## Focus : Ninth Five Year Plan

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3. A note about the author(s) not exceeding 50 words.

# Productivity

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# Contents

# Global Competitiveness Report 1997: The Indian Context & Imperatives

## Suresh D. Tendulkar

*Competitiveness is defined as the ability of the national economy to achieve sustained high rates of economic growth in the medium term. The globalisation process which has led to increased competition and lower profit margins in many industries has promoted growing concern among the business community as well as the national level policy makers. The Global Competitiveness Report (1997) of the World Economic Forum has ranked India at the 45th position among 53 participating countries, while China takes the 29th postion. This paper critically examines the database and methodology of GCR, while underlining the importance of image of a nation, which would be influenced by the Report. It elaborates the various factors that contribute to competitiveness and examines India's position and performance. Three major areas, government, finance and labour are identified as those where India lags behind most of the competitors. The paper also emphasises the urgent need to tackle the problems of labour market inflexibility and public sector inefficiency.*

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Global Competitiveness Report (GCR) defines competitiveness as the ability of a national economy to achieve sustained high rates of economic growth over the medium term of 5 to 10 years. There is also a consensus the world over that rapid economic growth is a necessary precondition for raising the living standards of the population. In India too, the economy managed to emerge out of the proverbial Hindu rate of growth of 3.5 per cent per annum (pcpa for short) experienced for three decades ending 1980-81 and recorded 5.5 pcpa growth rate during the 1980s. There is also currently a welcome and widespread social acceptance of the imperative need for the Indian economy to achieve seven per cent or higher rate of growth of gross domestic product (GDP) in a sustained fashion.

GCR evaluates competitiveness ranking in terms of weighted average index of eight factors. Of these, four factors—*openness, government, finance* and *labour* are assigned equal weights of 16.7 per cent each. Two other factors—*technology* and *infrastructure* are assigned 11.1 per cent each. The remaining two—*management* and *institutions* carry the weight of 5.5 per cent each. In the case of the first four, 3/4th weight is given to hard data and 1/4th to survey data. In the case of the next two, 1/4th weight is assigned to hard data and 3/4th to survey data. Evaluation of the remaining two—*management* and *institutions* is entirely survey-based. Survey data are collected from over 3000 business executives in 53 countries involving opinions presumably based on informed impressions, judgements, experience and observation. When we take account of the division between hard data and opinion survey across factors, it turns out that the rankings are based on an index which assigns 55 per cent weight to hard data and 45 per cent to survey data. Hard data themselves relate usually to not more than 5 years preceding the year of the report. Even here, it would be useful to bear in mind that hard data relate to immediate past and require to be interpreted with reference to the future potential of the

country in respect of sustained economic growth. Clearly, an element of judgement is inescapable even in the interpretation of hard data.

In view of the importance given to the opinions of business executives and judgemental elements in interpreting, it would be in order if the global competitiveness ranking is taken as reflecting the dominant image of a given country in comparison with other countries, in the eyes of the rest of the world. This may, but need not necessarily, coincide with the image of the country as viewed from within the same country.

This raises the fundamental question—why should we be bothered about our global image in terms of competitiveness ranking? The answer is straightforward, namely, we ought to be bothered if we wish to engage in commercial exchange with the rest of the world. For this purpose, it is important to know how the rest of the world views us. This in turn raises the question: why should we interact with the rest of the world in trading goods and services, technology, capital and skills? Because, economic policy reform initiated in 1991, involving liberalisation and globalisation as major plans, actively seek interaction with the rest of the world. In this connection, a legitimate question has been raised. Is this interaction sought because of external pressures from World Bank, International Monetary Fund, World Trade Organisation, etc.? If it was external pressure and not our own interest as a society, we should clearly not be doing it. It is, therefore, necessary to analyse how active interaction with the rest of the world is in our own interest and how it can be mutually gainful, i.e., not only to ourselves but also to our trading partners.

> **Economic policy reform initiated in 1991, involving liberalisation and globalisation as major plans, actively seek interaction with the rest of the world.**

In analysing these questions, the need for Indian economy to attain sustainable rapid economic growth is taken as imperative because rapid economic growth has managed to reduce absolute poverty not only in other countries of the world but also in India. In this context, the following three propositions, could be put forth.

*One*, among the alternative forms of organising the economy that have actually been tried out, the capitalist form based on private enterprise and driven by competitive market forces has turned out to be the most flexible and resilient in achieving rapid growth in a sustained fashion in a fast-changing world and the least bad in terms of minimising the negative side effects on the economy and society. The government has played a supportive and regulatory role mostly in successful cases in terms of providing responsible and efficient governance and in a few cases a creatively activist role in reinforcing the market forces. This proposition, whether explicitly admitted or not, has been the foundation of the economic reforms initiated since July 1991. Otherwise, liberalisation of direct discretionary bureaucratic controls would not have been undertaken. Undoubtedly, liberalisation has unleashed creative energies of private entrepreneurs in a large variety of productive areas which earlier had been constricted despite a functioning market economy. The turnaround in our growth performance since 1993-94 undoubtedly owes to this.

*Two*, although the mainsprings of the process of rapid economic growth must lie within the country, experience shows the international trade (in goods and services, technology, capital and skills) has provided the most effective and hence the best available instrument for stepping up and maintaining the higher rate of economic growth. However, it is important to recognise that international trade is a demanding instrument. Much as it confers benefits of faster improvement in living standards that arise out of mutually gainful opportunities for creative and fruitful participation in international division of labour, it demands, in return, strict efficiency oriented discipline in terms of macroeconomic stability, realistic foreign exchange rate policy and swift mobility of factors of production including labour across productive units and sectors in response to ever-changing structure of demand, both domestic and international, and fast-changing technologies. It also inflicts heavy penalties for default in discipline because other countries can and do switch to alternative destinations for private foreign investment as well as for buying and selling goods and services. Gains from international trade can be reaped only if the society is willing to accept and practise the discipline that goes with it.

*Three*, reasonably free multilateral trading system with effective policing by the World Trade Organisation offers the closest available approximation to competitive markets. It is well established both in theory and practice that competitive markets ensure efficiency which in dynamic context, translates into competitive economic structure that ensures sustained and rapid economic growth. It is again important to recognise that domestic markets in India had for long been distorted into rigid the past and hence cannot provide the required competition merely from liberalisation. Competition has got to come from threat of imports with non-distortionary

low tariffs or compulsion to export in return for concessions in the domestic market.

In the light of the three propositions put forth, the answers to the questions raised earlier in connection with GCR 1997 should be obvious. In order to reduce absolute poverty at the fastest possible speed, it is necessary for the Indian economy to grow at 7 per cent or higher rate and hence, it is in our own interest to use the instruments of liberalisation and globalisation for this purpose. It follows that for the rapid growth to materialise, we ought to recognise and put into practice the discipline demanded by globalisation. It also follows that for this purpose, the political process must find ways of tackling the domestic vested interests who are going to be adversely affected by the process of liberalisation and globalisation and who have been and are, therefore, going to be opposed to this process. .

If the need for aggressive participation in international division of labour is accepted, which we must, and if the imperative need for rapid growth is conceded, it should be obvious that we ought to compare ourselves with our major competitors in exporting labour-intensive manufactures and seeking direct foreign investment and assess our own strengths and weaknesses requiring corrective action. Our major competitor is clearly mainland China — an economy that is much larger than that of India in terms of population and has experienced much higher rates of economic growth than that of India.

> **Our major competitor is clearly mainland China.**

In the overall ranking of global competitiveness among 55 countries, GCR 1997 places India at 45th spot in comparison with 29th for China. In GCR ranking, China has jumped from 36 in 1996 to 29 in 1997, whereas India has just managed to retain the same rank in 1996. Only in respect of two factors does China's rank lower than India's — technology (one notch down from India) and management (5 notches down). With reference to openness, both the countries are at the bottom: China at 48 and India at 51. However, hard data show that China has a considerably better performance in terms of rate of growth of exports and inflow of foreign exchange reserves exceeding $ 140 billion. Clearly, GCR ranking of China — just three notches above India with respect to openness — does seem to be consistent with objective facts. Subjective impressions and judgmental interpretations of hard data emphasised earlier in the GCR ranking appear to be playing a major role in this context.

What is more interesting is that the Chinese rank is much higher than India's in respect of three major factors — government (China at 12 is 11 places higher), finance (China at 16, 12 places higher) and labour (China at 8, as high as 22 places above). Clearly, as the rest of the world views these two giants, China provides better and more effective government services and policy environment, presumably a government that works swiftly and hence a more effective governance, than India.

Despite long established financial system in India, China is perceived to have a better financial intermediation and higher rate of domestic savings. Finally, and not so surprisingly, the Chinese labour is perceived to be considerably more efficient and productive in relation to wages and the flexibility of labour market greater in China than in India. In respect of the remaining two factors — infrastructure and institutions — China is 8 and 6 places above India respectively.

> **China is perceived to have a better financial intermediation and higher rate of domestic savings.**

That these perceptions are not too wide of the objective reality is indicated by the outcome reflected in the comparative growth performance of China and India. Both India and China had a per capita GDP in 1980 that was 4 per cent of USA, that by 1996, China reduced this gap to 12 per cent compared to 6 per cent for India. This was the result of very rapid rate of growth GDP per capita (relative to United States) in China at 6.4 per cent per annum compared to a mere 1.6 per cent per annum in India.

If we wish to improve our global competitiveness ranking which we must if we want to maintain a 7 per cent or higher growth rate in a sustained fashion using international trade as a very important instrument for this purpose, it is necessary to change the perception of the rest of the world about India's economy. This can be done by identifying our areas of weakness, the constraining factors in those areas and analysing how we can relax these constraints. The above discussion of our comparison with China provides a useful starting point for this purpose. The three major areas where we have been lagging behind not only China but other competitor developing countries as well are: government, finance and labour. If we manage to post dramatic improvements in these areas, this will have a favourable impact on openness and infrastructure as well so that these two critical areas do not need separate attention.

As we argue below, the three major factors of government, finance and labour are themselves interlinked so that they require a co-ordinated focus of policy.

> **The three major areas where we have been lagging behind not only China but other competitor developing countries as well are: government, finance and labour.**

Starting with government, it is necessary to underline the fundamental truth that the core business of the government is to govern in the light of the deteriorating quality of governance in such basic areas, as law and order, establishment, enforcement and speedy voluntary transfer of property rights and elementary education as well as basic health. These are the critical areas that reinforce the impulses of rapid economic growth and these are known to be not well served by the market. Inordinate delays in taking critical decisions requiring swift action, and further administrative, procedural and judicial delays in implementing the decisions that have been taken are clear reflections of deterioration in the quality of governance. The overenthusiastic formal machinery of the government has taken upon itself functions and activities especially in the commercial domain well beyond its competence, and organisational-administrative capabilities at its disposal and which can be better performed by the market. It is necessary to recognise that the deterioration in the quality of governance has taken place as a direct consequence of the over-extended functions and activities of the government in the commercial domain. Ideological cobwebs in mistaking the means of the public sector as an end in itself irrespective of whether public interest is served or not, have been coming in the way of speedy withdrawal of public sector from non-core activities and re-deployment and reallocation of the government machinery to perform well the core functions of governance. This assessment matches with the perceptions in GCR 1997 in respect of detailed factors relating to government. India's rank is 45th or lower with reference to well-directed subsidies, government fiscal balance, competitive government policies, effective state interference, bureaucratic quality and tax evasion. In terms of the competence of government, India's rank is 39th in comparison with in 14th for China.

Apart from the core functions in the classical fiduciary domain of the state mentioned above, modern government need to provide facilitating favourable environment to private economic activity especially in the context of globalisation. Two critical elements of this environment are important. One, the responsible macroeconomic management for maintaining low rate of inflation while balancing government revenues and expenditure for efficiently supplying the core services of fiduciary nature mentioned above. The second is the flexible yet stable and transparent policy environment that keeps up with our major competitors in international trade and minimises bureaucratic hurdles in the implementation of policies by simplification of laws, rules and procedures. Despite reforms having entered the seventh year, precious little has been concretely done in this area.

> **Modern government need to provide facilitating favourable environment to private economic activity especially in the context of globalisation.**

Because of the overstretching of the government machinery as discussed above, public sector reforms assume urgency, as it has a dominant presence in the financial, manufacturing as well as service sectors. The direction is clear, withdrawal from non-core areas, giving autonomy while ensuring accountability for improving efficiency in areas which remain in the public sector and finally, providing effective and impartial regulatory environment for private sector in critical areas of infrastructural investment. In the past, the assured budgetary support irrespective of economic performances and the resulting political and bureaucratic interference under the garb of public accountability subverted the autonomy and commercial viability of public sector undertaking (PSUs) including those supplying critical infrastructural facilities and services. The administered pricing policy has been often guided by non-economic, subsidy-cum-patronage disbursing considerations to reap immediate political gains. The result has been de-linking of economic performance and commercial viability from the reward of those managing or employed in such enterprises.

Tolerance of inefficiency, overstaffing and wasteful use of resources have been the inevitable and but initially unintended consequences. This is particularly damaging in two areas of public financial sector and basic infrastructural services. Crippled by priority lending often on non-commercial considerations, and political pressures and accentuated further by poor lending practices and sheer inefficiency (arising out of monopolistic position) public financial institutions constitute the weakest link in integrating the Indian economy to the rest of the world, especially when we are actively seeking private foreign investment in infrastuctural sectors. India's 38th rank in GCR 1997 in respect of finance is a

reflection of this weakest link. Non-traded physical infrastructural facilities and basic infrastructural services emanating from them constitutes among the conventional core functions of the government in all the economies. Poorly maintained and often congested infrastructural facilities and high cost of infrastructural services with irregular, fluctuating and interrupted supplies has a cascading effect on the cost structure of the entire economy besides bottlenecking the very process of rapid economic growth. India's 48th rank for infrastructure among 53 countries in GCR 1997 accords well with the objective situation. Apart from forced withdrawal of budgetary support as part of the fiscal correction since 1991-92, PSUs are subjected to inordinate delays in administrative decision-making as regards their restructuring and investment proposals, public accountability to legislature and legislative committees, and audit by the Comptroller and Auditor General, besides the normal one mandated under the Companies Act and the surveillance by the Central Bureau of Investigation and Central Vigilance Commission. This environment makes public sector managers hesitant to take genuine commercial risks. The urgent need is to consider whether we can amend article 12 of the Constitution to take PSUs outside the purview of the definition of State or whether we disinvest beyond 50 per cent for this purpose even in the core areas.

> **Poorly maintained and often congested infrastructural facilities and high cost of infrastructural services with irregular, fluctuating and interrupted supplies has a cascading effect on the cost structure of the entire economy.**

The final problem area that requires urgent attention not only for promoting rapid growth but also for pushing up India's rank in global competitiveness ranking relates to labour market inflexibility. In the labour market, effective enforceability of labour policy and labour legislation have been confined at best only to the formal segment of the industrial sector. These legislative provisions backed by liberal judicial interpretations, expanded the scope of the terms industry and workmen, and have sought to protect the existing employment in the organised sector establishments. These interventions in the past produced several consequences which have proved harmful to the organised workers as a class.

*One*, they involved considerable loss in productive efficiency. As mentioned in the beginning, these inefficiencies inevitably translate themselves into high real cost of production hurting not only the consumers and

users of output but also the international competitiveness of the industrial sector and most importantly, the capacity of the affected units to provide employment in a sustained fashion.

*Two*, they discouraged new investors from entering into the formal sector and wherever they did the interventions induced them to save on labour by adopting capital intensive techniques.

*Three*, they adversely impacted the behaviour of existing entrepreneurs as regards expansion.

*Four*, private sector units looked for legal loopholes that would enable them to escape coming under the legislative provisions by giving contracts to works which would exempt them from employer-employee nexus.

*Five*, the job protection provisions were also bypassed by the private sector units through prolonged lockouts, non-payment of water, electricity and other dues to induce closure and inducing separations first by linking pay to production/productivity and then curtailing output.

The sum-total of these adverse consequences has been not only to constrict the employment expansion in the high productivity organised sector but more importantly, workers not getting their legally rightful dues which they would have if orderly closures and work force adjustments had been permitted through legitimate means. Even though the Industrial Relations Bill has been on the agenda of reforms since 1991, virtually no progress has taken place on this front.

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While the private sector enterprises did manage (often through not fair means) to escape the rigours of state interventions in the labour market, public sector enterprises and formal government machinery could not. In the event, employment in the public sector (including administration) grew much faster than that in the private organised sector. Overstaffing in the public sector enterprises and government administration resulted from the political pressures for expanding recruitment even when strictly not warranted by considerations of their need and productive utilisation. Judicial pronouncements and/or political pressures also

forced the public sector to turn temporary/casual workers in their employment into permanent ones irrespective of whether they could be productively employed or not. The primacy given to the role of public sector as a model employer over the basic commercial or productive activity also contributed its share.

In GCR 1997, India has been ranked at the 30th position in respect of labour. This is relatively higher than India's overall rank mostly due to the availability of cheap and skilled manpower in comparison with mostly European, Latin American and erstwhile communist countries with greater labour market inflexibility. China gets the 8th rank without similar stock of skilled manpower. Appropriate amendments in overprotective labour legislation is clearly the first but a very important step towards greater flexibility of the labour market. It would have a very significant signalling effect for the rest of the world. Its implementation would also contribute to the sustenance of the recent spurt in the rate of economic growth by introducing the much needed labour market flexibility. The current inflexibility is hurting the public financial institutions and other PSUs much more than those in the private sector and the resulting infrastructure bottlenecks have been constraining the growth process. Overstaff-

> **Appropriate amendments in overprotective labour legislation is clearly the first but a very important step towards greater flexibility of the labour market.**

ing in the government machinery combined with job security and non-transparent accountability are also adversely impacting the quality of governance. In so far as these factors are constraining economic growth, labour market inflexibility is preventing generation of more productive employment opportunities elsewhere in the economy. Serious and credible organisational efforts are needed to alleviate immediate hardships arising out of downsizing and redeployment and to facilitate the movement of labour to units, sectors and areas experiencing rapid growth. Foregoing are the economic imperatives for successfully maintaining and raising the current seven per cent growth rate. These inevitably raise political questions which need to be addressed in the political domain. Whether the political leadership is willing to accept the challenge in a creative fashion or not is an open question. □

# Centre State Fiscal Relations: The Alternative Scheme of Devolution

## S.P. Gupta & A.K. Sarkar

*The assignment of tax powers in the Indian Constitution has become lop-sided, with the Centre possessing the right to collect the most productive taxes while the States have been allocated the responsibility of important public services. The authors envisage changes in the present arrangement with due consideration of national as well as regional priorities.*

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The Constitution of the Republic of India has been described as quasi-federal in character. It provides for a federal structure with strong unitary features in both political and economic spheres. The States do enjoy a substantial degree of autonomy within the areas of responsibility granted to them by the Constitution. The Constitution assigns to the States several major responsibilities relating not merely to the basic functions of government such as the maintenance of law and order, but also other wide-ranging crucial functions closely connected to the social sectors, agriculture, infrastructure, including water management and the overall development of the economy.

It should be noted that the Indian Constitution provides three lists—the Union List; the State List and the Concurrent List. Briefly all matters relating to currency, banking, finance, defence, foreign affairs, including economic relations with foreign entities, matters affecting the country as a whole and those relating to inter-state relations are placed in the exclusive domain of the Centre. On the other hand, matters closely connected with the life and welfare of the population, such as local government, public health, much of the communication, land, agriculture and water management, are placed on the State List. The Concurrent List covers three important areas: industries, education, and economic and social planning. Although industry is a category on the State List, the Centre is given the power to legislate by law in the Parliament and through the Industrial Development and Regulation Act.

The assignments of tax powers in the Indian Constitution seem to have been based on two fundamental principles. The first is that the assignments should avoid giving concurrent tax to the Centre and the States. The second is that the most important taxes which have economy-wide implications or which can be collected most efficiently and economically be assigned to the Centre. Based on the second criterion, the Centre was given the power to levy income tax on non-agricultural

income (individual as well as corporate), customs duties, and all excise taxes on production, except those on liquor. This meant that the Centre had within its jurisdiction the most productive sources of revenue with a broad tax base. The States have been assigned tax revenues related to land and agriculture (land revenue, agricultural income tax, and other duties on agricultural land), sales taxes except those on inter-state trade, excise on liquor, taxation of inland transport except railways, property tax and the entry tax (the last two have generally been delegated to the local authorities).

## Share of Central Taxes & Grants-in-Aid

Since the most important and productive taxes were allocated to the Centre, the constitutional assignment to the States of responsibility for important public services led to vertical fiscal imbalance. Anticipating such an imbalance, provision was made for giving grants-in-aid to States in need of assistance for the sharing of two of the important central taxes with the States. Taxes on the non-agricultural income of non-corporate entities shall be distributed between the Centre and the States. In this case, the sharing is mandatory. Constitution also provides that the yield of Union excise duties may be shared with the States if parliament so provides by law.

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## Finance Commission

The financial position of the states was unsound, and the states were making continuous demands for further increases in their percentage shares. The nexus between expenditure decisions and the related raising of tax revenues had seriously weakened. The constitution envisaged that grants-in-aid of revenues to the states would flow mainly on the basis of recommendation of the Finance Commission. The Finance Commission was assigned the task of statewise distribution of non-plan revenue and expenditure. Since the Finance Commission is not authorised to make the final decision, their report is recommen-

datory. But in course of time a convention has grown of the Central Government accepting all or most of the major recommendations of the finance commission. However, as the Constitution has not provided any guidelines to the Commission, the approaches of the different commissions have varied and have not led to the evolution of a set of principles firmly grounded in economic analysis or empirical research. The States' share of central taxes was raised from 50 per cent of income tax in 1950-51 to 85 per cent of Union excise duties in 1985-86 to 1989-90. For the years 1995 to 2000 income tax share has been reduced to 77.5 per cent and Union excise duties raised to 47.5 per cent.

