There are eleven chapters; in the introductory chapter for evaluating of the present planning frame and a new approach to planned economic development are given.

In Third Chapter, the author evaluates the effectiveness of both planned economic development and market mechanism particularly from the angle of organisational structure. He suggests that the centralised and decentralised forms of organisational structure are not opposite with each other. They are very much supportive. In this Chapter, the author suggests a three tier organisational structure. In the next chapter on the concept of mixed economy, the author has successfully highlighted two basic aspects. The planned economic development has marginalised the role and importance of the unorganised sector. Secondly, in the organised sector including state sector has helped in concentrating the production potential in few hands. This has happened probably due to non-participatory approach to the mode of production. For the ill distribution of wealth and income author highlights the weaknesses of the strategy of development tried during the last fifty years.

The author has criticised in the fifth chapter, the strategy for taking employment generation as by product. He points out that the present strategy of development transfers savings from household sector to the government and corporate sector. The basic weakness of the strategy according to the author is again with the institutional pattern. The major weakness of the implementation of planning through is its bureaucratic approach. In bureaucratic approach, there is no much scope of participation and accountability in the implementation mechanism. There is no scope of involving the people in deciding objective, strategy and implementation. The next two chapters evaluates all the Five Year Plans and in particular, district planning. The author tried to provide an alternate implementation mechanism ensuring active and effective participation of the people in evolving a macro-frame, micro level action plan, executive, monitoring and evaluation of development plan. The major short-comings of the micro level planning particularly in respect of planning of plan implementation, policy design and instrument; mismatch between resources and commitment, and lack of control over prices, employment income distribution and external balance have been discussed.

The Ninth Chapter describes the impact of liberalisation on Indian planning again from the angle of organisational structure. The author is of the opinion that liberalisation has reduced the role of planning commission significantly. Non-existent of proper implementation mechanism favoured the liberalisation policy, the author of the book observes. The Tenth Chapter of the book is suggestive one. It covers the aspects—contents, methodology alongwith social science approach to planning. From all the angles, the author finds the planning superior than the market mechanism and micro-level planning over centralised planning. According to the author, instead of rejecting the planning, there is a need to redesign different components of planning.

In brief, the subject matter of the book concentrates on one aspects i.e. planning of plan implementation. In the beginning this aspect has been considered from theoretical angle. In the middle, the aspect has been considered from the practical angle that too from the view point of each Five Year Plan. In the end, the author has successfully suggested a new planning frame ensuring the application of Social Science approach to planning.

The presentation of the subject matter is medium. The issues have been supported by the proper references. To some extent, the author succeeded to convey the message—it is not the concept of planning but the aspects like contents, methodology, strategy and planning of plan implementation—which failed. The book is very useful for the academicians, researchers and planners particularly of Third World Countries.

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Agricultural Trade Policy in Asia-Pacific: A study Meeting Report by Asian Productivity Organisation, Tokyo, 1996, unpriced.

This volume is a compilation of papers and proceedings of the Study Meeting on Agricultural Trade Policy organized by Asian Productivity Organisation (APO) from 24-31 October, 1995 at Seoul, Republic of Korea. It contains fourteen country papers and five resource papers. While country papers provide an outline of the status of food and agriculture in each of the fourteen countries, the resource papers

written by distinguished agricultural experts reflect on the impact of trade liberalization policies and suggestions to face the challenges of market-friendly approach implied in the objectives of the newly created World Trade Organisation(WTO). The volume has a succinct section which provides a Summary of Findings of the Meeting.

The levels of agricultural development in various countries of Asia-Pacific region vary due to large variations in farming systems followed by farmers. Even-though rice is the staple food in most of these countries, due to "increased per capita incomes during recent years in the region there has been a noticeable shift in food consumption patterns, i.e., reduced rice consumption in favour of increased intake of animal protein. The changes in life styles, particularly the eating habits, are influenced by urbanization and exposure to Western food habits" (p. 1). This may be true of some countries like Japan, Thailand and Philippines and not in the case of countries like India, and Nepal. Country papers do provide glimpses of the levels of agricultural development accomplished along with the policy measures adopted from time to time to overcome the problem of food insecurity.