## Plan Expenditure Development

With the establishment of the Planning Commission, the Centre began to give grants and loans to the states to help them finance their public sector plans. The Planning Commission which functioned directly under the Prime Minister as Chairman and kept outside the regular government structure, coordinated the plans of the Centre and of the States and developed a national development plan. The plans of the States were approved by the Planning Commission and the plan transfers to the states were made through, or on the recommendations of the Planning Commission. Transfers to major states eventually became formula-based, but the Planning Commission still retains some discretions in the matter, particularly in respect to the allocation of plan funds to the special category states. The plan transfers consist of grants and loans. In addition, conditional grants are being given for the implementation of the national welfare programmes under the rubric of central sector and centrally sponsored schemes.

The total volume of plan assistance to be given to the states for the five years and the annual plan is decided jointly by the Ministry of Finance and the Planning Commission. The approach of the Planning Commission and the manner of financing the Plan on revenue account encourage the states and the central ministries to increase their levels of recurring expenditure on staff and related expenditures in particular with a five year horizon in view, because plan resources are available during the concerned plan period. After that period, such an increase in recurring expenditure usually becomes a permanent addition to the revenue budget on non-plan account. This approach to expenditure planning lacks a long-term strategy to control the growth of public expenditure. Large federal transfers had to be made to cover the deficits of the States which considerably weakened the finances of the Centre.

Moreover, the loans granted by the Centre were to be invested in development projects such as irrigation works, electricity and transport undertakings or were to be lent for productive purposes. In actuality, portions of the loans were used to cover deficits, and whatever was invested did not bring sufficient returns to cover interest and amortization.

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The flow of grants outside the recommendations of the Finance Commission gives rise to the problem of coordination of different flows. The overlap of functions of the Finance and Planning Commissions is also yet to be sorted out. Again the fact that the Planning Commission continues to approve of increase in expenditure within a five year period, even when the planned increases in revenue expenditure lead to revenue deficit continues to create disequilibrium in the budgets.

## Economic Reform & Planning

The economic reform since 1991-92 to 1994-95 was occupied with problems of stabilization, which pertains mainly to balancing the public sector income and expenditure and the payment gaps. In India's quasi-federal structure, the income and expenditure responsibility of the Government between the Centre and States provides almost full powers to the Centre. For reducing costs, and increasing competitiveness and efficiency thereby leading to higher growth and welfare of the society, India has now entered effectively into the second phase of reform, the phase of structural adjustments. In this effort, the existing Centre-State relations including the financial one are coming into focus and likely to aggravate the problems already in hand. Even the present stabilisation achieved will not be sustainable if the associated restructuring of the economy does not take place simultaneously. Structural adjustments involve areas which pertain not only to the Central prerogative in their assigned economic responsibilities but also largely to the domain of the States. Is the present framework of Centre-State relations, congenial and compatible for this?

It has been observed over time that increasing vertical fiscal imbalances develop between the Centre and States as the responsibilities of financial needs for carrying out all the economic activities assigned to the States far exceed their normal revenue raising capacities. This is largely because of the lower buoyancy of the States' sources of revenue and the higher elasticity vis-a-vis growth in the major areas of their expenditure. The two institutions Finance Commission and Planning Commission between them evolved a set of fixed formulas for allocations and some discretionary modes in grants and loans to the States to fill the gaps. However, the gaps are ever increasing and the necessary filler is coming from the Centre at the expense of more deficits and higher subsequent cost to the society in general. The States become more and more dependent on the Centre with their local based development priorities often being superseded by the Centre's priorities through explicit or implicit grant conditions often based on political and other considerations. Secondly, because the States have the luxury of getting an easy source of gap filler, their fiscal discipline is disappearing. They have neither the initiative to improve the revenue earning nor any intention to control their unnecessary expenditure on wasteful channels.

> **Because the States have the luxury of getting an easy source of gap filler, their fiscal discipline is disappearing. They have neither the initiative to improve the revenue earning nor any intention to control their unnecessary expenditure on wasteful channels.**

With stabilization being reached by some soft options and at the neglect of many hard alternatives relating to structural adjustments, a scenario has developed which is opposite to the desired direction of the structural adjustments. To summarise in brief, for controlling the budget deficit, heavy cuts in the social expenditure/infrastructure and transfer to the states have been undertaken in the Central Budget instead of any significant reduction in the government's wasteful revenue expenditure. But as a consequence, the budgetary transfer to the States has fallen.

Table 1 presents the time series data on resource transfers from the Centre to the States starting 1991-92, the year in which the reform process began. The table shows the five ways through which these transfers take place: States' shares in central taxes as per the Finance Commission award; non-plan grants under Article 275 of the Constitution as determined by the Finance Com-

**Table 1:** Transfer of Resources from Centre to States

(Rs. Crores)

| Items | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 | 1996-97 (RE) | 1997-98 (BE) |
|---|---|---|---|---|---|---|---|
| Total receipts of the Centre (1+2+3) | 121850 | 130899 | 153188 | 184618 | 197766 | 230505 | 272430 |
| Gross tax revenue | 67361 | 74637 | 75744 | 92294 | 111237 | 132319 | 15347 |
| Non-tax revenue | 15961 | 20084 | 22004 | 23629 | 28191 | 33571 | 39750 |
| Capital receipts | 38528 | 36178 | 55440 | 68695 | 58338 | 64615 | 79033 |
| Transfer of resources from the centre to state | 44786 | 50510 | 56953 | 62966 | 69553 | 81123 | 87351 |
| State share in central taxes | 17197 | 20522 | 22242 | 24840 | 29298 | 35107 | 40254 |
| Non-plan grants | 2600 | 2652 | 2318 | 2238 | 5878 | 6129 | 4871 |
| Non-plan loans | 5465 | 4852 | 4921 | 9371 | 9873 | 10066 | 10516 |
| Plan support (grants & loans) | 13650 | 15508 | 19395 | 19446 | 17536 | 22407 | 24348 |
| Centrally Sponsored Schemes | 5874 | 6976 | 8077 | 7071 | 6968 | 7413 | 7362 |
| Gross transfers to states as % of Centre's total receipts | 37 | 39 | 37 | 34 | 35 | 35 | 32 |
| Resources from states to Centre | 9990 | 11091 | 13753 | 15676 | 18414 | 20669 | 24334 |
| Loan payment | 3149 | 3366 | 4058 | 4333 | 5325 | 5624 | 6642 |
| Interest payment | 6841 | 7725 | 9695 | 11343 | 13089 | 15045 | 17692 |
| Net transfers from Centre (B-D) | 34796 | 39419 | 43200 | 47290 | 51139 | 690454 | 63017 |
| Net transfers from Centre as % of its total receipts | 29 | 30 | 28 | 26 | 26 | 26 | 23 |

mission; non-plan loans representing essentially plough back of the net small savings mobilised by the State; plan support comprising normal central assistance distributed across States according to the Gadgil formula and additional central assistance to cover externally aided projects; and assistance for centrally sponsored schemes with a grant element of over 98 per cent.

At an aggregate level, the data shows that resource transfers from the Centre to the States as a proportion of Centre's total receipts (revenue + capital) have been coming down, dropping by as much as 5 percentage points since the reforms began. The drop is even more significant in net terms.

The divisible pool, as of now, comprises only income tax (77.5 per cent) and excise duties (47.5 per cent). In its alternate scheme of devolution, the Tenth Finance Commission suggested the pooling of all central taxes for sharing with the states. There is a significant drop in non-plan grants from Rs. 6129 crore (1996-97) to Rs. 4871 crore (1997-98). But these are all formula driven grants and decline, as a rule, over the

award period of the Finance Commission. The Finance Minister has some flexibility, to the extent that it is not formula driven, in determining the plan support to states. Even so, fiscal constraints seemed to have become binding. The increase in plan assistance from Rs. 22,407 crore (1996-97) to Rs. 24,348 crore (1997-98) reflects a growth of just 8.7 per cent in nominal terms and near zero in real terms.

The seventy five per cent of the net small savings mobilised by the States is transferred to the States as loan and has been an important source of finance for State plans. After a quantum jump in 1994-95, there has been near stagnation under this head which can be attributed to the unattractive interest rates on these instruments and the money, competing opportunities now available for saving, several of them with tax shelters.

If the present revenue sharing responsibility remains unchanged, this will result in an increasing problem of gap filler and the likely aggravation of the dependence of the States on the Centre in the structural adjustments process. The basic premise of market

> **A decentralised revenue sharing scheme is to be innovated along with a sense of fiscal discipline and cost accountability in the State finance.**

economy has with it a large in-built decentralisation to make structural adjustment possible and introduces initiative and competition between States. Therefore a decentralised revenue sharing scheme is to be innovated along with a sense of fiscal discipline and cost accountability in the State finance.

## Devolution of Fund to States

For the devolution of funds to Centre and States, the major institutions are Planning Commission and Finance Commission. The two commissions have to function in tandem in the coordination of resource transfer to States. The assessment period being different, an overall view of the resources and the requirement of non-plan and plan at both levels of federation in an integrated manner is difficult. This problem was taken up in earlier plans and the dysfunction was corrected in the third, fourth and fifth plans. But from sixth Plan onwards, this correction for dysfunction between the span of the two agencies was not followed. The Tenth Finance Commission (TFC) (1995) mentions, "We were considerably handicapped in our work by the fact that the period of our report does not coincide with the period of recommendation of Finance Commission or with that of a five year plan. In the past, due recognition was given to this factor and upto the Seventh Commission the periods were synchronized". This correction should be made urgently—otherwise it will jeopardise the fiscal coordination between the two levels and horizontally between the plan and non-plan accounts. This is particularly important during the process of fiscal consolidation.

## Tenth Finance Commission

The Tenth Finance Commission (TFC) has broken new grounds and recommends basic changes in determining the devoluable tax revenues of the Centre by pooling the proceeds of some taxes instead of going tax by tax. It has tried to rationalise the tax devolution formula by unifying the criteria for the allocation of both Income Tax and Excise Duties. The major question is, do the innovation and new formulation help to address the basic tasks which every large federation has to face, reducing the vertical and horizontal fiscal imbalances resulting from the distribution of power and function be-

tween Centre and States? We propose to highlight this issue of pooling of tax revenues.

In the framework of cooperative federalism, the Constitution currently provides for the sharing of two taxes, Income tax and Union excise duties, with the States. The progress of tax reforms will be greatly facilitated if the ambit of tax sharing arrangement is enlarged so as to give greater certainty of resource flows to, and increased flexibility in tax reform for, the two layers of government.

The major benefits resulting from the new arrangement of pooling taxes for devolution between Centre and States are as follows:

- With a given share being allotted to the States in the aggregate revenues from Central taxes, States will be able to share the aggregate buoyancy of Central taxes

- The Central Government can pursue tax reforms without the need to consider whether a tax is shareable with the States or not

- The impact of fluctuations in central tax revenues would be felt alike by the Central and State Governments

- Should the taxes mentioned in articles 268 and/or 269 form part of this arrangement, there will be a greater likelihood of their being tapped.

The relevant ratios determining the vertical allocation in tax devolution have remained at 85 per cent in the case of income tax and at 45 per cent for Union excise duties for the past ten years. As the share of the Central Government in income tax is only 15 per cent, it has often been claimed that the Centre has shown lack of interest in tapping this source of revenue fully. Similarly, it is also believed that the large share of Union excise duties accruing to the State has reduced the flexibility of the Centre in the choice of tax measures.

Of the major Central taxes, the two taxes presently shareable seem to be less buoyant than the other two, corporation tax and customs duties. An advantage of pooling these Central taxes would be that both the Centre and the States would share in the buoyancy of

> **An advantage of pooling these Central taxes would be that both the Centre and the States would share in the buoyancy of aggregate revenues.**

aggregate revenues. This would be of particular advantage in a period of tax reform, when relative buoyancies undergo changes.

In their memoranda to Finance Commission the States have suggested moving towards a larger pool of revenues from which they can be assigned a share and that corporation tax and income tax should be pooled together and then distributed.

Finance Commissions in the past have noted, with concern, that a share was not being assigned to the States in the proceeds of the corporation tax. The Third and Fourth Commissions took this factor into account for raising the States' share in income tax from 60 to 63 and to 75 per cent, respectively. The Third Commission also raised the number of items of excise to be shared, to compensate for the loss. The Sixth Commission suggested a review of this issue by the National Development Council and the Seventh Commission recommended that the Centre may hold consultations with the States in order to settle the point finally. The Eighth Commission expressed the view that since the corporation tax had shown a high elasticity, it would seem only fair that the States should have access to such a source of revenue.

The Sarkaria Commission also examined this issue at length. It favoured bringing the corporation tax into the divisible pool as part of permissive participation like that of the Union excise duties. It suggested that this may be accomplished by a suitable Constitutional amendment.

The Chelliah Committee on Tax Reforms (1991) expressed the view that the present Constitutional provisions regarding tax sharing need to be re-examined. In this context, the committee's observations in its Interim Report are as follows: The task of fiscal adjustment at the Centre has been rendered more difficult because of the compulsions arising from the formula of tax sharing with the States. At present tax devolution to the States constitutes around 24 per cent of gross Central Government tax revenues. With the consent and cooperation of the States, the relevant constitutional provisions could be amended to the effect that 25 per cent of the aggregate tax revenues of the Centre shall be shared with the States. A proposal for a share of the states based on the amounts currently accruing to the states is to be made. For this purpose a distinction has been made between shares in income tax, basic excise duties and grants in lieu of tax on railway passenger fares as a proportion of central tax revenues on the one hand and the share of additional excise duties on the other.

During the period covered by the Reports of the Seventh, Eighth and Ninth (1990-95) Commissions, the average value of tax share to States was 27.28, 25.44 and 27.26. Considering these values the share of States in the gross receipts of Central taxes may be 26 per cent. A recommendation of a further share of three per cent in the gross tax receipts of the Centre for the States in lieu of additional excise duties is then made, so that the total share is 29 per cent of the gross tax receipts. These shares of twenty six and three per cent respectively should be suitably provided for in the Constitution and reviewed once in 15 years.

The recommendation that the taxes form part of the pool, is guided by the consideration that this will induce the Centre to exploit these tax bases which are not currently being tapped. States will also benefit from such an exercise. While article 268 taxes may be kept out of the arrangement of fixing a common share for all central taxes, article 269 taxes except Central sales tax and consignment tax should be brought within the purview of these arrangements.

There have been occasions in the past when the Centre had to augment its revenue for meeting emergent but temporary needs. In such circumstances, a surcharge on income and corporation tax was imposed. Such occasions may arise in future also. The Centre should, therefore, continue to have the power to levy surcharges for the purposes of the Union and these should be excluded from the sharing arrangements with the States which have been recommended.

The Tenth Finance Commission recommended the share of States in income tax, Union excise duties, additional excise duties and grants in lieu of tax on railway passenger fares. TFC also recommended that the alternative scheme of resource sharing suggested may be brought into force with effect from 1st April, 1996 after necessary amendments to the Constitution. This should not affect the inter-se shares and grants recommended by the commission.

The Finance Ministry has circulated a discussion paper on the "Alternative Scheme of Devolution" recommended by the TFC to encourage a debate before a decision is taken. It examines, somewhat narrowly, the issue of pooling all the central taxes and assigning 29 per cent to the states. The details of the sharing pattern are given in table 2.

The discussion paper is basically sympathetic to the idea of pooling. This is not surprising in view of the fact that the UF government is structurally bound to be federal in its approach though it is after all, a coalition of State-level parties.

**Table 2:** Existing and proposed pattern of sharing of the proceeds of Central taxes with the States under the Tenth Finance Commission's alternative scheme of devolution

| Central Taxes/Duties | Gross collection BE 1996-97 (Rs. in crore) | Reference to the article of Constitution relating to sharing pattern | States' share under existing sharing pattern BE 1996-97 (Rs. in Crore) | TFC's award on existing sharing pattern | TFC's alternative scheme of devolution |
|---|---|---|---|---|---|
| Stamp Duty | ** | 268 | n.a. | Collected & appropriated by the States | Same as existing sharing pattern |
| Excise Duty on medicinal and toilet preparations | ** | 268 | n.a. | Collected & appropriated by the States | Same as existing sharing pattern |
| Central States Tax@ | ** | 269 | n.a. | Collected by the Union net proceeds assigned to the States | Same as existing sharing pattern |
| Consignment Tax | | 269 | Not being levied at present | Collected by the Union net proceeds assignable to the States | Same as existing sharing pattern |
| Surcharge | 143 | 271 | 0 | Non-shareable | Same as existing sharing pattern |
| Estate Duty# | 1 | 269 | Not being levied at present | Collected by the Union net proceeds assignable to the States | To be pooled |
| Terminal taxes on goods/passengers carried by railway/sea/air | | 269 | Not being levied at present, but Grants of Rs. 380 crore p.a. being paid to the States in lieu | Collected by the Union net proceeds assignable to the States | To be pooled |
| Taxes on railway fares and freights | | 269 | Not being levied at present | Collected by the Union net proceeds assignable to the States | To be pooled |
| Taxes on transactions in stock exchanges other than Stamp Duties | | 269 | Not being levied at present | Collected by the Union net proceeds assignable to the States | To be pooled |
| Taxes on the sale or purchase of newspapers and on advertisements published therein | | 269 | Not being levied at present | Collected by the Union net proceeds assignable to the States | To be pooled |
| Corporation Tax | 19600 | 270 | 0 | Non-shareable | To be pooled |
| Income Tax | 17700 | 270 | 13024 | 77.5% of net proceeds paid to the States | To be pooled |
| Basic/Special Excise Duties | 40098 | 272 | 18911 | 47.5% of net proceeds paid to the States | To be pooled |
| Additional Excise Duties in lieu of Sales Tax | 2985 | 272 | 2900 | 97.79% of net proceeds paid to the States | To be pooled |
| Additional Excise Duties on textiles | 440 | | 0 | Non-shareable | To be pooled |
| Interest Tax | 1250 | | 0 | Non-shareable | To be pooled |
| Wealth Tax | 110 | | 0 | Non-shareable | To be pooled |
| Gift Tax | 10 | | 0 | Non-shareable | To be pooled |
| Customs | 4435 | | 0 | Non-shareable | To be pooled |
| Service Tax | 970 | | 0 | Non-shareable | To be pooled |
| Foreign Travel Tax | 190 | | 0 | Non-shareable | To be pooled |
| Inland Travel Tax | 450 | | 0 | Non-shareable | To be pooled |
| Expenditure Tax | 190 | | 0 | Non-shareable | To be pooled |
| Taxes of UTs | 212 | | | Non-shareable | To be pooled |
| Total | 128784 | | 35215 | | |

** Included in Taxes of UTs' at Sl. No. 24     n.a. Not available

@ Taxes on the sale or purchase of goods other than newspapers, where such sale or purchase takes place in the course of inter-State trade or commerce.

# Including Duties in respect of succession to property other than agricultural land.

## The Need for Change

The reasons for change are systemic and should not be seen in terms of a confrontation of the Centre vs States. The pooling is not simply a scheme to enlarge the divisible pool in favour of the States. The need for a basic change in Centre-State financial relations arises due to various factors. The major issue of course, is redressing the constitutionally congenial imbalance. The constitution recognises that the functions and finances of the states are not in line with each other. Hence, the different mechanisms of resource transfer exist. While the existing system of resource sharing has served its purpose, there is a feeling among States, shared by many fiscal experts, that the extent of the devolution of central taxes is not consistent with the respective responsibilities of the Centre and the States.

This old issue has now gained a new relevance and urgency. The economy being headed for the second stage of reform, the thrust will be on improving the efficiency and optimal utilisation of economic resources. For this, an adequate level of social and economic infrastructure and cost effective provision of public services is critical. Thus, two basic areas for governmental actions are the improvement of physical infrastructure and development of social services. This is in addition to the prime responsibility of governments to provide an administrative and legal framework for the market economy to operate efficiently.

These areas are within the constitutionally delineated sphere of activity of the State governments whose overwhelming importance in these areas is obvious even from the existing structure of government expenditure. The States collectively incur more than 70 per cent of the total development expenditure. More importantly, this is concentrated in the areas of infrastructure (about 87 per cent), social service (about 85 per cent), and agricultural development (about 80 per cent). The requirements of liberalisation will result in an increase in these expenditure responsibilities of the States which will increasingly fall within the revenue budget. At the same time, the resources available for this component of the Budget may not expand, even after tax reform, at the required growth rate.

The State Finance Commissions set up under the 73rd and 74th amendment are bound to have a major impact on the vertical flow of funds. Large revenue sources like stamps and registration, motor vehicle tax, electricity duty will have to be either transferred to the local bodies or at least earmarked for them. Some expenditure responsibilities like primary education and health will also have to be shifted to the third tier which will lead to a mismatch between the finances of local bodies. As a result, the State Finance Commissions will have to recommend grants-in-aid from States to them. This has already been done in States which have set up State Finance Commissions. In the light of the fundamental changes in the Constitution and the economy, it would be unrealistic not to change the existing system of revenue sharing.

> **In the light of the fundamental changes in the Constitution and the economy, it would be unrealistic not to change the existing system of revenue sharing.**

The development pattern of fiscal federalism has been to increase the discretionary control of resources by the Centre. The increase in discretionary transfers to States implies the Centre's control over the expenditure of the States. Over time, in most cases, this amounts to underwriting the expenditure of the State governments.

The direction of restructuring federal transfers has to be from the expenditure allocation to revenue devolution. If this is not initiated, the dependence of the State on the Centre will increase over time.

### Points against TFC Devolution

The main difficulty with the TFC's scheme, in enlarging the divisible pool inclusive of all taxes is not that it may not make for greater certainty or assure more revenue to the States, but that it takes a simplistic view of the problems that plague Centre-State fiscal relations in India, blurs the distinction between tax sharing and grants as instruments of federal transfer. It seeks to impose a rigid rule of devolution that would pre-empt any radical reform in an area that cries out for restructuring.