Discussing about the trade aspects, Seung-Ryong Yang feels that "the region has shown an increasing demand for agricultural products" and Yang foresees, "that the Uruguay Round would bring fundamental change in agricultural production in the region" (p. 14). However, Yang emphasises that, countries of this region will have to aim more at food security and he provides a set of options to be followed to achieve this. Jae-Ok Lee's paper on the "Impact of Uruguay Round Agreements on Agricultural Trade and its Implications for Asian and Pacific Countries" identifies three major areas on which negotiations were focused, namely, "market access, export competition and domestic support". Lee has discussed implications of these three elements for both the exporting and the importing countries in detail. Discussing about the prices of agricultural and their behavior in a country like India, Lee points out that the domestic prices of major agricultural products have been maintained at lower levels than world prices by restricting exports for the stabilization of consumer prices otherwise, the prices would have risen (p. 17). Hence Lee maintained that very country should formulate a agricultural policies which are 'decoupled' from agricultural production but desirable in increasing the efficiency of agriculture and fostering structural adjustment.

While Myong-Keun Eor's paper discusses the "Implications of APEC Trade Liberalization on Regional Agricultural Trade", Myung-Soo Lee's paper discussed on the technical barriers to agricultural trade. Lee's paper on technical barriers emphasised the need to establish lists of international standards, guidelines and recommendations and check the current situation regarding the acceptance of these standards by each of the governments. Based on this a monitoring system for the use of international standards can be established and operated.

Vyas's paper indicated that Asian countries are not major players in the world agricultural trade and hence the poor countries should first concentrate more on domestic reforms before thinking about globalization. In this respect, he underscored the need to augment the productivity in non-food crops.

The volume contains general and specific recommendations of the Meeting for implementation by the participating countries. In addition to these papers, there is a Note included on the field visit of the participants to Icheon Warehouse of the Agricultural and Fishery Marketing Corporation (AFMC) in Kyonggi province, South-East of Seoul.

On the whole, the volume under review makes an interesting reading in view of the current discussion on the implications of the rules of the trade game of WTO. This volume will be useful to those involved in agricultural trade in Asia and Pacific region.

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Information Service Excellence through TQM *by Timothy Braithwaite*, Tata McGraw-Hill Publishing Co., New Delhi, 1996, p. 168, Price Rs. 225 (Hard Cover).

In this age of intensive global competition, the only way for the corporate sector to survive and grow is to offer goods and services of highest quality at least cost and minimum delivery times. Customer satisfaction is the key word. There has been a lot of thinking in management circles about strategies to be adopted in this regard.

As sophisticate technology makes inroads into the daily lives of individuals and corporate entities, the task of managing an enterprise has become complex. Information technology has come to the rescue of the management in managing complex operations, if judiciously applied after a thorough understanding of it's enormous potential and implications.

Normally one tends to associate TQM activities with shop-floor manufacturing activities and one doesn't think that it is applicable to Information Services (IS) department. Appropriately the author Braithwaite, has made readers aware that TQM is an relevant to IS area as it to manufacturing. The author has in a very ingenious manner depicted as to how the philosophy and precepts of TQM can be woven into IS activities. His concept of inside customer and outside customer is something which should be taken note of by all practicing managers. Furthermore the emphasis on preventive approach is welcome especially since a lot of frustrations can occur in the application of IS an ill conceived to corporate activities.

However, the value of the book would have been enhanced further, had Braithwaite focused more on the problems of IS department and dealt specifically as to how application TQM principles to software development can be of help. For example, the number of quick updates of the various softwares in the market that appear from time to time is an indication of unseemly the hurry with which software developers push their product on to the market place, without any regard to quality or possibly without any intensive interaction with the customers. This area therefore ought to have caught the attention of the author.

Notwithstanding what is mentioned above, this book is recommended for all these professions, in the IS area, who as he has pointed out, in the book, want to do the things "correctly and in the right way the very first time".

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Industrialisation in India and China: A Comparative Study of Machine Building and Electronic Industries, *by Ashok Jain, V.P. Kharbanda, Q. Cheng-ben and H. Ai-lan,* Har-Anand Publications, New Delhi, 1995, p. 120, Price Rs. 200.

The China-India Sub-committee on Science and Technology Cooperation decided in March 1989 to do a Cooperative project in the form of "A Comparative Study on the Importation of Technology for the Development of Domestic Machine Building and Electronics Industry in India and China". Later on the electronics industry was left out to narrow the focus and the Comparative Study was completed in July 1993. The project was taken up jointly by the Planning Research Institute (PRI), Ministry of Machinery and Electronics Industry, Beijing, China and the National Institute of Science, Technology and Development Studies (NISTADS), CSIR, New Delhi, India. The book under review is the published form of the Report of the Comparative Study.

The study reported in the book is divided into two parts which are covered into two chapters. Part one describes in detail the comparative features of the policy instruments and measures adopted for the import of technology in India and China. This is in chapter one. Part two of the study examines thoroughly the general situation and the development of machine building industry in the 1980s in the two countries.

Both India and China adopted policies of inward-looking industrialisation through a broad-based economic planning. China obtained allround support from former USSR till the middle of sixties and after that none so far. Also the cultural revolution in that country stopped whatever imports the country was getting from outside world regarding technology. China became liberal and open to the import of technology from 1979 onwards. India standing on a different plane on ideological ground had adopted the strategy of self sufficient growth with heavy bias on indigenous growth of technology. Like China, India also realised in 1980 that she had been lagging on technology front, and small countries like South Korea, Taiwan had developed good technology base by being open-minded regarding technology import. It started liberalisation in the import of technology in 1980s, but while China followed the liberalisation with consistency. It had shown hesitations for the adoption of foreign technology specially when the inflow of foreign capital became an issue.

The next chapter describes the general level of the industrial bases of machine building industry in two countries. Regarding China one important dimension is that since 1980 the speed of technological development accelerated and civilian production benefitted much from the spin-off of technology developed for military use. This has enabled a large number of enterprises to upgrade the quality of their products comparable to those produced in the developed countries.

The relatively open economy in India and the existence of a large private sector have helped in the diversification of industrial technology, though China intelligently concentrated into some priority areas ever since liberalisation started in that country in 1978-79. Both the countries have successfully absorbed foreign technology. Thus India has achieved indigenization level of 80-90 per cent for components and parts of the machinery and equipment and this in the case of China is 60-70 per cent. But China surpassed India in foreign

investment and this was 7 times larger than India in 1988. Like this other interesting information is there in this chapter regarding the comparative development in the two countries. The authors have compiled information but the interpretation of the same and their relative judgement are left to the readers. In a way the authors have not tried to influence the readers.

The book contains a select bibliography and an index which have increased the value of the book. The publication is relatively error-free and the presentation is nice.

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Management Ethics *by Joseph A Petrick and John F. Quinn*, Response Books, Sage Publications Ltd., New Delhi, p. 399, Price Rs. 425 (cloth), Rs. 250 (paper).

This Book aims at converting theories relating to ethics – both normative as well as prescriptive – into sound action steps per ensuring better management. It also seeks to redefine what it means for a manager to function with integrity.

The book has been divided into two parts: "Management Ethics and Integrity: Theory and Tools" and "Management Ethics and Integrity: Practice and Minicases in the Functions of Management", having seven chapters altogether. Part I is intended to present the need for improved ethical decision making and to identify the theoretical nature of management and ethics, exploring into certain theoretical dimensions of management integrity; whereas part II attempts to apply the theories to the management functions of planning, organizing, leading, and controlling, with a view to build integrity at work.