That Constitutional arrangements for Centre-State fiscal relations are not working too well is evident enough. For over a decade now, the budgets of both the

> **The States collectively incur more than 70 per cent of the total development expenditure in the areas of infrastructure, social service and agricultural development. The requirements of liberalisation will result in an increase in these expenditure responsibilities of the States.**

Centre and the states as a whole are out of balance, their revenues inadequate even to meet current expenditures. While the revenue gap has been hovering around 3 per cent of GDP for the Centre for the last five years, it exceeds 2 per cent of the GDP for several large states. The proportion of total government revenue (Centre and States combined) accruing to the states has gone up from about 55 per cent in the mid-seventies to nearly 66 per cent at present. Faced with rising expenditures, the States complain bitterly of resource crunch and growing dependence on the Centre because of insufficient revenue powers on the one hand and the Centre's tardiness in providing them with more funds on the other. Inter-state disparities in levels of income and public spending show no sign of abating, rather have accentuated, the statutory transfers having only a moderating effect. The root cause has been the flaws in the structure of federal finances, particularly the system of transfers. The deficiencies that plague the transfers are the multiplicity of transfer dispensing agencies with the Planning Commission being a rival channel, faulty design of general and specific purpose grants and the lack of a clear conceptual framework to guide them.

The imbalance in fiscal system is almost guaranteed when revenue needs of governments are assessed in a truncated fashion—"plan" and "non-plan" by two agencies independently. The imbalances get compounded when the transfers mandated by the Constitution are used primarily to fill the non-plan revenue gaps without serious efforts to determine them scientifically, and using tax devolution rather than grants-in-aid as the main medium of general purpose transfer. Originally devolution was intended to act as a "balancing factor" to take care of the vertical imbalances, over the years. It has overshadowed grants in the transfers ordained by the FCs with the result that fiscal discipline has been at a discount and all States including those not so needy receive handsome amounts through devolution.

The TFC's tax pooling scheme does not help to remedy these shortcomings. If the States are to be enabled to balance their budgets without increasing their dependence on the Centre or adding to the Centre's budgetary woes, it is necessary first to enlarge their tax powers. That would make for greater accountability of the States and also enable the Centre to shed some activities it has taken on needlessly. Transfers would still be needed, though presumably on a smaller scale. But if it is not to breed fiscal laxity, the transfer system must have incentives for economy, efficiency and revenue effort.

The TFC's scheme also overlooks the standard principles of tax assignment and tax sharing in federations. Taxes with nationwide bases and inter-jurisdictional ramifications are usually assigned to the national government on grounds of economy and efficiency. Central governments also need to have certain taxes at their exclusive command to meet exigencies. Making all of them divisible detracts from these objectives. It is not without reason that the Sarkaria Commission, while recommending the inclusion of corporation tax in the divisible pool, rejected the plea for putting all central taxes together for devolution.

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## Merits of The Alternative Scheme

The alternative scheme proposes enlarging the pool to include all central taxes (excluding Stamp Duty, Excise Duty on medicinal and toilet preparation, Central Sales Tax, Consignment Tax and Surcharge) and giving 26 per cent of it to States. In addition 3 per cent of the gross proceeds of all central taxes is to be assigned to the States for the existing shares in Additional Excise duties in lieu of sales tax on tobacco, cotton and sugar. The scheme has several merits. First, it will facilitate integrated tax reform at the Centre. Under the present arrangement the Centre has a temptation, to which it has no doubt succumbed on several occasions, to give away concessions in the two shared taxes while exploiting and appropriating the buoyancy in the non-shareable taxes.

Second, by giving the States a share in the overall buoyancy of the gross tax base of the Centre, the alternative scheme will remove their long standing grievance that the terms of tax sharing are shifting against them. In particular, international trade taxes will show greater buoyancy than domestic trade taxes. Moreover, as the economy modernises, the tertiary sector will grow faster than the manufacturing sector and taxes on services will become an increasingly important source of revenue. It is a share of this emerging buoyancy that the states are demanding. Third, the alternative scheme will make vertical sharing simple, transparent and predictable and, thus, remove the prevailing mistrust and apprehension. Fourth, if the taxes mentioned in Articles 268 and/or 269 form part of devolution, it will induce the Centre to mobilise resources through these taxes, with the states also benefitting. The TFC scheme envisages that the

power of the Union to levy and collect all taxes in the Union list should not be affected. Fifth, the progress of tax reforms will be greatly facilitated if the scope of tax sharing is enlarged. This will introduce greater certainty of resource flows to the States and enhance flexibility in the tax reforms.

Some may argue that it may not always be advantageous to the States in terms of revenue accrual for the simple reason that a bigger slice of selected revenue sources can yield a larger amount than a small share of the total. But the logic of the alternative scheme is not necessarily to ensure a larger share to the States but to give them a share in the overall buoyancy of Central taxes. Besides, perplexing as it may seem at first glance, both the Centre and the States may end up with larger shares because the alternative scheme will facilitate tax reform in the direction of exploiting buoyancy.

The Commission felt that if all Central taxes are to be termed 'divisible', the States would claim an 'interest' in each one of them and demand to be consulted, as a matter of right in all of Centre's tax policies. The TFC has taken care of this disadvantage by suggesting a constitutional amendment that would not designate any individual Central tax as 'divisible'. The States will simply be entitled to a prescribed percentage of the gross tax receipt of the Union. The TFC following the Sarkaria Commission's analysis did not favour pooling of all taxes for the divisible purpose like customs duty and the surcharge. Further TFC scheme envisages that the power of the Union to levy and collect all taxes should not be affected while assigning a certain percentages to States.

There are some concerns about the progressivity of transfers. These concerns relate to the horizontal distribution of the divisible pool among States rather than the determination of the size of the pool which is what the alternative scheme is all about. This would necessitate a de novo evaluation of the entire scheme of Central transfer under plan and non-plan and in the form of grants, loans and tax devolution. The alternative scheme proposed by the TFC is a step in the right direction and should not be deferred till the entire house is put in order.

The TFC scheme is a distinct improvement over the present type of situation. It gives sufficient flexibility to the Centre to mobilise resources for its exclusive use and assist in tax reforms by removing inter-tax bias. The basic feature of the TFC scheme, the pooling of the receipts of all Central taxes is acceptable. It would remove incentives to grant exemptions and deductions for the Centre. This scheme will also make for stability and certainty to revenue sharing facilitating budget planning by the Centre and the States.

Another point to be considered is freezing the vertical sharing formula for the next 15 years. A long period in adopting a gap filling approach is important for the vertical sharing. This will help in correcting the existing imbalance in the fiscal system.

The TFC had recommended the alternative scheme under the impression that this would not entail any additional burden on the Centre. However, calculations show that the acceptance of the TFC scheme would entail an additional burden of Rs. 2091 crore on the Centre in 1996-97. Hence, if revenue neutrality is to be achieved, the percentage share of the States should be reduced from the recommended level of 26 per cent and 3 per cent so as to maintain the level of transfers at the existing level in absolute terms.

The calculation is as follows:

| | (Rs. in crore) |
|---|---|
| Gross tax collection | 128784 |
| Less surcharge | 143 |
| Total divisible pool under the TFC scheme | 128641 |
| States' share (29%) | 37306 |
| State's share under existing sharing pattern | 35215 |
| Gain to States under the TFC scheme | 2091 |

Alternatively, the TFC scheme should be accepted with some modifications. The percentage share of the State should be increased from the recommended level of 26 per cent and 3 per cent but the increased share should not be merely in lieu of the existing shares in Central taxes but in lieu of all existing transfers on Revenue account. In other words, the fixed percentage of the pooled Central taxes should be frozen for the next fifteen years in lieu of all revenue transfers from the Centre to the States, The Plan transfers would then be only on Capital account. Both horizontal and vertical distribution amongst the States may be reviewed only in five years. This is because the distinction between Plan and Non-Plan expenditure within the Revenue account has ceased to have meaning and the Revenue account should be looked upon as one integrated whole. One of the basic flaws in the existing system of transfers to the States is the multiplicity of agencies determining the transfers, mainly the Planning Commission and the Finance Commission. Fiscal imbalance is bound to arise if the revenue needs of governments are assessed in a truncated fashion, "Plan" and "Non-Plan", by two agencies independently. The imbalances get compounded when the transfers mandated by the Constitution are

used primarily to fill the Non-Plan Revenue gaps without any significant effort to determine them scientifically, and using tax devolution rather than Grants-in-aid as the main medium of general purpose transfer. Although originally devolution was intended to act as a "balancing factor" to take care of the vertical imbalance, over the years, it has overshadowed grants in the transfers ordained by the Finance Commissions resulting in fiscal indiscipline.

## Concluding Remarks

The arrangement of federal system has passed the test of time—however, several cracks are noticeable in the system. The distribution of revenue power is tilted in favour of the Central Government disregarding the number of expanding functions to be performed by the States. In the total transfers received by the States, the statutory portion on which the states have claim and can use independently, have been falling over the years and the share of Plan transfers is increasing. The State transfers on Plan account received by the States are in the ratio of 70 per cent loan and 30 per cent grant (excepting special category states) thus becoming a factor of fiscal subordination to the centre. The discretionary component of grants comes to the States in so many different routes and is given by the Central Government on judging the project content which sometimes causes friction between Centre and States.

A change in the activity schedule of Central and State activities and reallocation of financial power in revenue raising are therefore needed in the perspective of the new policy of liberalisation and more decentralisation. This will concern the issue of both revenue power and revenue devolution sharing between Central and States. In this connection some inter-country studies involving countries undergoing economic reforms like China may be of some guidance for a desirable system of Central-State financial relations.

In China during the reform process between 1980-86, more autonomy to provinces was accorded in determining and pegging revenue sharing arrangement through negotiation with each province on a three year cycle. In the context of these new tax rules, the provincial governments were moved to raise more revenues directly and pay the share to the central authorities so as to safeguard its fiscal situation. This division of responsibilities made the fiscal system more decentralised in favour of the states towards the late 1980s resulting in a situation that the primary responsibility of the central government was for capital spending and defence while the provincial government undertook most of the current expenditure and sub-

sidies. The expenditure has reduced as the States are more careful in economising the expenditure level consistent with revenue raising capacity.

There are several shortcomings of this system which are felt by China since the early 1990s. The Centre has become weak and has lost control over the provinces. The Central Government is short of fund and is not in a position to help the poor regions in building even the essential infrastructure for helping growth and correcting regional imbalances. In the context of the socio-economic and political system in India, the system may not work well. It makes the Central Government weak. In the initial phase of liberalisation the central government must work as a regulatory body and co-ordinator in order to avoid the imbalances China is now facing.

In the perspective of the TFC scheme of pooling Central taxes, a better course of action would be to give more powers and autonomy to States in taxation. Whether to devolve the powers of taxation to the States or to devolve share in Central taxes is a fundamental issue. There are two considerations that favour the latter approach. The first is the issue of harmonization and the second is the basic Constitution scheme of protecting the interests of the weaker States. Though the scheme appears reasonable, its efficacy in establishing optimum Central-State fiscal relation in the present context of economic reforms is questionable.

Without making a complete overhaul of the present system, we should make some changes in the work distribution between Centre and States. The functions of lesser importance concerning social and economic activities may be shifted to State governments along with the required financial support either through more devolution of funds or relaxing the control of the Central Government in raising funds from the market. The States' resources may be improved if they can collect revenue through taxation of agricultural income which has so long been overlooked.

Taking into account all the factors together for a balanced and acceptable policy, the present constitutional arrangement need not be fully restructured. However adjustments in policies, procedures and regulatory measures are necessary to remove the operational irritants between the States and the Centre. For the economic reforms to be successful, co-operation between the Centre and States is absolutely necessary— the national as well as regional priorities should be the focal points of joint effort. The issue is to be tackled very carefully in view oft he existence of multi party rules in the states.

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# Emerging Demographic Scenario: Issues Before the Ninth Five Year Plan

S. Irudaya Rajan & P. Mohanachandran

*Demographic control has always been on the agenda of Indian planners, and it has invariably been included in all the Five Year Plans. What has been the achievement in terms of reducing fertility and mortality over the last 50 years since independence? Have the thrust and approach changed over plan periods? Has the program succeeded in all states of India? What is the current demographic profile of India? What is the expected population size over the next 50 years? What are the immediate issues that should be addressed by the Planning Commission in its Ninth Five Year Plan? The article is an attempt in this direction.*

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India has the unique distinction of having been the first country in the world to introduce an official family planning program in 1951 as an integral part of its socio-economic development plan. Since then, the program has grown steadily and today it is perhaps the second largest program in the world covering a huge population of about 90 crores.

The plan documents of the eight five year plans pertaining to health and family welfare program, merit a brief review to understand governmental efforts in this area.

## Five Year Plans & Demographic Planning

The First Five Year Plan sought an accurate picture of the factors contributing to the rapid increase of population. A sum of Rs. 6.5 million was allocated by the Central Government to the Ministry of Health for activities such as provision of contraceptives, advice, conducting field experiments on different family planning methods to determine their suitability, acceptability and effectiveness for different sections of population, development of suitable procedures to educate the people on family planning methods, collection of information on reproductive patterns, attitudes and motivations affecting family size, the interrelationship between economic, social and population change and research into the physiological and medical aspects of human fertility and its control.

The distribution of contraceptives was extended to primary health centres, hospitals, dispensaries, and maternity homes run by State Governments during the Second Five Year Plan. The Central Family Planning Board recommended the inclusion of sterilization operation in the family planning programs in hospitals and institutions where facilities existed. The number of service clinics was increased from 147 to 4165 with the expectation that people would go there for advice and

service. Research activities were extended to the field of demography and communication action. However, the approach during the first two plan periods was 'clinical'. A financial provision of Rs. 50 million was made in the Second Plan.

During the Third Five Year Plan period, the clinical approach was replaced by an extension education approach aimed at bringing the message and services to the people through PHCs and subcentres. The program gained momentum in 1966 when a Department of Family Planning was constituted in the Ministry of Health and Family Planning at the centre to give technical and administrative direction and guidance to the programme and effective coordination of its various facets. The emphasis was placed on time bound and target oriented programs. The annual plans during 1966-69 also focussed on the family planning program. The expenditure during this period increased to Rs. 704.6 million.

In the Fourth Five Year Plan period, family planning was included among the programs of highest priority. A numerical target was set for reducing the crude birth rate from 39 per 1000 population to 25 within the next 10-12 years. An outlay of Rs. 3150 million was made to strengthen and speed up the programs. The Medical Termination of Pregnancy which became effective from April 1, 1972, made it possible for pregnant women not desiring the pregnancy to have an induced abortion during the first trimester of pregnancy for medical, social or economic reasons including contraceptive failure. The target set in terms of sterilization was 14.9 million of which about 61 per cent was achieved.

Based on the 1971 census results, the Fifth Five Year Plan set a revised demographic goal of reducing the birth rate to 30 by 1979 and to 25 by 1984. In April 1976, the Union Minister of Health and Family Planning announced in Parliament a new population policy for India. The main feature of this policy was to raise the minimum legal age at marriage from 15 to 18 for girls and from 18 to 21 years for boys.

In the Sixth Plan, the family welfare program continued to be accorded high priority. The strategy was to integrate the health, family welfare, MCH and nutritional services at all levels. A working group on population policy was set up by the Planning Commission in 1979. This group recommended adoption of the long term demographic goal of reaching the NRR (Net Reproduction Rate) of 1 by 1996 for the country and 2001 in all the states.

In the light of the progress made in the initial years of the Sixth Plan, the Seventh Plan policy document aimed at a target of NRR of 1 by 2000.

The Eighth Plan made vigorous efforts to contain the population growth. To give a major thrust, a national population policy was enunciated and adopted by the Parliament.

However as of April 1996, the method specific targets for contraceptive acceptors assigned to every grassroot health worker and the incentives offered to clients undergoing sterilisations were abandoned. The impact of the new approach is yet to be assessed.

**Present Scenario**

The 1995 provisional estimates released by the Sample Registration System places India's crude birth rate as 28.3 (30.0 in rural and 22.6 in urban areas of the country). The indirect estimate made by Mari Bhat using the just released 1991 census data reveals that the crude birth rate has declined from 34.9 during 1974-80 to 31.6 during 1984-90. It is an impressive decline for the country which has above 900 millions of people of different castes, religions, languages, socio-economic and cultural diversities. Against this background, table 1 presents the desired demographic goals envisaged in the different Plan periods over the last 35 years.

None of the demographic goals has been realized over the last 35 years and all have been revised time and again by the Planning Commission. For instance, the goal of achieving a birth rate of 25 by 1972 set in 1962, has not been realized in 1982 or 1992 and it is likely to be realized by the end of Ninth Five Year Plan period, 2002. The planners and policy makers in India also could not identify the determinants of fertility and mortality in the earlier plan periods (Irudaya Rajan & Mishra, 1992; Zachariah, 1995). From the beginning of the Sixth Five Year Plan, the demographic goals set by the Planning Commission have shifted the emphasis from crude birth rate to net reproduction rate Srinivasan, et al. 1980; Srinivasan, 1983).

> **None of the demographic goals has been realized over the last 35 years and all have been revised time and again by the Planning Commission.**

The investment on health and family welfare over the Plan periods is summarized in table 2. During the Eighth Plan period, the Government of India had allocated Rs. 14082 million for health and family welfare activities. Though the absolute amount invested looks very huge over the plan periods, the ratio of investment on health

**Table 1:** Desired Demographic Goals, India, 1962-1997

| Year of Statement | Specified Demographic Goal | Year by which the Goal is to be Achieved |
|---|---|---|
| 1962 | CBR of 25 | 1972 |
| 1966 | CBR of 25 | as expeditiously |
| 1968 | CBR of 23 | 1978-79 |
| 1969 | CBR of 32 | 1974-75 |
| Beginning of IV Plan | CBR of 25 | 1979-81 |
| 1974 | CBR of 30 | 1979 |
| Beginning of V Plan | CBR of 25 | 1984 |
| April 1976 | CBR of 30 | 1978-79 |
| I Population Policy | CBR of 25 | 1983-84 |
| April 1977 | CBR of 30 | 1978-79 |
| II Population Policy | CBR of 25 | 1983-84 |
| January 1978 | CBR of 30 | 1978-79 |
| Central Council of Health | CBR of 30 | 1982-83 |
| Sixth Five Year Plan | NRR of 1 | 2000 |
| Document (1980-85) | CBR of 21 | 2000 |
| | CDR of 9 | 2000 |
| | Expectation of Life at Birth of 64 Years | 2000 |
| | Couple Protection Rate: 60 per cent | 2000 |
| Seventh Five Year Plan | NRR of 1 | 2006-11 |
| Document (1985-90) | CBR of 29 | 1990 |
| | CDR of 11 | 1990 |
| | IMR of 90 | 1990 |
| | Couple Protection Rate: 42 per cent | 1990 |
| Eighth Five Year Plan | NRR of 1 | 2011-16 |
| Document (1992-97) | CBR of 21 | 2000 |
| | CBR of 26 | End of Eighth Plan |
| | CDR of 9 | 2000 |
| | IMR of < 60 | 2000 |
| | IMR of 70 | End of Eighth Plan |
| | CPR > 60% | 2000 |
| | CPR > 56% | End of Eighth Plan |
| | Expectation of Life at Birth of 64 years | 2000 |
| | Average Family Size of 2.3 | 2000 |

**Note:** Updated based on the Eighth Five Year Plan document.
*Source:* K. Srinivasan, 1982; 1983; Irudaya Rajan & Padmavathi, 1990.

**Table 2:** Investment on Health and Family Welfare During Various Plan Periods

(Rs. in crores)

| Period | Total Plan investment Outlay | Health | Family Welfare | Total |
|---|---|---|---|---|
| | (1) | (2) | (3) | (2) + (3) |
| First Plan | 1960.0 | 65.2 | 0.1 | 65.3 |
| (1951-56) | (100.0) | (3.3) | (0.0) | (3.3) |
| Second Plan | 4672.0 | 140.8 | 5.0 | 145.8 |
| (1956-61) | (100.0) | (3.0) | (0.1) | (3.1) |
| Third Plan | 8576.5 | 225.9 | 24.9 | 250.8 |
| (1961-66) | (100.0) | (2.6) | (0.3) | (2.9) |
| Fourth Plan | 15778.8 | 335.5 | 278.0 | 613.5 |
| (1969-74) | (100.0) | (2.1) | (1.8) | (3.9) |
| Fifth Plan | 39426.2 | 760.8 | 491.8 | 1252.6 |
| (1974-79) | (100.0) | (1.9) | (1.3) | (3.2) |
| Sixth Plan | 109291.7 | 2025.2 | 1387.0 | 3412.2 |
| (1980-85) | (100.0) | (1.8) | (1.3) | (3.1) |
| Seventh Plan | 218729.6 | 3688.6 | 3120.8 | 6609.4 |
| (1985-90) | (100.0) | (1.7) | (1.4) | (3.1) |
| Eighth Plan | 434100.0 | 7582.2 | 6500.0 | 14082.2 |
| (1991-96) | (100.0) | (1.7) | (1.5) | (3.2) |

*Source:* Compiled from various Plan Documents by the authors.

and family welfare over the last eight Five Year Plan periods to total plan investment was almost constant and hovering around 3 per cent. The pattern of investment in health and family welfare has changed over a period of time emphasising more on family welfare.

What was the achievement of the family welfare program in terms of couples effectively protected, number of equivalent sterilisation and births averted over the last 40 years? Some data are presented in table 3. The percentage of couples effectively protected has reached the level of 44 per cent in 1993 from zero in 1951. The 1991 census enumerated the population of India (including the projected population of Jammu and Kashmir) as 844 million. The population of India could have crossed 1 billion in 1991 if we had not averted 155 million births through the family planning program during the period under consideration (table 3).

Mari Bhat has indirectly estimated the crude birth rate and total fertility rate using the 1981 and 1991 censuses for all the districts of India (Mari Bhat, 1996; 1997). We have provided the estimates for major states, smaller states and Union Territories in table 4 to assess the level of fertility in the past 20 years. Comparisons are made between 1974-80 to 1984-90. Some States and Territories have reported more than 20 per cent

decline during the study period (Tamil Nadu, Goa, Andaman & Nichobar Islands and Chandigarh); others have shown a decline of 15 to 20 per cent (Andhra Pradesh, Gujarat, Kerala, Himachal Pradesh, Lakshadweep and Pondicherry) and some others have registered a decline of more than 10 per cent and less than 15 per cent (Karnataka, Punjab, Mizoram, Manipur and Sikhim). Overall, six major states, five smaller states and four union territories have registered a decline of more than 10 per cent. Among the major states, Tamil Nadu has reported the highest fertility decline during the last decade; South India is ahead in fertility decline, followed by West and Northeast India.

If we consider the total fertility rate in the last decade, the decline is most impressive for Andhra Pradesh, Gujarat, Karnataka, Kerala, Tamil Nadu, Goa, Himachal Pradesh, Mizoram, Manipur, Andaman & Nichobar Islands, Chandigarh, Lakshadweep and Pondicherry with more than 20 per cent decline, followed by Punjab, Uttar Pradesh and Sikkim with more than 15 and less than 20 per cent decline, and lastly Haryana, Rajasthan, West Bengal, Daman and Diu with more than 10 per cent and less than 15 per cent decline. Interesting, states like Rajasthan and Uttar Pradesh have shown an impressive decline. Even Madhya Pradesh registered a decline of 8.6 per cent. The political transition of

**Table 3:** Achievement of Family Welfare Program in India, 1951-1993

| Year | Number of Equivalent Sterilisation (in Lakhs) | Birth Averted (Millions) | Birth Averted Cumulative Total (Millions) | Percentage of Couples Effectively Protected (per cent) |
|------|------|------|------|------|
| 1951-56 | 0.07 | 0.00 | 0.00 | – |
| 1956-61 | 25.00 | 0.07 | 0.07 | – |
| 1961-66 | 16.13 | 0.56 | 0.63 | – |
| 1966-67 | 12.16 | 0.55 | 1.19 | 4.5 |
| 1967-68 | 20.92 | 0.84 | 2.03 | 6.7 |
| 1968-69 | 18.78 | 1.25 | 3.29 | 8.7 |
| 1969-70 | 16.59 | 1.61 | 4.91 | 10.3 |
| 1970-71 | 15.98 | 1.92 | 6.82 | 10.6 |
| 1971-72 | 24.81 | 2.14 | 8.96 | 12.4 |
| 1972-73 | 33.73 | 2.53 | 11.50 | 14.6 |
| 1973-74 | 12.33 | 2.99 | 14.49 | 14.7 |
| 1974-75 | 16.38 | 3.02 | 17.52 | 14.8 |
| 1975-76 | 30.67 | 3.10 | 20.65 | 17.0 |
| 1976-77 | 86.57 | 3.72 | 24.37 | 23.5 |
| 1977-78 | 12.38 | 5.05 | 29.42 | 22.5 |
| 1978-79 | 18.67 | 4.92 | 34.35 | 22.4 |
| 1979-80 | 21.59 | 4.90 | 39.26 | 22.3 |
| 1980-81 | 24.79 | 4.93 | 44.19 | 22.8 |
| 1981-82 | 33.03 | 5.11 | 49.30 | 23.7 |
| 1982-83 | 46.85 | 5.48 | 54.77 | 25.9 |
| 1983-84 | 57.50 | 6.21 | 60.98 | 29.5 |
| 1984-85 | 55.55 | 7.23 | 68.25 | 32.1 |
| 1985-86 | 66.63 | 8.12 | 76.37 | 34.9 |
| 1986-87 | 71.04 | 9.00 | 85.37 | 37.5 |
| 1987-88 | 72.51 | 9.95 | 95.32 | 39.9 |
| 1988-89 | 72.54 | 10.87 | 106.20 | 41.9 |
| 1989-90 | 69.32 | 11.67 | 117.87 | 43.3 |
| 1990-91 | 70.82 | 12.30 | 130.17 | 44.1 |
| 1991-92 | 66.97 | 12.70 | 142.87 | 43.6 |
| 1992-93 | 70.32 | 12.76 | 155.63 | 43.5 |

*Source:* Irudaya Rajan, 1987; Irudaya Rajan, Padmavathi, 1990.

**Notes:** Updated based on the annual year books published by the Ministry of Health and Family Welfare, Nirman Bhavan, Delhi. Equivalent Sterilisation is computed by using the following ratio: 1 sterilisation = 3 Intra Uterine Device Users = 18 Conventional Contraceptive Users = 9 Equivalent Oral Pill Users.

'BIMARU' (BIMARU means sickness in Hindi. This word is coined from the four demographically backward states of India. They are Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh) states might lead to a quickening of the demographic transition (Irudaya Rajan, 1996).

According to the estimates of crude birth rates of 1995 as per the Sample Registration System, the decline reported by Mari Bhat seems to be on the continuous trend. The birth rate reported by all the major and small states including the Union Territories in 1995 is much lower than the birth rate of 1984-90 (Mari Bhat, 1997). For instance, the absolute decline in the birth rate for India during the period 1974-80 and 1984-90 was 3.3 points and between 1984-90 and 1995 was almost identical with 3.3 points. For the states which registered high crude birth rates during 1984-90, the decline was more sharp. The absolute decline during 1984-90 and 1990 was 1.7 in Tamil Nadu and 2.6 in Kerala if was 4.9 in Bihar, 4.6 in Uttar Pradesh, 4.2 in Madhya Pradesh and 3.8 in Rajasthan. Infact, the decline for BIMARU states is higher than the All India figure. If the family planning

**Table 4:** Estimates of Fertility from 1981 and 1991 Censuses

| States | | Crude Birth Rate | | | Total Fertility Rates | | |
|---|---|---|---|---|---|---|---|
| Union Territories | | 1974-80 | 1984-90 | % Decline | 1974-80 | 1984-90 | % Decline |
| | Total | 34.9 | 31.6 | 9.4 | 4.9 | 4.1 | 15.5 |
| India* | Rural | 35.9 | 33.2 | 7.6 | 5.2 | 4.5 | 12.4 |
| | Urban | 30.7 | 26.8 | 12.8 | 4.0 | 3.1 | 20.6 |
| *Major States* | | | | | | | |
| Andhra Pradesh | | 33.5 | 28.2 | 15.9 | 4.3 | 3.2 | 25.4 |
| Assam | | N.A. | 35.1 | N.A. | N.A. | 4.1 | N.A. |
| Bihar | | 38.2 | 37.0 | 3.1 | 5.3 | 5.1 | 5.3 |
| Gujarat | | 34.2 | 28.8 | 15.8 | 4.3 | 3.2 | 25.4 |
| Haryana | | 35.9 | 33.0 | 7.9 | 5.1 | 4.5 | 13.1 |
| Karnataka | | 32.2 | 28.0 | 13.1 | 4.3 | 3.4 | 21.2 |
| Kerala | | 25.0 | 20.3 | 18.7 | 2.9 | 2.0 | 29.6 |
| Madhya Pradesh | | 39.2 | 37.2 | 5.2 | 5.5 | 5.0 | 8.6 |
| Maharashtra | | 30.5 | 28.8 | 5.5 | 4.1 | 3.7 | 9.2 |
| Orissa | | 33.3 | 30.4 | 8.8 | 4.5 | 3.9 | 14.5 |
| Punjab | | 30.4 | 27.2 | 10.6 | 4.2 | 3.5 | 17.3 |
| Rajasthan | | 40.5 | 37.0 | 8.6 | 6.0 | 5.2 | 14.2 |
| Tamil Nadu | | 28.2 | 21.9 | 22.3 | 3.5 | 2.3 | 34.9 |
| Uttar Pradesh | | 42.0 | 38.1 | 9.4 | 6.3 | 5.3 | 15.4 |
| West Bengal | | 31.1 | 28.9 | 7.1 | 4.0 | 3.6 | 11.8 |
| *Smaller States* | | | | | | | |
| Arunachal Pradesh | | 39.4 | 39.1 | 0.9 | 5.6 | 5.6 | 1.5 |
| Goa | | 25.5 | 18.3 | 28.0 | 3.2 | 1.9 | 38.8 |
| Himachal Pradesh | | 32.7 | 27.8 | 15.2 | 4.2 | 3.2 | 24.4 |
| Mizoram | | 36.7 | 31.5 | 14.1 | 5.3 | 4.1 | 22.7 |
| Manipur | | 31.2 | 27.3 | 12.5 | 4.3 | 3.4 | 20.2 |
| Meghalaya | | 37.4 | 38.3 | −2.4 | 5.1 | 5.3 | 2.3 |
| Nagaland | | 31.2 | 29.6 | 5.2 | 4.6 | 4.2 | 8.6 |
| Sikkim | | 36.9 | 32.5 | 12.0 | 5.4 | 4.3 | 19.5 |
| Tripura | | 31.5 | 31.1 | 1.4 | 4.2 | 4.1 | 2.3 |
| *Union Territories* | | | | | | | |
| Andaman & Nicobar Islands | | 38.6 | 28.8 | 25.3 | 5.0 | 3.0 | 39.1 |
| Chandigarh | | 31.6 | 25.3 | 20.0 | 3.4 | 2.3 | 31.6 |
| Dadra & Nagar Haveli | | 38.9 | 36.2 | 6.8 | 5.1 | 4.6 | 11.3 |
| Daman & Diu | | | 26.1 | | | 2.7 | |
| Delhi | | 31.4 | 31.0 | 1.3 | 3.8 | 3.7 | 2.1 |
| Lakshadweep | | 37.0 | 29.8 | 19.5 | 4.8 | 3.3 | 30.8 |
| Pondicherry | | 28.5 | 23.0 | 19.3 | 3.8 | 2.6 | 30.6 |

\* Excludes Jammu and Kashmir; Crude birth rate is defined as births per thousand population; Total fertility rate denotes the average number of children that would be born to a woman during her life time, if she passes through her child bearing years confirming the age specific fertility rates of the year.

*Source:* P N Mari Bhat. 1996.

*Demographic Issues Before the Ninth Five Year Plan*

program is given top priority in the Ninth Five Year Plan under the present Union Health Minister, then the fertility decline in the future will be much more.

Table 5 also provides the crude death rates for the country as a whole for 1995 with a breakdown for the major states. Two observations can be made: the states which have registered high crude birth rates also report high death rates. For instance, among the major states, Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh have reported their crude birth rates as above 33 and except Rajasthan, the other three states have registered their crude death rate as above 10. It can be inferred that to bring down fertility levels in the demographically backward states of India, it is important to bring down the mortality level. Few states have reported crude death rate below 7 as of 1995. If the crude death rates are high, it indirectly indicates a high level of infant and child mortality rates.

> If the crude death rates are high, it indirectly indicates a high level of infant and child mortality rates.

Indirect estimates of infant and child mortality were made for all the districts of India based on the 1991 census (Irudaya Rajan & Mohanachandran, 1997). To assess the current levels of infant and child mortality, estimates are provided for all states and union territories as well as rural and urban areas in table 6. Though we have provided information by sex and place of residence, the discussion on infant and child mortality will be confined to total. As reported in table 1, the Eighth Five Year Plan document categorically states that the country should reach the IMR of 70 by the end of Eighth Plan and an IMR of less than 60 by 2000. Let us assess the real situation based on the 1991 census estimates.

According to our estimates, the following states and union territories have reported their IMR as less than 60 based on the 1991 census: Andhra Pradesh, Haryana, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu, Delhi, Goa, Manipur, Mizoram, Nagaland, Sikkim, Andaman & Nichobar Islands, Chandigarh, Daman and Diu and Pondicherry. Two states (Madhya Pradesh and Orissa) have reported their IMR as above 100 and another four states (Assam, Rajasthan, Uttar Pradesh and Arunachal Pradesh) have registered their IMR as above 80. Among the 15 major states, 8 states have reported their IMR as above 60. The Infant mortality level revealed from the 1991 census is not very impressive and the present government through its Ninth Five Year Plan should concentrate on the maternal and child health

programs to reduce infant and child mortality. The child mortality levels are also extremely high for many states and union territories as can be seen from table 6. The estimates are above 100 for the following states (Assam, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh, Arunachal Pradesh and Tripura), the highest being reported for Madhya Pradesh with 145.

With this background, we would like to assess the level of child vaccination among the states and union territories of India. As of now, not even a single survey conducted in India provides such an assessment of immunisation status among children across states. The National Family Health Survey (NFHS) (1992-93) provides some benchmark data on the demographic and health situation of different states. The data collection for the NFHS was carried out in three phases during April 1992 and September 1993. The survey was based on a systematic, multistage, stratified sample design. The major topics covered included fertility, marriage pattern, family size preferences, the level of unwanted fertility, knowledge and practice of family planning, the potential demand for contraception, utilisation of antenatal care services, breast feeding and food supplementation services, child health and nutrition, vaccination and infant and child mortality (International Institute for Population Sciences, 1995). Some extensive work was carried out using the National Family Health Survey on areas such as reproductive health, unmet need, abortion, fertility transition, family planning, role of private sector and choice of contraceptive (Mishra & Irudaya Rajan, 1996; Mishra et al., 1996; 1997; Pandey et al., 1997; Ramanathan et al., 1997; Irudaya Rajan et al., 1997; 1997). Table 7 provides the status of vaccination such as BCG, DPT, Polio and Measles of children aged 12-23 months. Children vaccinated against BCG, measles, DPT (three doses) and Polio have been classified as **ALL.** In states which reported high infant and child mortality, the proportion of children who had received all vaccinations is extremely low. The percentage is below 25 for the following states (Rajasthan in North India, Uttar Pradesh in Central India, Bihar in East India, Arunachal Pradesh, Assam, Meghalya and Nagaland in Northeast India). Children who have received none of the four vaccinations are also high in these states. It is high time the central government streamlined the child health and vaccination program so that all children born during the Ninth Plan period are vaccinated against common childhood diseases. Through a vigorous maternal and child health system the family planning program acceptance is also likely to gain momentum (Mishra, Roy & Irudaya Rajan, 1997).

The sample registration system has recently published the expectation of life at birth by sex for the period 1970-75 and 1989-93 (table 8). It is observed that

**Table 5:** Estimates of Birth and Death Rates, 1995

| States & Union Territories | Crude Birth Rate | | | Crude Death Rate | | |
|---|---|---|---|---|---|---|
| | Total | Rural | Urban | Total | Rural | Urban |
| India* | 28.3 | 30.0 | 22.6 | 9.0 | 9.7 | 6.5 |
| *Major States* | | | | | | |
| Andhra Pradesh | 24.0 | 24.6 | 22.0 | 8.3 | 9.0 | 5.9 |
| Assam | 29.3 | 30.2 | 21.8 | 9.6 | 10.0 | 6.7 |
| Bihar | 32.1 | 33.0 | 23.8 | 10.5 | 10.9 | 6.7 |
| Gujarat | 26.7 | 28.0 | 24.0 | 7.6 | 8.3 | 6.2 |
| Haryana | 30.0 | 31.3 | 25.2 | 8.0 | 8.4 | 6.7 |
| Karnataka | 24.2 | 25.1 | 22.1 | 7.6 | 8.5 | 5.6 |
| Kerala | 17.7 | 17.7 | 17.5 | 6.0 | 6.0 | 6.0 |
| Madhya Pradesh | 33.0 | 34.8 | 23.9 | 11.1 | 11.8 | 7.7 |
| Maharashtra | 24.5 | 25.9 | 22.4 | 7.4 | 8.9 | 5.3 |
| Orissa | 27.7 | 28.5 | 22.0 | 10.8 | 11.2 | 7.4 |
| Punjab | 24.7 | 26.0 | 20.8 | 7.3 | 7.8 | 6.1 |
| Rajasthan | 33.2 | 34.7 | 26.6 | 9.1 | 9.5 | 7.1 |
| Tamil Nadu | 20.2 | 20.9 | 18.6 | 7.9 | 8.7 | 6.4 |
| Uttar Pradesh | 34.7 | 35.9 | 28.8 | 10.4 | 10.8 | 8.2 |
| West Bengal | 23.6 | 26.1 | 16.8 | 7.7 | 8.0 | 7.0 |
| *Smaller States* | | | | | | |
| Arunachal Pradesh | 23.8 | 24.5 | 15.8 | 6.0 | 6.3 | 1.9 |
| Goa | 14.3 | 14.9 | 13.5 | 7.3 | 8.2 | 6.0 |
| Himachal Pradesh | 25.2 | 25.2 | 17.9 | 8.6 | 8.8 | 6.1 |
| Manipur | 20.3 | 21.3 | 17.7 | 6.7 | 6.9 | 6.0 |
| Meghalaya | 28.9 | 31.7 | 14.8 | 8.9 | 9.6 | 5.1 |
| Nagaland | N.A. | N.A. | 13.3 | N.A. | N.A. | 1.5 |
| Sikkim | 22.5 | 22.8 | 16.4 | 6.9 | 7.0 | 3.0 |
| Tripura | 18.7 | 18.9 | 17.7 | 7.6 | 7.8 | 6.6 |
| *Union Territories* | | | | | | |
| Andaman & Nicobar Islands | 18.7 | 19.0 | 17.6 | 5.7 | 6.5 | 3.4 |
| Chandigarh | 18.5 | 20.6 | 18.3 | 5.1 | 4.7 | 5.1 |
| Dadra & Nagar Haveli | 29.7 | 29.4 | 32.2 | 8.2 | 8.6 | 5.0 |
| Daman & Diu | 21.8 | 23.4 | 20.5 | 8.0 | 7.7 | 8.3 |
| Delhi | 22.6 | 19.9 | 22.8 | 5.9 | 5.1 | 5.9 |
| Lakshadweep | 25.5 | 24.8 | 26.1 | 7.7 | 5.0 | 10.1 |
| Pondicherry | 19.8 | 21.4 | 18.7 | 7.3 | 8.9 | 6.3 |

\* Excludes Jammu & Kashmir and Mizoram; N.A. – not available due to non receipt of returns; Crude birth rate is defined as births per thousand population; Crude death rate is defined as deaths per thousand population.

*Source:* Communication from the Sample Registration System, Office of the Registrar General, New Delhi.

**Table 6:** Estimates of Infant and Child Mortality from 1991 Census

| States & Union Territories | | Infant Mortality (Q1) | | | Child Mortality (Q5) | | |
|---|---|---|---|---|---|---|---|
| | | Person | Male | Female | Person | Male | Female |
| Andhra Pradesh | Total | 49 | 51 | 45 | 68 | 68 | 67 |
| | Rural | 54 | 56 | 50 | 78 | 78 | 76 |
| | Urban | 31 | 33 | 29 | 41 | 43 | 40 |
| Assam | Total | 85 | 86 | 83 | 111 | 112 | 108 |
| | Rural | 87 | 89 | 86 | 115 | 117 | 113 |
| | Urban | 57 | 56 | 59 | 63 | 61 | 64 |
| Bihar | Total | 70 | 61 | 79 | 89 | 76 | 104 |
| | Rural | 73 | 63 | 82 | 94 | 80 | 111 |
| | Urban | 48 | 44 | 53 | 54 | 48 | 61 |
| Gujarat | Total | 69 | 66 | 72 | 77 | 69 | 85 |
| | Rural | 78 | 75 | 82 | 90 | 81 | 101 |
| | Urban | 49 | 46 | 52 | 51 | 46 | 56 |
| Haryana | Total | 55 | 52 | 56 | 72 | 66 | 79 |
| | Rural | 58 | 56 | 60 | 81 | 73 | 90 |
| | Urban | 30 | 37 | 39 | 49 | 44 | 44 |
| Himachal | Total | 73 | 76 | 69 | 91 | 95 | 87 |
| | Rural | 74 | 78 | 70 | 94 | 98 | 91 |
| | Urban | 54 | 56 | 51 | 52 | 55 | 50 |
| Karnataka | Total | 60 | 62 | 57 | 81 | 80 | 83 |
| | Rural | 65 | 68 | 63 | 91 | 89 | 93 |
| | Urban | 45 | 47 | 43 | 57 | 56 | 58 |
| Kerala | Total | 37 | 36 | 38 | 46 | 44 | 47 |
| | Rural | 38 | 38 | 39 | 48 | 46 | 49 |
| | Urban | 30 | 29 | 34 | 39 | 37 | 42 |
| Madhya Pradesh | Total | 108 | 105 | 110 | 145 | 138 | 152 |
| | Rural | 115 | 113 | 118 | 160 | 153 | 167 |
| | Urban | 74 | 71 | 77 | 89 | 83 | 94 |
| Maharashtra | Total | 58 | 59 | 56 | 79 | 75 | 81 |
| | Rural | 65 | 67 | 62 | 90 | 90 | 90 |
| | Urban | 39 | 40 | 37 | 47 | 48 | 46 |
| Orissa | Total | 108 | 106 | 110 | 136 | 131 | 141 |
| | Rural | 112 | 110 | 115 | 143 | 138 | 148 |
| | Urban | 76 | 78 | 74 | 88 | 82 | 95 |
| Punjab | Total | 54 | 53 | 55 | 61 | 58 | 65 |
| | Rural | 61 | 60 | 61 | 73 | 71 | 77 |
| | Urban | 37 | 36 | 39 | 34 | 33 | 36 |
| Rajasthan | Total | 81 | 79 | 83 | 109 | 101 | 118 |
| | Rural | 88 | 87 | 91 | 121 | 111 | 131 |
| | Urban | 53 | 52 | 54 | 66 | 62 | 64 |
| Tamil Nadu | Total | 53 | 52 | 53 | 69 | 66 | 72 |
| | Rural | 58 | 58 | 58 | 77 | 72 | 82 |
| | Urban | 42 | 41 | 41 | 52 | 52 | 52 |
| Uttar Pradesh | Total | 89 | 84 | 94 | 120 | 107 | 135 |
| | Rural | 94 | 90 | 100 | 132 | 118 | 149 |
| | Urban | 58 | 55 | 61 | 69 | 63 | 77 |