In the introductory chapter, regretfully the opening paragraph under the heading "Nature and Value of Management" is somewhat confusing, as it does not clearly state what is being meant by the term "Management" and how it is being interpreted in the chosen context. The last sentence of this first para reads "This book is devoted to enhancing managerial performance by integrating managerial and ethical competence". Such a statement appears somewhat disjointed because neither 'managerial performance' nor 'ethical competence' had been talked about, let alone being defined prior to usage of these terms in the book. In particular, what constitutes ethical daism making is not clearly indicated. The meaning of management used in the book gets clarified to some extent on page 6 with authors providing some explanation using competing values framework. Five reasons have been adduced (p. 25) why managers need to improve ethical decision making, which are: (a) the cost of unethical workplace conduct; (b) lack of awareness of ethically questionable, managerial, role-related acts; (c) the widespread erosion of integrity and exposure to ethical risk; (d) the global corruption pressures that threaten managerial and organisational reputation; and (e) the benefits of increased profitability and intrinsically desirable organisational order.

Envisaged benefits of improved management ethics, quoted by the authors on the basis of assorted study reports, give an impression that authors include many things under the banner "management ethics". For example, quoting certain studies the authors point out that companies that use proactive grievance handling procedures, incentive programmes, information sharing and job designs have much better final performance than companies without such progressive workplace processes.

The overgeneralized view of ethics taken by the authors becomes somewhat apparent from the definition provided of ethics in the beginning of chapter 2, (p. 42). In an unduly long statement they say, can be defined as the systematic attempt to make sense of individual, group, organisational, professional, social, market, and global moral experience in such a way as to determine the desirable, prioritized ends that are worth pursuing, the right rules and obligations that ought to govern human conduct, the virtuous intentions and character traits that deserve development in life, and to act accordingly". At one place (page 42) they call ethics as the study and at another place (page 43), they talk of various levels at which study of ethics can occur. However, thee discussions relating to the type of ethics managers implicitly endorse, and how their choice of action emanate from four alternative theories: teleological, deontological, virtues, and system development is quite interesting.

Chapter 3 concerns the dimensions of management integrity focussing on three areas: (a) management judgement integrity, (b) management process integrity and (c) management developmental integrity. Under management judgement integrity authors talk about legal systems of the world, present various communications and ethics theories, and try to link these. Defining management process integrity as repeated individual alignment of ethical awareness, judgement, intention and conduct at all levels of managerial practice the authors come up with definitions and present theories relating to these four components. To supplement with

necessary elaboration, management development integrity stages of individual moral development and moral reasoning at work have been explained.

The remaining four chapters of the book are devoted to application of the theories developed in part I with one chapter each being assigned to four basic management functions, planning, organizing, leading and controlling. Much of chapter 4 deals with the elements of ethical planning processes aimed at building integrity. Essentially the authors take the readers through certain "dos" and "don'ts", in planning, picking up some examples to illustrate their point of view. Through seven mini cases, drawn from a variety of organisations, authors talk about what are some of the things that were not done right in those because of which organisations attracted actions from legal and/or other regulatory authorities.

Structure, people and technology are the three factors considered by the authors in chapter 5, detailing some merits and demerits associated with each of these. Scanning, formulation, implementation, and evaluation, control and improvement, are suggested as the four-step sequence of subprocesses towards responsible organizing. The authors then link these subprocesses with the ethical processes of awareness, judgement, intention and conduct, suggested earlier.

People and contextual factors have been kept in view in the analysis of integrity building (Chapter 6). The subprocesses considered for leading, however, remain the same as those used for organizing, expectedly with the term leading prefixed on them.