*(Table 6 Contd.)*

| States & Union Territories | | Infant Mortality (Q1) | | | Child Mortality (Q5) | | |
|---|---|---|---|---|---|---|---|
| | | Person | Male | Female | Person | Male | Female |
| West Bengal | Total | 67 | 65 | 69 | 88 | 84 | 92 |
| | Rural | 72 | 70 | 74 | 100 | 96 | 104 |
| | Urban | 45 | 42 | 48 | 69 | 82 | 54 |
| Arunachal Pradesh | Total | 83 | 86 | 79 | 139 | 142 | 133 |
| | Rural | 90 | 93 | 86 | 152 | 155 | 149 |
| | Urban | 48 | 52 | 44 | 62 | 59 | 65 |
| Delhi | Total | 49 | 48 | 49 | 56 | 55 | 57 |
| | Rural | 56 | 57 | 56 | 74 | 70 | 79 |
| | Urban | 48 | 47 | 48 | 54 | 53 | 55 |
| Goa | Total | 34 | 37 | 32 | 49 | 48 | 50 |
| | Rural | 39 | 41 | 37 | 56 | 55 | 57 |
| | Urban | 30 | 32 | 28 | 39 | 38 | 42 |
| Manipur | Total | 36 | 37 | 35 | 37 | 36 | 39 |
| | Rural | 35 | 36 | 34 | 39 | 37 | 41 |
| | Urban | 38 | 38 | 37 | 33 | 32 | 34 |
| Meghalaya | Total | 76 | 78 | 74 | 98 | 100 | 97 |
| | Rural | 81 | 83 | 79 | 106 | 108 | 104 |
| | Urban | 50 | 51 | 49 | 60 | 62 | 59 |
| Mizoram | Total | 54 | 59 | 52 | 601 | 73 | 65 |
| | Rural | 83 | 84 | 82 | 92 | 98 | 87 |
| | Urban | 24 | 30 | 22 | 23 | 44 | 38 |
| Nagaland | Total | 56 | 54 | 58 | 58 | 57 | 60 |
| | Rural | 58 | 58 | 58 | 60 | 58 | 63 |
| | Urban | 50 | 44 | 56 | 52 | 52 | 52 |
| Sikkim | Total | 57 | 58 | 56 | 84 | 87 | 81 |
| | Rural | 57 | 58 | 57 | 86 | 90 | 85 |
| | Urban | 48 | 57 | 38 | 54 | 56 | 51 |
| Tripura | Total | 78 | 84 | 71 | 101 | 101 | 100 |
| | Rural | 81 | 87 | 74 | 103 | 106 | 104 |
| | Urban | 60 | 65 | 55 | 73 | 74 | 71 |
| Andaman & Nicobar islands | Total | 49 | 50 | 49 | 69 | 72 | 64 |
| | Rural | 54 | 55 | 53 | 78 | 82 | 73 |
| | Urban | 37 | 35 | 38 | 41 | 42 | 41 |
| Chandigarh | Total | 46 | 50 | 42 | 43 | 45 | 41 |
| | Rural | 53 | 58 | 49 | 62 | 64 | 60 |
| | Urban | 45 | 48 | 40 | 41 | 43 | 39 |
| Daman & Diu | Total | 55 | 61 | 48 | 75 | 75 | 74 |
| | Rural | 53 | 62 | 52 | 59 | 60 | 58 |
| | Urban | 56 | 65 | 46 | 85 | 85 | 85 |
| Pondicherry | Total | 47 | 52 | 43 | 67 | 68 | 66 |
| | Rural | 52 | 55 | 49 | 76 | 78 | 73 |
| | Urban | 45 | 50 | 39 | 62 | 63 | 61 |

**Note:** Estimated by S. Irudaya Rajan & P. Mohanachandran from the 1991 census data; The district level estimates of infant and child mortality are available with the authors.

Infant mortality rate is defined as infant deaths per 1000 live births.

**Table 7:** Vaccination Status of Children by States

| State | BCG | DPT | | | Polio | | | Measles | All | None |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 1 | 2 | 3 | | | |
| India | 62.2 | 66.3 | 59.2 | 51.7 | 67.0 | 61.2 | 53.4 | 42.2 | 35.4 | 30.0 |
| *North* | | | | | | | | | | |
| Delhi | 90.1 | 89.0 | 81.9 | 71.6 | 88.8 | 85.1 | 75.0 | 69.6 | 57.8 | 6.7 |
| Haryana | 77.4 | 80.4 | 75.0 | 66.8 | 80.5 | 75.4 | 67.7 | 60.9 | 53.5 | 17.5 |
| Himachal Pradesh | 84.5 | 90.1 | 83.8 | 78.2 | 90.1 | 85.9 | 77.7 | 71.5 | 62.9 | 8.7 |
| Jammu & Kashmir | 81.3 | 83.7 | 82.3 | 77.8 | 83.8 | 82.4 | 77.1 | 69.1 | 65.7 | 16.2 |
| Punjab | 77.4 | 81.9 | 78.5 | 73.6 | 82.2 | 78.2 | 73.4 | 64.8 | 61.9 | 17.5 |
| Rajasthan | 45.7 | 47.8 | 38.6 | 29.7 | 48.8 | 41.2 | 32.8 | 31.2 | 21.1 | 48.5 |
| *Central* | | | | | | | | | | |
| Madhya Pradesh | 56.8 | 60.8 | 53.5 | 43.7 | 62.8 | 56.7 | 46.6 | 40.7 | 29.2 | 34.4 |
| Uttar Pradesh | 48.9 | 52.2 | 41.8 | 34.1 | 51.8 | 44.7 | 37.1 | 26.3 | 19.8 | 43.3 |
| *East* | | | | | | | | | | |
| Bihar | 33.9 | 42.8 | 37.0 | 29.1 | 45.0 | 40.6 | 31.6 | 14.6 | 10.7 | 53.5 |
| Orissa | 63.3 | 69.0 | 63.6 | 56.3 | 70.3 | 64.8 | 56.7 | 40.2 | 36.1 | 28.0 |
| West Bengal | 63.1 | 73.7 | 62.9 | 51.9 | 75.2 | 66.6 | 56.0 | 42.5 | 34.2 | 22.4 |
| *Northeast* | | | | | | | | | | |
| Arunachal Pradesh | 46.3 | 50.0 | 45.6 | 38.8 | 48.1 | 44.4 | 38.8 | 27.5 | 22.5 | 47.5 |
| Assam | 48.2 | 53.4 | 42.2 | 31.0 | 54.2 | 42.9 | 32.7 | 25.8 | 19.4 | 43.6 |
| Manipur | 63.8 | 66.1 | 55.9 | 43.3 | 63.8 | 51.2 | 39.4 | 37.0 | 29.1 | 32.3 |
| Meghalaya | 43.8 | 36.8 | 30.6 | 22.9 | 36.1 | 31.9 | 23.6 | 13.2 | 9.7 | 54.9 |
| Mizoram | 7.3 | 83.6 | 80.0 | 71.8 | 80.9 | 76.4 | 69.1 | 65.5 | 56.4 | 14.5 |
| Nagaland | 19.4 | 21.3 | 16.9 | 12.5 | 21.9 | 18.8 | 15.0 | 10.0 | 3.8 | 75.0 |
| Tripura | 39.7 | 57.0 | 43.8 | 32.2 | 57.0 | 43.0 | 32.2 | 28.9 | 19.0 | 42.1 |
| *West* | | | | | | | | | | |
| Goa | 93.5 | 93.9 | 90.0 | 86.7 | 94.3 | 90.7 | 87.1 | 77.8 | 74.9 | 5.4 |
| Gujarat | 77.1 | 77.8 | 71.4 | 63.8 | 77.8 | 71.2 | 62.9 | 55.9 | 49.8 | 18.9 |
| Maharashtra | 86.9 | 90.0 | 85.9 | 83.1 | 90.2 | 85.5 | 81.6 | 70.2 | 64.1 | 7.5 |
| *South* | | | | | | | | | | |
| Andhra Pradesh | 73.9 | 77.3 | 72.3 | 66.1 | 78.9 | 74.6 | 68.0 | 53.8 | 45.0 | 17.5 |
| Karnataka | 81.7 | 80.6 | 76.6 | 70.7 | 81.9 | 77.7 | 71.4 | 54.9 | 52.2 | 15.2 |
| Kerala | 86.1 | 84.8 | 81.5 | 73.7 | 85.1 | 82.3 | 75.2 | 60.5 | 54.4 | 11.4 |
| Tamil Nadu | 91.7 | 95.0 | 92.2 | 86.5 | 94.1 | 91.0 | 85.3 | 71.6 | 64.9 | 3.3 |

Header note: Percentage vaccinated among children aged 12-23 months

1 Children who are fully vaccinated (those who have received BCG, measles and three doses of DPT and polio vaccine)
*Source:* National Family Health Survey, 1992-93.

females have achieved accelerated improvements in their life expectancy as compared to males. The per annum increase in life expectancy for females is much higher in comparison to that of males in all the major states in India. For instance, the expectation of life at birth among females was one year lower than males in 1970-75 whereas the females have shown an increase of 0.7 years than males in 1989-93 (Sample Registration System, 1996). Let us assess the current demographic profile of India based on the 1991 census. To study the demographic profile over a period of time, we provide the percentage distribution of population by age and sex from the 1961 and 1991 censuses. To explain further, we also produce a projected age composition for India for the period 2021 (table 9). The proportion of children under 4 years has shown an absolute decline of

**Table 8:** Expectation of Life at Birth by Sex, 1970-75 and 1989-93

| | 1970-75 | | 1989-93 | | Per annum Increase | |
| | Male | Female | Male | Female | Male | Female |
|---|---|---|---|---|---|---|
| India* | 50.5 | 49.0 | 59.0 | 59.7 | 0.47 | 0.59 |
| Andhra Pradesh | 48.4 | 49.3 | 59.5 | 61.5 | 0.62 | 0.68 |
| Assam | 46.2 | 44.8 | 54.6 | 55.3 | 0.47 | 0.58 |
| Bihar$ | 54.2 | 51.2 | 59.7 | 57.2 | 0.69 | 0.71 |
| Gujarat | 48.8 | 48.8 | 59.0 | 61.1 | 0.57 | 0.68 |
| Haryana | 59.0 | 55.6 | 62.5 | 63.7 | 0.19 | 0.45 |
| Himachal Pradesh | 54.8 | 50.9 | 63.6 | 63.6 | 0.49 | 0.71 |
| Karnataka | 55.4 | 55.1 | 60.2 | 63.5 | 0.27 | 0.47 |
| Kerala | 60.8 | 63.3 | 68.8 | 74.7 | 0.44 | 0.63 |
| Madhya Pradesh | 47.6 | 46.3 | 54.1 | 53.8 | 0.36 | 0.42 |
| Maharashtra | 53.3 | 54.5 | 63.0 | 65.4 | 0.54 | 0.61 |
| Orissa | 46.0 | 45.3 | 55.7 | 55.3 | 0.54 | 0.56 |
| Punjab | 59.0 | 56.8 | 65.2 | 67.6 | 0.34 | 0.60 |
| Rajasthan | 49.2 | 47.5 | 57.4 | 58.5 | 0.46 | 0.61 |
| Tamil Nadu | 49.6 | 49.6 | 61.4 | 63.4 | 0.66 | 0.77 |
| Uttar Pradesh | 45.4 | 40.5 | 56.5 | 55.1 | 0.62 | 0.81 |
| West Bengal$ | 56.8 | 58.0 | 60.8 | 62.3 | 0.50 | 0.54 |

* Excludes Jammu & Kashmir; $ relates to 1981-85.
*Source:* SRS Analytical Studies, Report No. 1 of 1996, Registrar General India, New Delhi.

**Table 9:** Percentage Distribution of Population by Five-year Age Groups and sex for India, 1961, 1991 and 2021

| | Males | | | Females | | |
| | 1961 | 1991 | 2021 | 1961 | 1991 | 2021 |
|---|---|---|---|---|---|---|
| 0-4 | 14.7 | 12.2 | 8.7 | 15.5 | 12.5 | 8.7 |
| 5-9 | 14.6 | 13.3 | 9.0 | 14.9 | 13.4 | 9.0 |
| 10-14 | 11.6 | 12.0 | 9.0 | 10.8 | 11.6 | 9.0 |
| 15-19 | 8.2 | 9.8 | 8.7 | 8.1 | 9.2 | 8.6 |
| 20-24 | 8.0 | 8.7 | 8.2 | 9.0 | 9.2 | 8.1 |
| 25-29 | 8.2 | 8.0 | 7.7 | 8.5 | 8.6 | 7.6 |
| 30-34 | 7.1 | 6.9 | 7.9 | 7.0 | 7.9 | 8.0 |
| 35-39 | 6.0 | 6.4 | 7.4 | 5.6 | 6.2 | 7.4 |
| 40-44 | 5.3 | 5.3 | 7.1 | 5.1 | 4.9 | 6.8 |
| 45-49 | 4.3 | 4.4 | 5.8 | 3.9 | 4.3 | 5.5 |
| 50-54 | 4.0 | 3.9 | 4.9 | 3.8 | 3.5 | 5.1 |
| 55-59 | 2.3 | 2.5 | 4.3 | 2.1 | 2.6 | 4.7 |
| 60-64 | 2.5 | 2.8 | 3.7 | 2.6 | 2.7 | 3.8 |
| 65-69 | 1.1 | 1.5 | 3.0 | 1.1 | 1.6 | 2.9 |
| 70+ | 1.9 | 2.5 | 4.6 | 2.1 | 2.5 | 4.6 |

2.5 points among males and 3 points among females between 1961-91 indicating the fertility transition of the country. Some age groups also have shown an increase from 1961-91 probably due to the low levels of mortality in those age groups. However, after the age 55 and above, both sexes have shown a marginal increase of the aged population in the country. The projected proportion for 2021 also reveals a similar situation. As the state of Kerala is ahead in the demographic transition (Zachariah & Irudaya Rajan, 1997a; 1997b; Zachariah et al., 1994; Irudaya Rajan & Zachariah, 1996), we provide age pyramids for Kerala and India for the periods 1961, 1991 and 2021 for comparison (Figs. 1 and 2; table 10).

**Table 10:** Percentage Distribution of Population by Five-year Age Groups and sex for Kerala, 1961, 1991 and 2021

|  | Males | | | Females | | |
|---|---|---|---|---|---|---|
|  | 1961 | 1991 | 2021 | 1961 | 1991 | 2021 |
| 0-4 | 15.29 | 9.53 | 6.18 | 14.61 | 8.79 | 5.39 |
| 5-9 | 14.84 | 10.16 | 6.65 | 14.07 | 9.43 | 5.85 |
| 10-14 | 13.48 | 11.00 | 7.02 | 12.97 | 10.38 | 6.21 |
| 15-19 | 8.25 | 10.30 | 6.94 | 8.70 | 10.50 | 6.30 |
| 20-24 | 8.11 | 10.33 | 6.39 | 8.84 | 11.07 | 6.11 |
| 25-29 | 7.22 | 8.83 | 5.68 | 8.04 | 9.46 | 5.62 |
| 30-34 | 6.24 | 7.31 | 6.93 | 6.45 | 7.18 | 6.87 |
| 35-39 | 6.06 | 7.08 | 7.68 | 5.89 | 7.01 | 7.61 |
| 40-44 | 4.55 | 5.34 | 7.57 | 4.36 | 4.90 | 7.58 |
| 45-49 | 4.31 | 4.60 | 7.61 | 4.12 | 4.59 | 8.02 |
| 50-54 | 3.33 | 3.66 | 7.52 | 3.29 | 3.65 | 8.13 |
| 55-59 | 2.63 | 3.26 | 6.53 | 2.60 | 3.45 | 6.99 |
| 60-64 | 2.18 | 2.93 | 5.41 | 2.28 | 3.08 | 5.56 |
| 65-69 | 1.42 | 2.28 | 4.52 | 1.48 | 2.53 | 4.62 |
| 70-74 | 0.97 | 1.40 | 3.32 | 1.05 | 1.57 | 3.53 |
| 75+ | 1.09 | 1.76 | 4.04 | 1.22 | 2.14 | 5.62 |

*Source:* Calculated by the authors from the 1961 and 1991 census data; 2021 data are taken from the projections made by K.C. Zachariah & S. Irudaya Rajan, Centre for Development Studies, Trivandrum.

**Table 11:** Expectation of Life at Birth and Total Fertility Rate Assumed in the Projections, India, 1991-2051

|  | Expectation of Life at Birth | | Total Fertility Rate |
|---|---|---|---|
|  | Males | Females |  |
| 1991-1996 | 61.6 | 62.2 | 3.4 |
| 1996-2001 | 63.6 | 64.2 | 3.2 |
| 2001-2006 | 65.1 | 66.0 | 3.0 |
| 2006-2011 | 66.6 | 67.5 | 2.8 |
| 2011-2016 | 68.1 | 69.0 | 2.6 |
| 2016-2021 | 69.6 | 70.5 | 2.4 |
| 2021-2026 | 70.6 | 71.5 | 2.2 |
| 2026-2031 | 71.6 | 72.5 | 2.0 |
| 2031-2036 | 72.6 | 73.5 | 2.0 |
| 2036-2041 | 73.1 | 74.0 | 2.0 |
| 2041-2046 | 73.6 | 74.5 | 1.8 |
| 2046-2051 | 74.1 | 75.0 | 1.8 |

**Note:** The above values are taken from the projections made by S. Irudaya Rajan, Centre for Development Studies, Trivandrum.

If the current decline of fertility and mortality continues in the future, what is the likely demographic scenario for the country for the next 60 years? To answer this question, we have projected India's population for the period 1996 to 2051 using the 1991 census age profile. The levels of fertility and mortality assumed in the projections are presented in table 9. The expectation of life at birth for males may increase from 63.6 in 1996-2001 to 74.1 in 2046-51 whereas the same rates for females are likely to be 64.2 and 75.0 respectively.

**Table 12:** Population Projections, 1996-2051 (In Million)

|  | V & V | Total | Number | | | Proportion | | |
|---|---|---|---|---|---|---|---|---|
|  |  |  | 0-14 | 15-59 | 60 + | 0-14 | 15-59 | 60 + |
| 1996 | 929 | 913 | 317 | 532 | 64 | 34.72 | 58.27 | 7.01 |
| 2001 | 1011 | 991 | 322 | 594 | 75 | 32.49 | 59.94 | 7.57 |
| 2006 | 1089 | 1073 | 327 | 657 | 89 | 30.48 | 61.23 | 8.29 |
| 2011 | 1160 | 1155 | 341 | 708 | 106 | 29.52 | 61.30 | 9.18 |
| 2016 | 1222 | 1234 | 350 | 759 | 125 | 28.36 | 61.51 | 10.13 |
| 2021 | 1283 | 1305 | 349 | 809 | 147 | 26.74 | 61.99 | 11.26 |
| 2026 | 1345 | 1365 | 338 | 855 | 172 | 24.76 | 62.64 | 12.60 |
| 2031 | 1403 | 1414 | 320 | 898 | 196 | 22.63 | 63.51 | 13.86 |
| 2036 | 1457 | 1463 | 312 | 930 | 221 | 21.33 | 63.57 | 15.11 |
| 2041 | 1504 | 1508 | 312 | 940 | 256 | 20.69 | 62.33 | 16.98 |
| 2046 | 1548 | 1535 | 306 | 942 | 287 | 19.93 | 61.37 | 18.70 |
| 2051 | 1589 | 1553 | 294 | 941 | 318 | 18.93 | 60.59 | 20.48 |

**Note:** V & V refer to Visaria and Visaria, 1996. The authors have used the 1991 age distribution, however Visaria and Visaria have used the SRS age distribution. The above projected figures are taken from the projections made by S. Irudaya Rajan, Centre for Development Studies, Trivandrum.
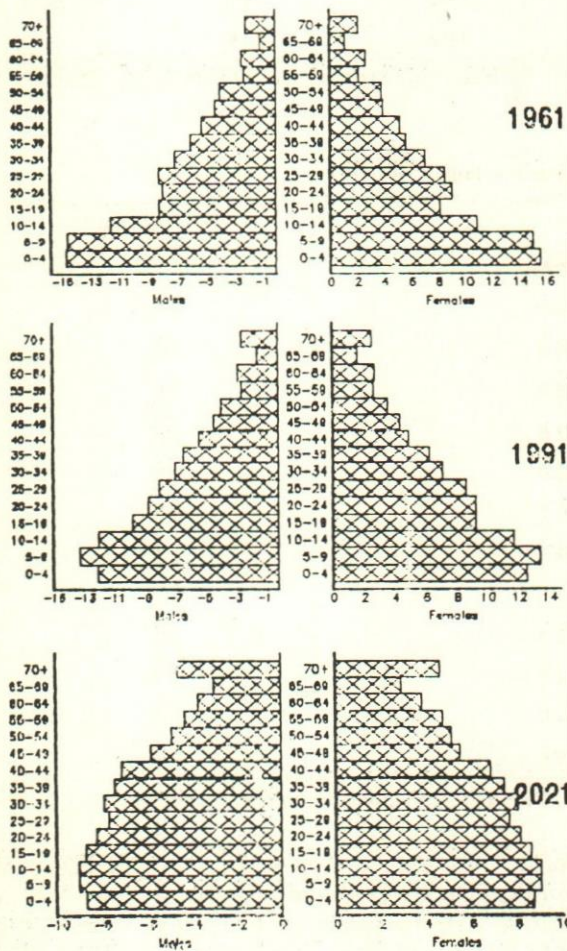


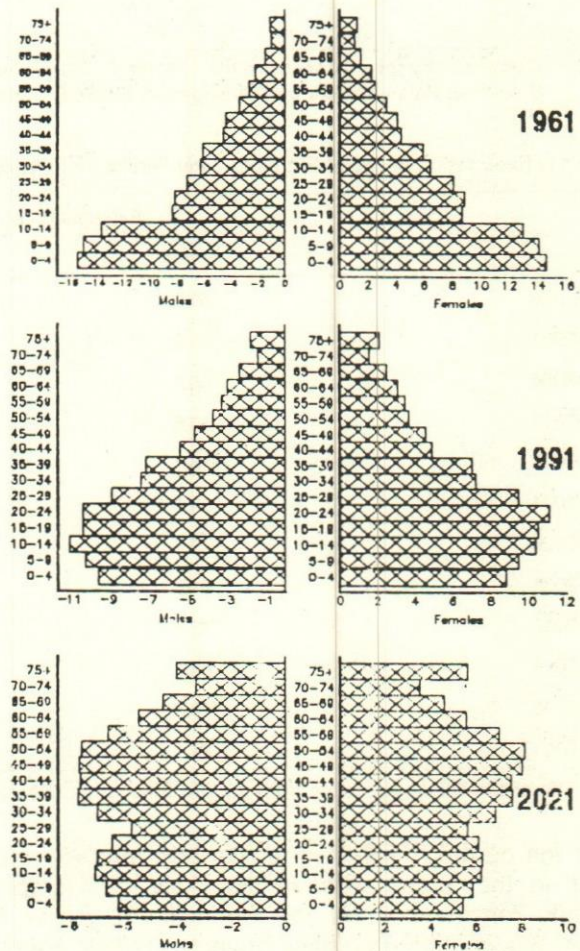**Fig. 1.** Age Pyramids for Kerala



**Fig. 2.** Age Pyramids for India

*Demographic Issues Before the Ninth Five Year Plan*

The prevailing level of total fertility rate TFR is 3.4 per woman and we have projected the TFR to be reaching 2 in 2026-31, 1.8 in 2046-51 (table 11).

Some results of the long-term projections are presented in table 12. We have provided the population size along with the number and proportion of the broad age composition such as children, adults and the aged. Along with our projections, we have also included the projections made by Leela Visaria and Pravin Visaria (1996) for a comparison. From the table it can be observed that in the year 2001, India's population size is likely to be 1 billion which will reach 1.3 billion in 2021 and 1.6 million in 2051. According to the United Nations 1994 assessment, India is likely to be heading the first rank in population size in the world, overtaking China around 2045 (United Nations, 1995).

The proportion of children is expected to decline from 35 in 1996 to 27 in 2021 and 20 in 2051 whereas the proportion of aged is expected to increase from the current level of 7 in 1996 to 11 in 2021 and 21 in 2026. The year 2051 is likely to see more old people in India than children. The working age proportion is hovering around 60 throughout the period 1996-2051.

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# Infrastructure & Human Development

**Arup Mitra**

*The author analyses the strong association between the existence of infrastructure and economic growth. He also deals with the complex issue of Rural-Urban migration with the reverse flow of rural growth utilising urban infrastructure without the overcrowding and other disadvantages of urban areas. Policies would do well to consider these implications to bring about tangible results in human development.*

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The basic prerequisite for economic growth, employment generation and for overall human development is the adequate supply of physical and social infrastructure. Quality of life and productivity are intimately related to the availability of infrastructure — major infrastructure failures can lead to a massive deterioration in the activities of households and in economic production, illustrating infrastructure's multi-dimensional impact on human development.

## Infrastructure & Growth

Infrastructure plays a crucial role in diversifying production, expanding trade, coping with population growth, reducing poverty and in improving environmental conditions. One per cent increase in the stock of infrastructure is associated with one per cent increase in GDP across all countries (World Bank, 1994). A strong association exists between the availability of certain infrastructure — telecommunications, power, paved roads, and access to safe water — and per capita GDP. The links between growth and infrastructure work both ways, that is, infrastructure causes growth and, again, growth causes infrastructure investment. The effect of growth on overall living standards is positive provided it percolates down to those located in the lower echelons of the socio-economic ladder. Otherwise growth accentuates the inequality, leaving the poor unbenefitted. The direction in the growth of infrastructure in this context is important, especially in enabling the poor households to benefit from the effects of growth. Economic growth

> **Infrastructure shortage has often affected production, technical efficiency and total factor productivity growth in industries, although in terms of growth rates, the performance of the infrastructure sector has not been all that unimpressive.**

**Table 1:** Trends in the Performance of Infrastructure Sectors

| | Change over Previous Year (%) | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1985-90 Average | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 | 1995-96 |
| *Energy* | | | | | | | |
| *Coal* | | | | | | | |
| Production | 6.4 | 5.4 | 8.3 | 3.9 | 3.3 | 3.2 | 6.4 |
| Pit-head stocks | – | 13.7 | 14.5 | 5.3 | –1.2 | –8.4 | 0.7 |
| Despatches | – | 4.8 | 8.8 | 5.6 | 5.0 | 2.4 | 6.4 |
| Electricity Generated (utilities only) | 9.4 | 7.7 | 8.5 | 4.9 | 7.5 | 8.5 | 9.9 |
| *Petroleum* | | | | | | | |
| Crude oil production | 3.3 | –3.1 | –8.1 | –11.2 | 0.3 | 19.3 | 11.6 |
| Refinery throughput | 8.0 | –0.3 | –0.7 | 4.0 | 1.5 | 3.8 | 3.0 |
| *Transport and Communication* | | | | | | | |
| Railway revenue-earning goods traffic | 5.6 | 2.7 | 6.2 | 3.6 | 2.5 | 1.7 | 5.7 |
| Cargo handled at major ports | 6.9 | 3.0 | 3.3 | 5.7 | 7.6 | 10.0 | 11.1 |
| Telecommunications new telephone connections provided | 16.6 | 14.7 | 51.5 | 34.2 | 24.5 | 44.0 | 32.5 |

*Source*: Economic Survey 1995-96, Government of India.

resulting from infrastructure development generates positive effects on human development provided it is employment intensive. In the Indian context, infrastructure shortage has often affected production, technical efficiency and total factor productivity growth in industries, although in terms of growth rates, the performance of the infrastructure sector has not been all that unimpressive (table 1).

Different infrastructure sectors have different effects on improving the quality of life and reducing poverty. Water supply and sanitation have direct consumption benefits in reducing mortality and morbidity and increasing productivity. Transport and irrigation raise the level of incomes enabling the poor to manage risks. Inexpensive public transport enables the unemployed and poor to develop access to the job market.

Although infrastructure variables are positively and significantly correlated with growth, major benefits in economic growth, poverty alleviation, and environmental sustainability can be attained by increasing the supply of infrastructure provided it generates services that respond efficiently to effective demand. Irrigation infrastructure can be both beneficial and harmful. It can reduce pressure on land resources by permitting greater intensity of cultivation on existing plots, and at the same time it can also promote excessive water usage leading to ground water salinization and land subsistence.

Here it may be interesting to give a definition of infrastructure. Following the World Development Report, (World Bank, 1994) the term economic infrastructure may be taken to include public utilities (power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal and piped gas), public works (roads, and major dam and canal works for irrigation and drainage), and other transport sectors (urban and inter-urban railways, urban transport, ports and waterways and airports). Industry divisions like transport, storage and communication and electricity, gas and water together account for slightly more than 5 per cent of the value added in low income countries and public infrastructure accounts for 2 to 8 per cent of GDP. In India about 5 per cent of GDP originates from the sector, transport, storage and communication, and in terms of employment share, this sector constitutes about 2.8 per cent of the workforce (1991).

Although the positive effects of infrastructure are widely cited, evidence exists to suggest that projects like construction of dams and other major irrigation ventures have often led to involuntary displacement of communities, loss of land and so on. Rehabilitation schemes which accompany such projects are either not implemented efficiently or are not effective in providing the same quality of land asset to the displaced. Particularly when infrastructure projects are

undertaken by the private providers, the poor are the greatest sufferers. The government, in such situations, is responsible for creating policies and regulatory frameworks that safeguard the interests of the poor, improve environmental conditions and coordinate cross-sectional interactions. Experiments with alternative ways of providing infrastructure and technological innovations are of crucial importance when infrastructure activities involve strong external effects. Appropriate representation of the infrastructure users and other stakeholders in the planning and regulation of infrastructure services is essential when it involves external diseconomies.

> **Appropriate representation of the infrastructure users and other stakeholders in the planning and regulation of infrastructure services is essential.**

## Rural-Urban Migration & Employment

In the development economics literature, rural-urban migration plays a crucial role in equalising the wages across space, thus eliminating the rural-urban wage differentials and providing opportunities to improve the quality of human resource endowment. In the process of urban growth, the non-labour resources drawn from the rural areas can be ploughed back, as Harriss and Harriss (1984) suggested in two different forms: the resources can be directly reinvested in the rural areas for developmental purposes, or they can be utilised for generating employment opportunities in the urban areas so as to absorb the rural unemployed/under-employed in high productivity activities. Such a pattern of urban growth is then considered as conducive to overall economic development.

In the Indian context, the rural-urban migration rate (defined as the proportion of gross decadal inflow of population to total population at the place of destination) is, however, found to be perceptibly low. An important determinant of rural-urban migration, among various other factors, is the rural-urban (dis)continuum. One way of conceptualising this factor is to bring in the distance variable, and the transport cost associated with it. The lack of transport network between the rural and urban areas reduces the population movement across regions.

The proportion of population residing in urban areas in India increased very modestly over the decade 1981-91. It turned out to be only 25.7 per cent as against the projected level of 27.5 per cent in 1991. The annual rate of growth of urban population, in fact, declined during the eighties as compared to the seventies. Several scholars have tried to analyse the reasons for this slackening of the urbanisation process. Some contend that both natural growth of urban population and rural-urban net migration declined during the period 1981-91 as compared to the preceding decade. It was suggested by some others that the component of urban growth due to reclassification of areas as rural in one census, and then as urban in the following census, fell sharply in 1991. The proponents of this view also suggested that the share of rural-urban migration in total urban growth rose marginally during the eighties over the seventies. However, the collaborative research between the office of the Registrar General, India and the East-West Center, Honolulu and the Bureau of the Census, Washington brings out very interesting results. Urban population rose to the extent of 49.45 million during 1971-81. In the subsequent decade, the increase was as much as 56.45 million. Natural increase accounted for 49.75 per cent of the total urban growth in the seventies, and its share shot up to 59.98 per cent in the next decade. The relative contribution made by area reclassification declined marginally from 18.85 per cent to 17.40 per cent in the same period, although in absolute terms, there was a nominal rise from 9.32 million to 9.82 million. The net rural-urban migration (decadal), on the other hand, registered a considerable decline even in absolute terms. Around 19.73 million people were estimated as net migrants over the decade 1971-81. This figure decelerated to 12.73 million during 1981-91 reducing its relative share in the total increase in urban population, from 39.40 per cent to 22.62 per cent. The decline in the growth rate of urban population in the last decade can, therefore, be attributed mainly to the decline in net rural-urban migration.

> **Both natural growth of urban population and rural-urban net migration declined during the period 1981-91 as compared to the preceding decade.**

The decline in the incidence of rural poverty during the period 1983 and 1987-88 was sharper (around 6.5 percentage point) than its urban counterpart (around 2 percentage point). Some scholars felt that this was mainly because the rural poor transferred their poverty to the urban areas. However, in the face of a declining rural-urban net migration as mentioned, it is quite difficult to hold such a view. Besides, the elasticity of urban poverty with respect to rural poverty as estimated in technical exercises, turns out to be extremely low, (Mills & Mitra, 1996).

What could have possibly caused rural-urban migration to fall? An important factor is the sluggish employment growth in the organised sector. Despite the fact that industrial value added growth rate accelerated during the eighties, the percentage of workforce engaged in non-household manufacturing dropped due to the adoption of capital intensive technology. The decline in infrastructure investment also reduced the pace of movement of population from rural to urban areas in the last decade.

> **The decline in infrastructure investment also reduced the pace of movement of population from rural to urban areas in the last decade.**

## Agglomeration Economies

Infrastructure investment which is mostly concentrated in the big (million plus) cities in the Indian context, leads to concentration of activities. The literature on agglomeration economies suggests that firms in order to reap the benefits of economies of scale locate in big cities. Firms cluster together into one nucleus in order to exploit localisation economies. This explanation is not just confined to manufacturing—the clustering and concentration of modern services in large metro areas are also explained by urbanisation economies (Henderson, 1988).

Infrastructure investment involves positive externalities and indivisibilities which attract firms engaged in the production of various goods and services to agglomerate so that they can utilise the inputs more efficiently. Resources engaged in the production of goods are more efficient in big cities as compared to medium sized and small towns (Shukla, 1995). An increase of about 9 per cent in factor productivity is achievable with every doubling of city size. However although firms located in big cities are more efficient as compared to their counterparts in medium-sized and small towns, benefits derived from agglomeration economies and infrastructure investment varies from industry to industry. Not all industries benefit equally from a given level of infrastructure [Mitra, forthcoming (a)]. It may be concluded that efficiency of firms, city size and the quantum of infrastructure investment are all in positive relationship with each other.

Attempts have been made in India to disperse industrial growth so as to achieve a balanced industrial growth. However, the review of Indian industrial location policy (Mohan 1993) reveals that the instrument of policy used has been inadequate in greatly altering the distribution of industries across the country. With subsidisation of inputs which is used extensively by the firm and is a poor substitute for other inputs, and infrastructure investment through subsidisation of that public input for which the firm is otherwise more willing to pay high prices, and which is a good substitute for other inputs, industrial growth can be dispersed (Lee, 1985 and Murray, 1988). However, infrastructure investment still continues to be concentrated in million plus cities and, thus, rural-urban migration is directed mainly to such cities. This has led to the overuse of the existing infrastructure facilities in the metropolises, and a steady deterioration in the quality of life including housing conditions and basic amenities (Mitra, 1994).

> **Infrastructure investment still continues to be concentrated in million plus cities and, thus, rural-urban migration is directed mainly to such cities. This has led to the overuse of the existing infrastructure facilities and a steady deterioration in the quality of life including housing conditions and basic amenities.**

## Rural Non-farm Sector

Another important aspect of change perceived during the eighties is related to the rural non-farm sector. Although the urban employment scenario has been quite gloomy, the rural non-farm sector did reveal signs of positive growth. As a study shows in Palampur Village (in Uttar Pradesh), per capita living standards rose between 1957 and 1993 in the face of population growth due partly to expanding non-farm employment.

Two major sets of hypotheses have been extended to explain the growth of the rural non-farm sector. One refers to the residual sector hypothesis according to which surplus labour pushed out from the agricultural sector gets absorbed residually in the rural non-farm sector, in the absence of rural-urban continuum. In other words, due to the lack of infrastructure the rural destitutes are unable to migrate to the urban areas in search of a livelihood, and consequently they end up engaging themselves in petty jobs carried out within the rural non-farm sector. The other hypothesis, however, attributes the growth of this sector to the effects of demand side variables. Evidence exists to suggest that the non-farm sector has been accompanied by a decline in the incidence of rural poverty (Mitra, 1993). Besides, there are many other factors which again suggest that its growth is mostly demand induced rather than being supply-push. An im-

portant finding which emerges from one of our ongoing projects [Mitra, forthcoming (b)] is that the states (and districts) which are relatively more urbanised have recorded increase in the size of the rural non-farm sector. In particular, the rural non-household manufacturing has shown spurts of development in terms of employment. This pattern of change may be explained again in terms of infrastructure development. As concentration of activities and city size increase, economies of scale get dissipated, and there comes a point when diseconomies of scale originating from congestion, and the overuse of infrastructure tend to outweigh the economies of scale. In such situations the second best solution for the firms is to locate in the rural hinterland of the big cities. This enables the firms to continue with their access to the existing infrastructure, marketing and other facilities offered by the city economy, and on the other hand, to reduce the diseconomies arising from factors like over-crowding and increasing land cost. All this is again indicative of the fact that infrastructure plays a dominant role in generating employment, and thus determining the movement of surplus population across space and sectors.

> **Best solution for the firms is to locate in the rural hinterland of the big cities. This enables access to the existing infrastructure, marketing and other facilities offered by the city economy, and, to reduce the diseconomies arising from factors like over-crowding and increasing land cost.**

Rural India's experiences suggest that infrastructure's direct and indirect effects on human development are enormous. A study of two villages (Wangale and Dalema) in rural Karnataka revealed a positive relation between infrastructure and rural living standards. Canal irrigation directly promoted rapid intensification of cultivation in Wangale. In Dalema, the villagers adjusted their way of life significantly in order to capture the indirect economic benefits from the irrigation project. They purchased land outside Dalema, sought positions in the Public Works Department and a nearby sugar mill, and became involved in the transport of the irrigated village's sugarcane to the mill. Thus it emerged as a service centre in the region (World Bank, 1994).

### Integrating Infrastructure with Agriculture and Industry

Another study (Chaudhary, 1994) aiming at examining the interconnection between industrialisation and urbanisation on the one hand and the impact of other variables like agricultural growth and infrastructure development on the other, estimated a three-equation simultaneous system model. Both infrastructure investment and urbanisation are found to raise the level of industrialisation. Agricultural growth however, does not turn out to be a significant determinant of industrialisation. Per capita income — a proxy for economic growth — is positively associated with industrialisation. The incidence of poverty affects per capita income negatively, and industrialisation accentuates the unequal urban growth. However, infrastructure development reduces such unequal urbanisation. Industries tend to get concentrated in and around the big cities in order to reap the advantages of economies of scale, and to reduce the transport cost. On the whole, unequal industrial growth, unequal economic growth and unequal urbanisation all three seem to be in relationship with each other. But such inequalities may be reduced by developing infrastructure across space and reducing poverty through employment generation in the high productivity sector.

### Urban Informal Sector & Infrastructure

Most of the studies have confirmed that at least half of the urban work force are located in the informal sector. Although not all informal sector workers belong to the poor households, considerable overlaps between these two sets have been identified. This is because a large spectrum of the activities conducted in the urban informal sector are characterised by low productivity. It is, therefore, very important to assess the impact of infrastructure development on these informal sector workers.

One of the studies in this context verified that there exists a negative relationship between city size and the size of informal sector employment (Mitra, 1994). Further it was noted that informal sector employment varied inversely with the size of organised industrial employment. It may be inferred that with infrastructure development, concentration of activities increases as firms intend to reap the benefits of external economics of scale by agglomerating in a particular area. This in turn opens up new employment opportunities in the high productivity sector, thus reducing the size of low productivity informal sector. In other words, it opens up possibilities of upward income mobility for those who are engaged in low-income-jobs in the urban informal sector, and improves their accessibility to health, education, housing and other basic amenities.

On the whole, economic growth, as Human Development Report (1995) emphasised, is necessary

though not sufficient for human development. Several suggestions have been made for creating links between growth and human development of which four major ones are as follows: human investment strategy with emphasis on investment in education, health and skills, enabling people to participate in growth and share its benefits, more equitable distribution of income and assets, well-structured social expenditures by government, and empowerment of people.

However, for these strategies to be implemented successfully, infrastructure development is essential. More equitable distribution of income and wealth can be attained not merely by fiscal measures. Utilisation of resources generated for the low income households can be effective only if they result in the creation of asset base of the households, and augment income earning opportunities. Judged from this angle, infrastructure development is a prerequisite for the benefits of growth to percolate down and reach various sections of the population. Physical infrastructure generates high productivity employment opportunities, and with increased incomes the motivation to utilise and the accessibility to social infrastructure improve which result in human development.

## Policy Measures

The New Delhi Action Plan (United Nations Economic and Social Council, 1995) emphasises the need for establishing regional linkages between the institutions active in education, training, research and policy formulation, in the developing countries of the ESCAP region. Availability of physical infrastructure can link isolated rural constituencies to the larger economy and benefit the rural poor. Similarly the development of urban transport can make job opportunities accessible to the urban poor. Some of the Asian Development Bank (ADB) and World Bank proposed projects in this context are as follows:

*Third Ports:* This project includes rehabilitation/replacement of more than 40-year old submarine oil pipelines and upgrading of oil births/loading facilities in Bombay Port; reconstruction of the collapsed old multi-purpose quay at Mormugao Port and reclamation of back-up areas, and augmentation of container handling facilities at Madras Port by extension of quay and storage area and provision of supplementary equipment.

*Haryana Highway Upgrading Project:* This would consist of: consulting services to assist the Haryana Public Works Department in design, tendering and supervision of construction; establishment of road management system; civil works to provide for approximately 800 km of widening and road improvement.

*Second Bombay Urban Transport Project:* The project comprises: rail improvements including new track and upgrading of existing track, signalling systems, rolling stock and station rehabilitation and expansion; road improvements including new roads, upgrading existing road links, and road and rail overpasses; bus improvements; and traffic management systems.

*Bombay Sewage Disposal:* This project would include: the consumption and commissioning of two marine outfalls, each extending three kms into the Arabian Sea; construction of two aerated lagoons; and technical assistance to provide consultant's services for supervision of construction.

*Second Madras Water Supply and Environmental Sanitation:* The four principal components of this project are: construction of raw and clear water transmission mains, ring mains; head works; sewerage system improvements; financing the full preparation, final design and construction of a long term programme to improve sanitation; and institutional strengthening and project support.

*Port Sector Modernization Project:* This project includes: an institutional component covering technical assistance and training to help implement agreed action programmes; and a physical component which would include modernization, upgrading and extending selected existing port infrastructure.

The expert group report on infrastructure (GOI, 1996) has offered extensive suggestions on the commercialisation of infrastructure projects. In several countries the infrastructure sector has been privatised and deregulated in order to improve efficiency and service quality—the Ninth Five Year Plan may draw lessons from such experiences.