Chapter 7 is concerned with the role of controlling in ethical management and is illustrated through 7 minicases. Control has also been divided into subprocesses such as scanning, formulation and choice, implementations, and evaluation, control and improvement. These subprocesses have been examined and analyzed through four steps of ethical process: awareness, judgement, intention and conduct. The authors have recommended use of qualitative ethical decision making tool (QL-TOOL) to arrive at a principled, feasible resolution. However, in reality, this might boil down to a compromise solution rather than necessarily an act based on ethics because, all said and done, "ethics", or its interpretation, yet remains largely subjective and is thus expected to very a great deal across individuals in organisations.

The book is apparently an early attempt to link management function subprocesses with ethical processes. Judging from this point of view the effort is indeed commendable. The material covered in the book is wide. Perhaps what the authors aim at is to study the many dimensions involved in achieving corporate growth and development, and find ways to simultaneously contribute to global prosperity and the well-being of humankind. However, despite enumeration of certain subprocesses involved in each management functions, the details of theory and the minicases, the book does not appear to do adequate justice in clearly resolving some of the age old dilemma that had bothered humankind about business–society relationship. Whether to, and if yes, how to strike a balance between individual commercial interests and the larger interests of the society. All said and done, business ethics is value-based reflection and choice concerning the moral significance of individual and organisational action by business decision maker. This being the case ethical reflection and choice would emanate from the critical issues and problems that confront an organisation and its leaders at any given point in time. The real question therefore is "What motivates a company to do the right things?" Unfortunately this question has not been handled effectively, although that should have justifiably been the core concern of the book.

All in all, I shall call the book as a general purpose treatise that evokes concern, and also the interest, towards the need to create link between ethical considerations and management actions. However, it does not present one with clearly laid out actionable guidelines free from dilemmas and ambiguities. The book, therefore, need not be a must-read for anyone in particular, although everyone could benefit from the contents by getting to know what exactly hurts and why.

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21st Century Capitalism *by Robert Heilbroner,* Affiliated East West Press, New Delhi 1996, p. 175, Price Rs. 80 (PB)

The book under review is an attempt to understand capitalism as an historical social system that evolves into a new future. Unprecedented mass upheaval in the centralised socialist societies of Eastern Europe and the Soviet Union in the 1980's culminating in the collapse of communist States and return of capitalist institutions has reopened theoretical and ideological debates on the dynamics of global capitalism. The immediate focus of the analysis followed was, not surprisingly, on the causes and consequences of the fall of the communist State.

Nevertheless, a good number of studies as reported in this book turned to look at this issue from an altogether different angle concentrating on the enduring features of capitalist institutions.

However, the book does not make any grandiose predictions about future of capitalism as the title may suggest. On the contrary, it patiently summarises the trajectory of capitalist development characterised by risks, uncertainties and indetermined outcomes. The author views capitalism as a total system comprising of various instances such as economy and politics, and in particular, capitalist economy and capitalist politics are analysed as independent autonomous domains.

Politics of capitalism is discussed in this book at two levels. At the more explicit level, it tries to show that the central political issue in capitalism lies in the relationship between economy and the State. The author maps out the structural location of the State within capitalist society to reason out that liberal democratic politics emerges not precisely from ideological compulsion but from the necessity of reproducing the elements for the system. At another level, he discusses capitalist politics in terms of social desire.

The author has argued that the market system is not synonymous with capitalism since the later is a much larger and more complex entity. Eventhough market system is not synonymous with capitalism since the later is a much larger and more complex entity. Eventhough market system is the binding and co-ordinating principle under capitalism, it is not the sole source of energies or of its distinctive bifurcation of authority. The method of separating out the part from the whole to understand the relationship between the two, gives him the leverage to examine both the stimulating and inhibiting roles that system plays in capitalist society.