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# Food Policies: Need for An Integrated Perspective

M.H. Suryanarayana

*This paper examines the implications of the ongoing economic reforms for planning methodologies and strategies with special reference to policies for food security. It evaluates the Targeted Public Distribution System, examines the current state of food security in its spatial and temporal dimensions and emphasises the need for an integrated and strategic perspective in planning and policy formulations.*

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The ongoing economic reform programme lays emphasis on the role of market in achieving increases in productivity by an efficient allocation of resources. It is in this spirit that many policy reformulations are being done. What is lost sight of in the reform agenda is that considerable scope exists for effective government intervention to ensure an efficient operation of markets and towards this end, for integrating different policies and for improving the efficiency of the vast manpower available in the country by promoting their food and nutrition security. Policy announcements are made independently and are not bound by an overall plan framework. As regards the available resources, manpower is underutilised as the labour force is inefficient due to poverty and malnutrition.[1] The magnitude of poverty and malnutrition in India is large and the potential lost is substantial (Suryanarayana, 1995a; United Nations Development Programme, 1996). Therefore, a major concern of policies today should be food security of the poor.[2]

In India, the Five Year Plans and policies have aimed at growth with social justice. However, they have remained academic exercises as there has been very little emphasis on understanding the dynamics of structural and institutional changes and their implications for poverty.[3] In some cases, plan targets were unrealistic (Suryanarayana, 1983); while some others carried out assessments of requirements and targets with assump-

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1. This is a problem faced by countries, particularly the developing ones, the world over. The World Bank estimates show that more than 1.3 billion people in the developing world do not get to eat even the basic minimum; every year nearly eight million children die from diseases arising from dirty water and air pollution; 50 million children are mentally or physically handicapped because of inadequate nutrition; and 130 million children are denied elementary education (World Bank, 1996).

2. Food security refers to availability of foodgrains in adequate quantities (physical access) and having the necessary economic resources to purchase in required quantities (economic access).

3. For more details on this issue, see Suryanarayana (1995a).

tions depending upon data availability (Suryanarayana, 1991b). Even policy debates and discussions betray little appreciation of statistical tools and empirical realities. For instance, Ahluwalia (1978) mistakes a statistically spurious decline in nominal consumption inequality for a decline in real consumption inequality and calls into questions the view that agricultural growth without removing the institutional constraints will not contribute to poverty reduction.[4] Rao (1994) lauds the role of Green Revolution in promoting food security of the poor by pointing out the decline in the relative prices of foodgrains. In fact, along with the Green Revolution the foodgrain production basket has undergone a change in favour of superior but costlier cereals like rice and wheat. As a result, the poor, whose major staple diet consists of the cheaper (but nutritionally equivalent, if not better) coarse cereals, experienced a decline/stagnation in their cereal consumption in spite of an apparent increase in their real income (Suryanarayana, 1997). At present, reform policies and strategies for food security are formulated and suggested with textbook precision but with little understanding of empirical facts and constraints (Suryanarayana, 1995b, 1996b). Recent food policies and the Targeted Public Distribution System (PDS) GOI, 1997a) launched by the Government of India on 1 June, 1997 provide a good illustration of this issue.

> **Five Year Plans have remained academic exercises as there has been very little emphasis on understanding the dynamics of structural and institutional changes and their implications for poverty.**

### Imperatives

On achieving independence, India adopted planning to achieve 'Growth with Redistribution'. By economic development, the Government wanted to build a modern, self-reliant economy; reduce poverty and unemployment and improve the quality of life, remove regional disparities and strengthen the redistributive bias of public policies and services towards the weaker sections of the country. Given the critical conditions of underdevelopment, risks were too high, capital requirements too large and returns too low for the private sector to take up the initiative. Therefore, the Government decided to realise these objectives under its regulation with the public sector providing the infrastructure and leadership for development. In this task, planning was assigned a major role in working out sectoral growth targets consistent with development objectives. Their implementation was to be ensured by a system of licensing provided for by the Industries (Development & Regulations) Act, 1951, and by a system of import licensing and foreign trade policies meant to promote import substituting industrialisation. Thus, licensing evolved as an instrument to ensure that the physical targets for capacity creation set by the Plans were realised; the trade policies, import control policies in particular, aimed at promoting domestic industrialisation by physical allocation of imports by products. Planning as it originated was essentially concerned with physical planning; its subsequent evolution laid emphasis on perfecting this particular approach.[5] Thus, all the plan models were formulated at fixed prices and were concerned with arriving at a set of internally consistent and feasible output and investment targets for different sectors. Issues were examined from the point of view of their implications for public sector investment policies and strategies.

Such an approach made sense so long as the bulk of the investment was concentrated in the public sector and the government ensured realisation of plan targets by physical control. Following this approach, the government has been able to build a strong, diversified and near self-reliant industrial sector. However, this achievement has been at a high price involving high cost structure and low quality of product. Indiscriminate imposition of physical controls, involving industrial licensing and rationing of foreign exchange and imports, has created conditions where industries, though not economically viable, prospered financially and thus led to inefficient allocation of resources. However, with the recent liberalisation of the economy and the ongoing economic reforms involving a switch-over to financial controls, the system of physical planning is no longer relevant. Plan models cannot continue to assume constant relative prices and concern themselves with target setting. To implement policies by financial and other indirect instruments like taxes, subsidies, credit control measures and administered prices, plan models will have to endogenise the price vectors by incorporating behavioural functions like supply and demand functions. In addition to these changes in plan methodologies and strategies, consistency and efficiency of policy instruments would call for a proper specification of the plan model and time frame. For instance, there have been many computable general equilibrium models which seek to address some of the policy related questions with endogenised price vectors

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4. For more details on this debate, see Suryanarayana (1991a, 1994 and 1995a).

5. For more details on these issues, see Suryanarayana (1987).

but their major shortcomings arise from crude specifications of supply and demand functions.[6] Time frame is important to account for not only structural changes in econometric specifications but also changes in crucial macro parameters. The importance of macro parameters may be illustrated with reference to the Eighth Five Year Plan (1992-97) for Kerala. The Plan targeted a State Domestic Product (SDP) growth rate of 5.60 per cent per annum which, assuming an incremental capital-output ratio (ICOR) of 5.4:1, called for a savings rate (as per cent of projected SDP) of 26.17 per cent after adjusting for non-resident Indian (NRI) remittances. However, the actual growth in SDP was higher and the NRI remittances registered a quantum jump due to rupee devaluation and hence, the required domestic savings rate for the first three years of the Eighth Plan for Kerala were only 21.87, 15.21 and 17.29 per cent respectively for 1992-93, 1993-94 and 1994-95. Thus the actual potential for Kerala was much higher than that envisaged. This shows how Kerala could not harness a substantial part of the savings available to the economy.[7] In other words, in an era of market dominated economic administration, the Government cannot implement plans and policies assuming constancy of major parameters for the entire plan period but instead should subject plan policies and their feasibility estimates to constant review. Such reviews and assessments would be possible only within a well defined overall policy based on strategic moves and variables. This would be illustrated, *inter alia*, from the limited perspective of the issue being examined in this paper, with reference to the question of food security and poverty and its specification in the overall economic policy frame.

> **With the recent liberalisation of the economy and the ongoing economic reforms involving a switch-over to financial controls, the system of physical planning is no longer relevant. Plan models cannot continue to assume constant relative prices and concern themselves with target setting.**

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6. Some of these models have characterised demand functions by the Linear Expenditure System (LES). The LES specification is based on the premise of additivity of preferences and hence cannot satisfactorily capture substitution effects of price changes, which are important in an era of emphasis on price instruments and policies (see, Suryanarayana, 1996c).

7. These estimates are by the author based on Government of Kerala (1994a, 1994b, 1996) and unpublished estimates of non-resident external (NRE) deposits provided by the Kerala State Planning Board for a background paper for the Ninth Five Year Plan of Kerala.

## Food Policy & the Poor

In fact, right from its inception, planning in India had a consistent framework covering all the sectors. From the point of view of the poor, the Government opted for a policy of their protection from higher food prices by compensating them for the losses in real income through food subsidy. Systems of controls were introduced during the 1950s to mobilise surplus food and distribute it at reasonable prices across states, both surplus and deficit, according to their requirements. This was to ensure price stability and a decent standard of living for the emerging working class during the initial stages of development. The agricultural sector was looked upon as the source of cheap labour and food in tune with the growth theories of Fei and Ranis (1964) and Lewis (1954) which considered the relative price of foodgrains as a major determinant of savings and investment rates in the agricultural and industrial sectors of developing countries (Suryanarayana, 1995b). The Second and Third Five Year Plans continued with this classical approach in laying emphasis on growth by accelerated capital accumulation and industrialisation; towards this end, they also provided for food reserves to cover moderate price fluctuations. From the mid-60s, the Government followed an integrated food and agricultural policy in order to achieve self-sufficiency in foodgrain production, stabilization of consumer prices and safeguarding the interests of the low income consumers. As part of the scheme, the Government followed a positive price policy towards agriculture so as to provide an incentive to the farmers to adopt the Green Revolution technology and to cover the risks associated with higher input costs and output price instability. The package introduced consisted of output price policies; input price subsidies; and a Public Distribution Scheme (PDS) for providing foodgrains to the consumers at reasonable prices. As a result, foodgrain production increased and the Government sought to make PDS a permanent feature of the economy covering the entire population (Government of India, 1981).

At present, during the economic reform programme carried out under the neoclassical philosophy, the emphasis is on removing inefficiencies. But inefficiencies prevail all around: Assured minimum support and procurement prices have led to inefficient utilisation of resources like power, credit and water. These inefficiencies are sought to be reduced through input subsidy withdrawal and price revisions. Even within the PDS, there are organisational inefficiencies of the Food Corporation of India (FCI) and unwarranted subsidies to the non-poor due to the universal entitlement policy of PDS. For remedying this, suggestions range from dismantling the FCI to dismantling the PDS itself. As a first step, the Government has targeted the PDS with effect

from 1 June, 1997 entitling only the poor to food subsidies. The PDS is no longer conceived as a permanent feature of food security of the entire population but only as a part of the safety-nets to the deserving poor population. But, the general hope that the PDS reform by excluding the non-poor and targeting only the poor would achieve Government expenditure reduction without any compromise on the food security of the poor is misplaced (Geetha & Suryanarayana, 1993). Providing a paltry 10 kg of foodgrains per poor family per month would cost about Rs. 8,000 crore (GOI, 1997a). Due to the large regional imbalances in foodgrain production the Government has been carrying huge buffer-stocks of foodgrains for the PDS and also for public intervention during periods of price rise. With India's integration into the world economy as part of the liberalisation programmes under structural adjustment and General Agreement on Tariffs and Trade (GATT) programmes, foodgrain prices and their instabilities, in all probability, would increase. Protecting the population against such price instabilities through timely public intervention would call for buffer-stocks of foodgrains which involves locking up of resources and hence inefficient resource use. Such wastage could be reduced by a strategy of broad-based growth in foodgrain production of focusing on the eastern states. Most important, increases in productivity can also be achieved by augmenting labour efficiency through improvements in food and nutrition security wherein the PDS has a major role to play. In sum, given the inter-regional disparities in food grain production, self-sufficiency and economic access to food, one policy option could be a broad-based agricultural strategy coupled with combinations of different poverty alleviation programmes wherein the emphasis on instruments should vary depending upon the nature and causes of food insecurity in a given region.[8] But, it appears that policy decisions are made *ad hoc* and not within a consistent framework as the recent policies on the food front and on Targeted PDS, discussed in the next section, would show.

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8. Some experts have suggested replacing the PDS with the Employment Guarantee Scheme (EGS) on the ground that the latter option is self-targeting. This argument has weak empirical and logical bases for the following reasons. PDS is an effective instrument for food security; it ensures availability of foodgrains at reasonable prices. Thus, it takes care of both physical and economic access to foodgrains. EGS, on the other hand, essentially takes care of unemployment and to that extent, poverty due to unemployment. Thus, EGS can tackle only one aspect of food security, that is, economic access to food, that too, of a segment of the poor population since unemployment is only one of the causes of poverty and the size of the poor is much larger than the size of the unemployed. Even this merit seems suspect given the evidence that the EGS without an efficient foodgrain delivery system would only end up in increasing prices and hence, reduced economic access to food (Venugopal, 1992).

> **Given the inter-regional disparities, one policy option could be a broad-based agricultural strategy coupled with combinations of different poverty alleviation programmes depending upon the nature and causes of food insecurity in a given region.**

## Recent Food Policies & the Targeted PDS

Economic liberalisation does not imply a regime of free-for-all for extempore policies. With the private sector becoming dominant, government has to make strategic moves and counter-moves while formulating and implementing policies. Its importance may be illustrated with the recent policies on the food front. India had foodgrain stocks of 35.60 million tonnes in July, 1995 and 29.90 million tonnes in October, 1995 which were substantially in excess of the minimum buffer stock norms of 22.30 and 16.60 million tonnes respectively for the corresponding months (GOI, 1997b). Believing that there is a major foodgrain surplus and rice and wheat have emerged as export products, the Government abolished quantitative ceiling and minimum export price for rice. It permitted the FCI to export or sell for export 3 million tonnes of fine/superfine varieties of rice and up to 2.5 million tonnes of non-durum wheat and 0.5 million tonnes of durum wheat (GOI, 1996a). Between April 1995 and August 1996, India exported 1.50 million tonnes of rice from public stocks and over 5 million tonnes of rice on private account; in addition, the FCI sold more than 6.30 million tonnes of wheat, considered in excess of buffer stock norms, in the open market (GOI, 1997b). But, with a marginal decline in wheat production from 65.50 million tonnes in 1994-95 to 62.60 million tonnes in 1995-96, the private trade decided to make hay and procurement of wheat was less in 1995-96 by 3 million tonnes. Public stock of wheat was only 10.40 million tonnes in October, 1996, less than the norm for that month, that is, 10.60 million tonnes. Wheat prices soared and the annual increase in January 1997 over that in the same month in 1996 was 32.80 per cent. As a result, PDS offtake of wheat during April-December 1996 was higher than those for the corresponding period in the previous year by more than 66 per cent. To meet the situation, the Government sold 27 lakh tonnes of wheat and 2.25 lakh tonnes of rice between April 1996 and mid- January, 1997. It increased FCI's open market sales of wheat to 6 lakh tonnes per month from December onwards (GOI, 1997b) which was later given up due to corrupt practices by traders (Leo, 1997). The Government has announced imports up to two million tonnes of wheat and granted permis-

sion to roller flour mills to import wheat under Open General Licence (GOI, 1997b). All these only point out the failure of the Government in controlling inflation by proper management and sequencing of foodgrain sales/exports and imports. In fact, the production/availability and consumption of foodgrains during the last few years did not warrant the kind of rise in wheat prices experienced recently. Given that cereals constitute a major food item of the population in general and the poor in particular, cereal price stability should be a major concern of the Government. Towards this end, there is a need for a sensible strategy for foodgrain management including the identification of scarcity regions, the amount of shortfall and the timing for open market intervention.

> **With the private sector becoming dominant, government has to make strategic moves and counter-moves while formulating and implementing policies.**

Against this background, the Targeted PDS *per se* cannot ensure food security of the poor, Under the Targeted PDS, families Below the Poverty Line (BPL) would be issued 10 kgs of foodgrains at specially subsidised prices. Subsidised foodgrains will also be available to all the beneficiaries under the Employment Assurance Scheme/Jawahar Rojgar Yojna at the rate of 1 kg per manday. This is supposed to be a beginning in streamlining the PDS "where the need is most acutely felt, namely, issue of foodgrains" (GOI, 1997a). As regards the non-poor, the Centre would provide additional quantities of foodgrains as determined by the average lifting of foodgrains for the last ten years by the states at the Central Issue Prices as a transitory allocation. The guidelines for implementing the programme clearly state: "In some States, the scale of issue is fixed for each member of the family at as high a level as 15 kg. per member, per month. It will not be possible to maintain such an inflated scale of issue" (GOI, 1997a; p. 5). This is because foodgrains available is "just sufficient to give only 10 kg per month per family" and the PDS is "not a substitute for the open market but only a supplement to it" (GOI, 1997a; p. 5). Thus, the Targeted PDS in its new targeted version is going to scale down the entitlement of its beneficiaries who are the poorest and neediest in the society.

> **The Targeted PDS *per se* cannot ensure food security of the poor.**

This stand of the Government is surprising given the awareness that "A well targeted and properly functioning Public Distribution System is an important constituent of the strategy for poverty eradication. Food and Nutrition security are crucial in our fight against other dimensions of poverty like infant mortality, maternal mortality, low birth weights and all other forms of deprivation" (GOI, 1997a). The new policy betrays the lack of understanding on the part of the Government about the issue of food insecurity, its incidence across states and the potential promotional/ruinous roles of procurement of foodgrains and the PDS in ensuring food security of the poor.

The targeting policy seems to have been formulated without any regard for its implications for the question of physical access. With reduced government intervention in an economy characterised by substantial inter-regional disparities in per capita incomes and foodgrain production, the market cannot ensure physical access to foodgrains in poor and food deficit regions.[9]

In surplus states like Punjab and Haryana, where better cereals are available at prices less than the highly subsidised prices of the PDS, the Targeted PDS may not have any relevance at all. Even in a foodgrain deficit state like Kerala, the PDS is highly targeted and the actual utilisation is less than 50 per cent of the potential due to the inferior varieties of cereals supplied (Suryanarayana, 1996d). Yet, Kerala had to distribute rice and wheat up to 13.72 lakh tonnes in 1994 (Government of Kerala, 1996). Now the subsidised provision of rice and wheat is going to be only 1.84 lakh tonnes (GOI, 1997a) which is supposed to meet the requirements of the poor who constitute 25.43 per cent of the total population. Once the transitory allocation is abolished, Kerala, which has one of the most comprehensive and effective PDSs in India (Geetha & Suryanarayana, 1993), would get only 10.37 per cent of what it got during the last ten years for delivery through the PDS.[10] This would worsen the problem of physical access to foodgrains for the poor in particular.

By the Indian Council of Medical Research (ICMR) norm of 370 gm per person per day, the PDS, will have to provide for a per capita entitlement of 11.25 kg of foodgrains per capita per month. But the Government's provision of 10 kg per family per month, assuming an average family size of 5 persons[11], would work out to 2 kg per person per month. Such a paltry provision will

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9. For more on this issue, see Suryanarayana 1996b.

10. These estimates are based on GOI, 1997a.

11. The average household size of the poorest 5 per cent, ranked by monthly per capita consumer expenditure, is 5.7 in rural and 5.6 in urban India (GOI, 1996b).

not make any impact at all on the food and nutritional status of the poor. In fact, as the recent export-import policy experience and the procurement and buffer-stock policies of the 70s and 80s show, a mechanical application of guidelines and the impending buffer-stock requirements may send wrong signals to the private farmers and traders, giving scope for exponential price increases instead of the 'staircase-type movements' of the 1970s and 1980s (Suryanarayana, 1995b). Since, by Government's own admission the PDS is only a supplement to the open market and would provide only an insignificant part of the normative requirements, such price increases would only worsen food insecurity by eroding the purchasing power of the poor — a factor also responsible for the declining cereal consumption since the 70s, an era of apparent reduction in poverty and expansion in the PDS size and operation. Moreover, in such a situation, the accounting concept of subsidies will not be of any avail for the poor[12].

More important, the sources of food insecurity vary considerably across regions in India. The Government should follow a decentralised, discriminatory policy of weighted combinations of the PDS, employment generation and asset creation programmes depending upon the nature, magnitude and causes of food insecurity.

The average cereal consumption in India has been declining in spite of the Green Revolution and the expansion of the PDS during the 1970s and 1980s. The immediate task is to halt the decline and promote cereal consumption, which is a major source of calories (about 85 per cent for the poor). This is all the more vital given the continued reductions in cereal consumption during the reform era.

### Food Security Today

By the conventional measures, there seems to have occurred substantial improvement in food security across states in India. There has been an improvement in economic access; all-India rural and urban per capita consumer expenditures at constant prices has increased and poverty ratios have declined (Suryanarayana, 1995a). There has been an improvement in physical access as measured by the increases in all-India per capita foodgrain production. But, a major discomfiting feature of the observed growth process is the increase in inter-regional imbalances in income levels and disparities in per capita foodgrain production. However, inter-state variations in rural cereal consump-

tion and calorie intake have declined substantially due to public intervention. But along with this decline in inter-regional variation in cereal consumption, there has also been a decline in rural mean per capital cereal consumption in most states (Suryanarayana, 1996b).

> A major discomfiting feature of the observed growth process is the increase in inter-regional imbalances in income levels and disparities in per capita foodgrain production.

This seems to be mainly because of the following reasons. With Green Revolution, crop composition of foodgrain output and consumption has changed in favour of superior but costlier cereals and against coarse cereals. As a result, cereal consumption has declined over time mainly in the states where coarse cereals are the major cereal consumed. Coarse cereals are grown by subsistence farmers for self-consumption. With population growth and the institutional changes accompanying the development process, landlessness and casualisation of labour have increased. These factors coupled with the decreasing coarse cereal availability, have led to increased market dependence of the population, the poor in particular. Incomes/consumer expenditures, adjusted by deflators to account for percentage variations in prices, show an increase in income and economic access which is not so reality. With increasing market dependence and changing consumption patterns in favour of costlier superior cereals dictated mostly by availability than by choice, the economic entitlement of the poor with respect to the cereal basket has declined and hence their average cereal consumption and average calorie intake have declined. Coarse cereals constitute a relatively smaller proportion of the urban cereal consumption basket and the urban population is relatively less affected by such changes in labour markets and production patterns. Hence their average cereal consumption and calorie intake have been relatively stable and have not shown any drastic decline. Thus, the major concern of food policy is not how to minimise the likely reductions in the levels of living and nutrition of the population but how to stop the reduction in cereal consumption and ensure adequate consumption so as to achieve improvement in labour efficiency along with efficient resource allocation.