Resolving these issues, thus, becomes central to the sustainability of the capitalist system in future. His vision about the way in which these issues are tackled hinges on the prominent role he assumes national governments should play. A strong tradition of pragmatic government and public cohesion, a well developed civil service and responsible national organisations of labour and management are his prescriptions in this regard. Even if one ignores the Euro-centric predilections of his historical anthropology and weak theoretical basis of the earlier chapters, the absence of a convincing narrative to describe the spectrum of future capitalism in the final pages cannot be overlooked. His analysis unfortunately relies on admittedly unsupported visions, which give us no new clues for further contemplation. It is a closed book where the author's subjective impressions are presented for others to view, shrug, and forget. A detailed review of the actual processes of global division of labour, North-South relations, New social movements and challenges to democracy would have made the book more appealing than it is now. In the absence of a discussion of these central issues, no working framework for understanding the nature of capitalism in the next century could be advanced. This, indeed is a more pronounced failure of the book than the fact that the description of the evolution of capitalism and its present functional characteristics provided in the book is also less than satisfactory for any reader familiar with world system analysis of Immanuel Wallerstein or similar studies.

Nevertheless, it is a highly readable book and for those who are interested in the political dimension of the political analysis of capitalist development, the book could be a rich source of stimulants.

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Service Sector in Asia Pacific Economies by Asian Productivity Organisation, Japan, 1997, p. 207, unpriced.

This compendium of papers presented at the Singapore workshop on, "Productivity in Services Sector", during September, 1997, is a welcome addition to the scanty literature on the subject, especially of the Asia Pacific economies. While discussing major issues in the workshop, the focus was on difficulties in measuring the productivity in the services sector and sharing various approaches and practices in 15 countries in the Asia Pacific region. It was also noted that, according to the statistics from the GATT and WTO, the annual growth rates of export of services during 1982-1992 in Asia was the highest – the first seven of the top 10 fastest-growing economies is the world are all in Asia.

History of developed economies indicates that they passed different stages of development. Initially they were agrarian economies. As the productivity improved with use of efficient methods of cultivation and use of mechanization, it led to release of manpower. This led to search for alternative employment which was provided by the Industrial revolution movement. Technological development provided further fillip to productivity and effect was again release of manpower. This in turn, led to development of services sector.

The compendium is divided into four parts: Summary and conclusions; Selected resource papers; Selected country papers; and the Appendices. The two papers were Presented by resource persons from Hong Kong and China (Taiwan). The former focused on the interdependence between manufacturing and services sector due to relocation of services which provided a natural advantage of being able to provide value added services. The Hong Kong experience "illustrates that the most vital manufacturing support functions are in services performed by the indirect workers. The adoption of Rapid Response systems in the apparel and jewellery business is an example. The second resource paper dilates on the growth of services sector in Taiwan; dividing them into four main sectors and 23 subsectors which are further categorized.

There are 17 country papers from 14 countries of the Asia Pantic Region which the country reports and case studies delineate how the concepts and techniques of productivity improvements in different companies engaged in providing their services were applied and results achieved. The studies are as diverse as, hotel, self employment for rural women, distribution center functions of a manufacturing company, development banking services, export of garments, railways, consulting services, a government department and fast food etc. Given that there are measurement issues in the services sector, these case studies indicate the level and range of efforts required improving productivity. Although a few papers deal with broad economic and management aspects, it can discerned that those countries are is the early stages of a fast growing services sector.

The basic features of service sector are: Quality can not be judged in advance as it is possible in the case of a tangible product such as soap; secondly quality aspects come to the fore only when the service is delivered; thirdly, although technology plays an important role in improving productivity has in service sector, it is basically human resource dominated. More importantly, the customer expectations are wide ranging and changing each time as a determined level of service is provided. As such measurement of output in the service sector is a major problem since measurement tends to judgemental, especially the measurement of output. These characteristics of services sector render the traditional measures redundant. Also there are no standards to compare in this sector, except benchmarking with ones' own level of service each time or with the competitor, and identify ways and means to improve productivity further. It is here that this compendium comes handy, when one wants to know the approaches different companies in different countries under a given socio-economic scenario, adopted and adapted in measuring, and improving productivity. There are four cases on hotel industry in this compendium which enable comparison of practices in measuring and improving productivity, although each country has differences in terms of perception of quality of service, given the customer profile in that country. Again one finds that, to improve productivity in service sector, a company has to provide a clear strategic direction, so that a model for providing a level of service to customer is developed and measure the productivity achievements with the model.

A very profound thought comes to one's mind on reading this compendium. Achieving higher level of economic development is possible use of technology and tapping the human potential. Productivity improvement is a continuing effort. As productivity improves, the quality of life improves in an economy, in terms of more time for people to enjoy life. That is how the developed economies have transited from agriculture to manufacturing to service industry. Currently, leisure too has become an industry what with millions of dollars being invested by corporate sector in leisure industry such as sports, picnics parks, music, entertainment etc. So guess what new industry will evolve after leisure industry, if this industry achieves higher levels of productivity (provided one is able to conceptualize and handle measurement of happiness).

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Groundnut Economy of India *by K.N. Ninan*, Agricole Publishing Academy, New Delhi, 1997, p. 132, Price Rs. 200, US$ 40.

Oilseeds play an important role in Indian agricultural economy. Groundnut is an important oilseeds and heads the list of nine major oilseeds largely cultivated in India. Groundnut Accounting for almost 70 per cent of India's total oilseed production and grown in over 40 per cent of the total acreage under oilseeds, groundnut has, for obvious reasons, a much larger share. Until recently Indian contributed almost 50 per cent of world's output of groundnut, but China has since replaced it as a major supplier of this commodity to the global market. In India's agricultural economy, groundnut has always been of considerable significance and more so in some of the groundnut, groundnut growing areas like Saurashtra where the so called Telia Rajas have often played a more than ordinary role in the state politics on the strength of their

groundnut stock holdings. Considering the importance of groundnut, any research study that purports to contribute to its growth, overall production, yield and quality should be welcome to the agricultural fraternity and others concerned.

The book is based largely on the author's research efforts on the growth behaviour of groundnut across five major groundnut-growing states in India. The author claims that the study has been conducted at the instance of the Ministry of Agriculture and first amongst its objectives was examining the role of climatic factors on the cultivation of this oilseed.

The book starts with an introductory chapter wherein the author attempts, with the help of agricultural data of some states to establish the importance of groundnut both as an oilseed and an agricultural commodity. Most of the data used is rather old. This chapter also contains the objectives of the study and describes the methodology adopted by the author for this purpose.

Chapter 2 presents district-wise analysis of the growth and instability of groundnut crop in the five groundnut states of Andhra, Tamilnadu, Maharashtra, Gujarat and Karnataka for varying periods. Chapter 3 attempts a similar analysis for different seasons across various districts of the same states in order to assess various aspects of growth behaviour of groundnut crop.

Based on the conclusions arrived at in the earlier chapters, the author attempts in chapter 4, a further analysis of various factors causing fluctuation in groundnut yield but largely concentrates on the study analysis of groundnut yield-rainfall relationship. The role of irrigation in groundnut is also briefly mentioned by making reference to an earlier study carried out by the author in 1988.

The last chapter contains a summary of the inferences drawn from the analysis of the earlier chapters and enumerates sixteen major findings. Most of these are well known facts and the study can be said to have only corroborated these. The author also gives a brief review of India's oilseeds development and policy which once again is no more than a reiteration of well documented facts.

The book is fairly well referenced and indexed. Its general get up and binding are average. The print type used is rather small presumably to contain the size of the book. Despite this, the price of the book appears to be a little too high at Rs. 200 in relation to its contents. The book may be of some use to local planning authorities of the groundnut states for initiating suitable projects/plans to improve groundnut cultivation and yield.

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