This leads us to the question as to what is the state of food security in the wake of economic reforms. This question may be examined on the basis of estimates of cereal consumption during the reform period. The estimates from the National Sample Survey (NSS) annual

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12. There may be a subsidy in an accounting and statistical sense. That may not help the poor since their requirements are met only partly by the PDS and their levels of living are governed by a host of factors like open market prices, wages and employment (for more on this, see Suryanarayana, 1995b).

thin surveys for 1990-91 and 1992 show that cereal consumption has continued to decline in most states (Suryanarayana, 1996a). One important reason for the declining cereal consumption could be the increase in cereal prices. Most important, from the point of view of policy formulation were the wide disparities in price increases in both rural and urban areas across states. The percentage increase in average prices of total cereals ranged between 20.22 per cent in rural West Bengal and 55.74 per cent in rural Andhra Pradesh. As regards the urban areas, the increases ranged from 20.69 per cent in Punjab to 44.96 per cent in Maharashtra. The average all-India increases in the prices of total cereals were 36.30 and 32.44 per cents for the rural and urban areas respectively. Food consumption patterns and food market participation rates of both the population as a whole and the poor vary across states; hence the nature and extent of hardships of the poor also varied similarly. The decline in total cereal consumption was caused by a decline in wheat and coarse cereal consumption for the upper decile groups in rural India. In urban India, no such clear cut pattern is discernible. At the state level, estimates of cereal consumption are available only for sectoral total population. They show an increase in cereal consumption in the rural areas of Karnataka, Maharashtra, Orissa and Punjab and a decrease in their urban sectors except urban Karnataka where there was a marginal increase[13]; a decrease in cereal consumption in both the rural and urban sectors of Andhra Pradesh, Assam, Gujarat and West Bengal (but the percentage decline was more in the urban sectors); a decrease in cereal consumption in both the rural and urban sectors of Haryana, Madhya Pradesh, Rajasthan and Tamil Nadu (but the percentage decline was less in the urban areas) and a decrease in the rural areas and an increase in the urban areas of Bihar, Kerala and Uttar Pradesh. This is only a picture based on the estimates of average consumption of total sectoral populations in different states obtained from thin annual surveys. A better and reliable picture can be obtained using information from the 43rd and 50th round (quinquennial large ample) surveys of the NSSO for the years 1987-88 and 1993-94.[14]

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13. There are three cases where the changes were less than one per cent; hence virtually no change at all. These are rural Andhra Pradesh [(–)0.15 per cent], urban Madhya Pradesh [(–)0.69 per cent] and urban Karnataka (0.38 per cent).

14. The annual all-India survey in 1990-91 was based on 13,750 rural and 14,805 urban households; the corresponding sample sizes for the annual survey in 1992 were 8,324 and 4,808 households respectively (GOI, 1993 and 1994). In contrast, the quinquennial all-India survey of 1987-88 was based on 41,597 rural and 22,703 urban households; the corresponding numbers for the quinquennial survey in 1993-94 were 69,206 and 46,148 respectively (Source: GOI, 1991a and 1996b). One limitation of the comparison based on the estimates from the quinquennial surveys is that the available estimates from the survey in 1987-88 are based on the data of sub-sample 1 only (GOI, 1991a; p. 22).

The estimates of per capita consumption of cereals by decile groups for rural and urban all-India in 1987-88 and 1993-94 are provided in tables 1 and 2. Similar estimates for sectoral total population across states are provided in tables 3 and 4.[15] Some noteworthy features are as follows:

* Cereal consumption declined for the all-India rural population as a whole by 7.39 per cent (table 1). This decline was accounted for by a reduction in the consumption of wheat (3.73 per cent) and other cereals (3.52 per cent). The decline in total cereal consumption for the poorer five decile groups was less than the average for the total population at the all-India level for the rural sector. Except the poorest decile group, all the remaining groups enjoyed a reasonably comfortable (by the modest ICMR standard) level of cereal consumption.[16]

* However, the picture for the rural sector varies considerably across states. The decline (in percentage terms) in the rural total cereal consumption was more than the all-India rural average in the states of Haryana, Maharashtra, Punjab, Rajasthan and Uttar Pradesh and about the same as the all-India rural average reduction in the states of Andhra Pradesh, Assam, Bihar and Madhya Pradesh. The decline was one of the least (less than three per cent) in the states of Kerala and West Bengal; in rural Orissa, there was even an increase in cereal consumption. The commodity-wise pattern of decline also varies across states. For instance, the decline in total cereal consumption was largely due to a decline in coarse cereal consumption in rural Andhra and in rice consumption in rural Bihar.

* The reduction in rural cereal consumption varies across groups across states. The rural poorest five decile groups experienced a (percentage) reduction larger than the average reduction for the total rural population in the states of Andhra Pradesh, Haryana (except the poorest decile group) and Maharashtra. In Kerala and Tamil Nadu, rural total cereal con-

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15. Tables 3 and 4 do not provide estimates for Gujarat. This is because the published results of the NSS 50th round on quantities of cereal consumption for urban Gujarat in the Report No. 402 (GOI, 1996b; p. A-105) are not legible. Further, the results in these two tables provide estimates for the total population only and not by decile groups. However, the features discussed contain references to changes in cereal consumption by decile groups. Such estimates are available from the author on request.

16. Of course, the norm should vary depending upon age, sex and activity. For other possible norms for cereal consumption, see Geetha and Suryanarayana (1993).

**Table 1:** Per Capita Cereal Consumption (kg) Per Month by Decile Group of Population: All India Rural

| Decile Group | July 1987 – June 1988 | | | | July 1993 – June 1994 | | | | Percentage change in 1993-94 over that in 1987-88 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Wheat | Others | Total | Rice | Wheat | Others | Total | Rice | Wheat | Others | Total |
| 0-10 | 4.58 | 3.13 | 3.06 | 10.77 | 4.79 | 3.06 | 2.66 | 10.52 | 1.98 | (–)0.65 | (–)3.68 | (–)2.35 |
| 10-20 | 5.96 | 3.84 | 2.80 | 12.60 | 6.43 | 3.51 | 2.14 | 12.08 | 3.71 | (–)2.59 | (–)5.26 | (–)4.14 |
| 20-30 | 6.68 | 4.15 | 2.59 | 13.42 | 6.98 | 3.55 | 2.10 | 12.63 | 2.24 | (–)4.47 | (–)3.65 | (–5).89 |
| 30-40 | 7.12 | 4.33 | 2.46 | 13.91 | 7.49 | 3.74 | 1.95 | 13.19 | 2.64 | (–)4.21 | (–)3.64 | (–)5.21 |
| 40-50 | 7.37 | 4.56 | 2.43 | 14.36 | 7.45 | 4.06 | 1.85 | 13.36 | 0.54 | (–)3.49 | (–)4.01 | (–)6.96 |
| 50-60 | 7.49 | 4.82 | 2.51 | 14.82 | 7.54 | 4.29 | 1.90 | 13.73 | 0.35 | (–)3.61 | (–)4.12 | (–)7.38 |
| 60-70 | 7.69 | 5.11 | 2.40 | 15.20 | 7.67 | 4.55 | 1.86 | 14.08 | (–)0.15 | (–)3.66 | (–)3.56 | (–)7.37 |
| 70-80 | 7.61 | 5.72 | 2.33 | 15.66 | 7.60 | 4.98 | 1.83 | 14.41 | (–)0.06 | (–)4.73 | (–)3.19 | (–)7.98 |
| 80-90 | 7.62 | 6.22 | 2.30 | 16.14 | 7.01 | 5.75 | 1.82 | 14.58 | (–)3.75 | –)2.92 | (–)2.97 | (–)9.65 |
| 90-100 | 8.28 | 7.52 | 2.02 | 17.82 | 7.24 | 6.51 | 1.68 | 15.43 | (–)5.85 | (–)5.68 | (–)1.89 | (–)13.42 |
| All | 7.04 | 4.94 | 2.49 | 14.47 | 7.02 | 4.40 | 1.98 | 13.40 | (–)0.14 | (–)3.73 | (–)3.52 | (–)7.39 |

*Source:* GOI (1991b and 1996b).

**Table 2:** Per Capita Cereal Consumption (kg) Per Month by Decile Group of Population: All India Urban

| Decile Group | July 1987 – June 1988 | | | | July 1993 – June 1994 | | | | Percentage change in 1993-94 over that in 1987-88 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Wheat | Others | Total | Rice | Wheat | Others | Total | Rice | Wheat | Others | Total |
| 0-10 | 4.42 | 3.74 | 1.57 | 9.73 | 4.29 | 3.83 | 1.40 | 9.51 | (–)1.34 | 0.87 | (–)1.80 | (–)2.26 |
| 10-20 | 5.18 | 4.46 | 1.20 | 10.84 | 5.51 | 4.22 | 0.89 | 10.62 | 3.04 | (–)2.23 | (–)2.85 | (–)2.04 |
| 20-30 | 5.41 | 4.69 | 1.01 | 11.11 | 5.65 | 4.38 | 0.74 | 10.77 | 2.16 | (–)2.80 | (–)2.39 | (–5)3.04 |
| 30-40 | 5.49 | 4.84 | 1.00 | 11.33 | 5.64 | 4.60 | 0.66 | 10.90 | 1.33 | (–)2.13 | (–)3.01 | (–)3.82 |
| 40-50 | 5.58 | 4.85 | 0.98 | 11.41 | 5.51 | 4.84 | 0.64 | 10.98 | (–)0.61 | (–)0.09 | (–)3.02 | (–)3.73 |
| 50-60 | 5.56 | 4.97 | 0.74 | 11.27 | 5.51 | 4.83 | 0.57 | 10.91 | (–)0.44 | (–)1.20 | (–)1.54 | (–)3.18 |
| 60-70 | 5.51 | 5.34 | 0.66 | 11.51 | 5.53 | 4.94 | 0.48 | 10.95 | 0.17 | (–)3.48 | (–)1.56 | (–)4.87 |
| 70-80 | 5.45 | 5.62 | 0.56 | 11.63 | 5.26 | 5.07 | 0.41 | 10.73 | (–)1.67 | (–)4.75 | (–)1.28 | (–)7.70 |
| 80-90 | 5.54 | 5.47 | 0.47 | 11.48 | 5.10 | 5.24 | 0.34 | 10.68 | (–)3.81 | (–)2.03 | (–)1.12 | (–)6.96 |
| 90-100 | 5.36 | 5.82 | 0.40 | 11.58 | 4.80 | 5.26 | 0.28 | 10.24 | (–)4.82 | (–)4.81 | (–)1.93 | (–)11.56 |
| All | 5.35 | 4.98 | 0.86 | 11.19 | 5.28 | 4.72 | 0.63 | 10.63 | (–)0.63 | (–)2.32 | (–)2.06 | (–)5.00 |

*Source:* GOI (1991b and 1996b).

sumption declined but the poorest five decile groups, on the contrary, enjoyed an increase in cereal consumption. The rural population of Orissa, except two richer decile groups, enjoyed an increase. But the cereal dominating the reduction varied across rural decile groups within a state and for the population as a whole across states. For instance, in rural Bihar coarse cereals accounted for the bulk of the reduction in the cereal consumption of the poorest decile groups while for the rich, it was rice while in rural Andhra the coarse cereals dominated the reduction for all classes.

* Most important, the magnitude of shortfall of cereal consumption from the ICMR norm even for the rural poorest group is marginal and varies across states. Even the rural poorest ten per cent do not suffer from any shortfall in the states of Orissa, Rajasthan, Uttar Pradesh and West Bengal. There is some shortfall for the rural poorest 20 per cent in Karnataka and Madhya Pradesh, for the poorest 40 per cent in Maharashtra and Tamil Nadu, for the poorest 70 per cent in Punjab and the bottom 80 per cent in Kerala. Quantitative shortfall of cereal consumption for the poor in rural Punjab and rural

**Table 3:** Per Capita Cereal Consumption (kg) Per Month by Total Rural Population: Statewise

| State | July 1987 – June 1988 | | | | July 1993 – June 1994 | | | | Percentage change in 1993-94 over that in 1987-88 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Wheat | Other cereals | Total cereals | Rice | Wheat | Other cereals | Total cereals | Rice | Wheat | Other cereals | Total cereals |
| Andhra Pradesh | 11.39 | 0.14 | 2.82 | 14.35 | 11.57 | 0.19 | 1.51 | 13.27 | 1.25 | 0.35 | (–)9.13 | (–)7.53 |
| Assam | 13.46 | 0.77 | 0.00 | 14.23 | 12.53 | 0.64 | 0.00 | 13.17 | (–)6.54 | (–)0.91 | – | (–)7.45 |
| Bihar | 8.88 | 5.57 | 0.94 | 15.39 | 7.95 | 5.58 | 0.78 | 14.31 | (–)6.04 | 0.06 | (–)1.04 | (–)7.02 |
| Haryana | 0.85 | 13.42 | 0.75 | 15.02 | 0.73 | 11.88 | 0.31 | 12.92 | (–)0.80 | (–)10.25 | (–)2.93 | (–)13.98 |
| Karnataka | 5.16 | 0.80 | 7.79 | 13.75 | 5.44 | 0.85 | 6.86 | 13.15 | 2.04 | 0.36 | (–)6.76 | (–)4.36 |
| Kerala | 9.74 | 0.63 | 0.00 | 10.37 | 9.29 | 0.82 | 0.00 | 10.11 | (–)4.34 | 1.83 | – | (–)2.51 |
| Madhya Pradesh | 6.64 | 5.93 | 2.82 | 15.39 | 6.03 | 5.81 | 2.36 | 14.20 | (–)3.96 | (–)0.78 | (–)2.99 | (–)7.73 |
| Maharashtra | 2.83 | 2.26 | 7.94 | 13.03 | 2.97 | 2.21 | 6.21 | 11.39 | 1.07 | (–)0.38 | (–)13.28 | (–)12.59 |
| Orissa | 14.35 | 0.63 | 0.74 | 15.72 | 15.24 | 0.38 | 0.31 | 15.93 | 5.66 | (–)1.59 | (–)2.74 | 1.34 |
| Punjab | 0.71 | 11.09 | 0.61 | 12.41 | 0.74 | 9.87 | 0.17 | 10.78 | 0.24 | (–)9.83 | (–)3.55 | (–)13.13 |
| Rajasthan | 0.19 | 11.98 | 4.45 | 16.62 | 0.22 | 9.44 | 5.19 | 14.85 | 0.18 | (–)15.28 | 4.45 | (–)10.65 |
| Tamil Nadu | 9.57 | 0.22 | 2.45 | 12.24 | 10.32 | 0.34 | 1.06 | 11.72 | 6.13 | 0.98 | (–)11.36 | (–)4.25 |
| Uttar Pradesh | 3.70 | 10.59 | 1.03 | 15.32 | 4.00 | 9.16 | 0.75 | 13.91 | 1.96 | (–)9.33 | (–)1.83 | (–)9.20 |
| West Bengal | 13.66 | 1.46 | 0.01 | 15.13 | 13.73 | 1.18 | 0.05 | 14.96 | 0.46 | (–)1.85 | 0.26 | (–)1.12 |
| All India | 7.04 | 4.94 | 2.49 | 14.47 | 7.02 | 4.40 | 1.98 | 13.40 | (–)0.14 | (–)3.73 | (–)3.52 | (–)7.39 |

*Source:* GOI (1991b and 1996b)

**Table 4:** Per Capita Cereal Consumption (kg) Per Month by Total Urban Population: Statewise

| State | July 1987 – June 1988 | | | | July 1993 – June 1994 | | | | Percentage change in 1993-94 over that in 1987-88 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Wheat | Other cereals | Total cereals | Rice | Wheat | Other cereals | Total cereals | Rice | Wheat | Other cereals | Total cereals |
| Andhra Pradesh | 10.28 | 0.75 | 0.67 | 11.70 | 10.13 | 0.76 | 0.41 | 11.30 | (–)1.28 | 0.09 | (–)2.22 | (–)3.42 |
| Assam | 10.91 | 1.44 | 0.04 | 12.39 | 10.76 | 1.29 | 0.00 | 12.05 | (–)1.21 | (–)1.21 | (–)0.32 | (–)2.74 |
| Bihar | 7.16 | 5.96 | 0.25 | 13.37 | 6.81 | 5.93 | 0.08 | 12.82 | (–)2.62 | 0.22 | (–)1.27 | (–)4.11 |
| Haryana | 1.24 | 9.71 | 0.03 | 10.98 | 1.52 | 8.90 | 0.04 | 10.46 | (–)2.55 | (–)7.38 | (–)0.09 | (–)4.74 |
| Karnataka | 5.89 | 1.57 | 3.60 | 11.06 | 6.38 | 1.56 | 2.93 | 10.87 | 4.43 | (–)0.09 | (–)6.06 | (–)1.72 |
| Kerala | 8.69 | 0.63 | 0.97 | 0.00 | 9.60 | 8.45 | 1.00 | 0.01 | 9.46 | (–)1.88 | 0.31 | – |
| Madhya Pradesh | 3.40 | 8.02 | 0.47 | 11.89 | 3.62 | 7.31 | 0.39 | 11.32 | 1.85 | (–)5.97 | (–)0.67 | (–)4.79 |
| Maharashtra | 2.90 | 4.59 | 2.69 | 10.18 | 3.16 | 4.43 | 1.78 | 9.37 | 2.55 | (–)1.57 | (–)8.94 | (–)7.96 |
| Orissa | 11.22 | 2.49 | 0.03 | 13.74 | 11.26 | 2.04 | 0.06 | 13.36 | 0.29 | (–)3.28 | 0.22 | (–)2.77 |
| Punjab | 1.03 | 8.61 | 0.10 | 9.74 | 0.92 | 7.99 | 0.01 | 8.92 | (–)1.13 | (–)6.37 | (–)0.92 | (–)8.42 |
| Rajasthan | 0.45 | 11.42 | 0.86 | 12.73 | 0.58 | 10.36 | 0.58 | 11.52 | 1.02 | (–)8.33 | (–)2.20 | (–)9.51 |
| Tamil Nadu | 9.24 | 0.74 | 0.16 | 10.14 | 9.13 | 0.84 | 0.08 | 10.05 | (–)1.08 | 0.99 | (–)0.79 | (–)0.89 |
| Uttar Pradesh | 2.36 | 9.23 | 0.04 | 11.63 | 2.61 | 8.39 | 0.08 | 11.08 | 2.15 | (–)7.22 | 0.34 | (–)4.73 |
| West Bengal | 8.55 | 3.15 | 0.01 | 11.71 | 8.69 | 2.95 | 0.00 | 11.64 | 1.20 | (–)1.71 | (–)0.09 | (–)0.60 |
| All India | 5.35 | 4.98 | 0.86 | 11.19 | 5.28 | 4.72 | 0.63 | 10.63 | (–)0.63 | (–)2.32 | (–)2.06 | (–)5.00 |

*Source:* GOI (1991b and 1996b)

Haryana need not cause much concern since it could be due to diversification of consumption patterns, and these two states are surplus with respect to foodgrains.

* As regards the urban population, cereal consumption declined by 5 per cent, that is less than the reduction in the rural areas. Wheat and coarse cereals are the two cereals which accounted for a substantial part of this reduction. As in rural India, the decline in total cereal consumption for the (seven) poorer decile groups was less than that in the average urban cereal consumption. The level of cereal consumption was uniformly less than the ICMR norm for all the decile groups in urban India.

* Among states, the reduction in urban cereal consumption was more than the all-India urban average only in the states of Maharashtra, Punjab and Rajasthan. Coarse cereals dominated the reduction in Maharashtra and wheat in Punjab and Rajasthan.

* The reduction in cereal consumption across the urban decile groups do not show such systematic patterns as those observed for the rural sector. The poorest five decile groups in urban Kerala and four decile groups in urban West Bengal enjoyed increases in cereal consumption.

* Cereal consumption falls short of the ICMR norm for the urban poorest decile group in all the states except Orissa, for the bottom 20 per cent in Madhya Pradesh and Uttar Pradesh, for the bottom 40 per cent in Andhra Pradesh, Karnataka, and Tamil Nadu, for the bottom 80 per cent and top 10 per cent in Haryana and for the entire population in Kerala, Maharashtra, Punjab and Tamil Nadu.

From the discussion and results, it follows that the nature and causes of food insecurity vary across states and prices and physical availability play major roles in this. Further, the reduction in inter-state disparities in cereal consumption even at the macro level in the face of growing disparities in per capita foodgrain production was possible only with active public intervention. Still, as our results show, undernutrition prevails even today. Therefore, the scope for diluting public intervention as proposed in the guidelines for the Targeted PDS is quite limited. Instead, there exists considerable scope for effective government intervention by maintaining bufferstocks of foodgrains and operating and effective PDS particularly in food deficit states to ensure foodgrain availability across space and price stability over time. Further, Orissa is the only state where even the poorest decile group has a cereal consumption above the ICMR norm. Then how does one explain the 'Kalahandi' syndrome? One explanation could be that the macro estimates for the state as a whole do not reveal the underlying regional dispersions. This would, therefore, call for decentralised policies to ensure food security. Instead of uniform policies based on a macro profile, decentralised policies at the grass-root level would be more effective in solving the problem. It would also involve a more efficient and effective utilisation of resources.

> **Instead of uniform policies based on a macro profile, decentralised policies at the grass-root level would be more effective.**

## Conclusion

Planning in the reform context has to undergo a transformation in terms of both methodologies and strategies. With the instruments of physical controls being replaced by those of financial controls, conventional quantitative planning based on fix-price models has little relevance. Plan models can no longer be concerned only with target setting; instead they have to integrate both instruments (policies) and targets. Fixed price models have to be replaced by flex-price models which can effectively simulate alternative policy options and give clear directions for policy. This would call for policy-oriented research involving improvements in econometric specifications and estimations of plan models.

With changes in the relative roles of private and public sectors, the overall economic policy frame has to recognise explicitly the interrelationships between agents, sectors, and instruments. This is all the more vital the recent experience of policies on exports and imports of foodgrains, speculative hoarding of wheat and the resultant price escalation endangering the food security of the poor. Policies based on information on macro parameters may not be effective in addressing

> **The reduction in inter-state disparities in cereal consumption was possible only with active public intervention. Therefore, the scope for diluting public intervention as proposed in the guidelines for the Targeted PDS is quite limited.**

the problem at the micro level, as the micro units and the causes of their food insecurity differ across regions and over time. Policies will have to be decentralised so as to have a realistic micro perspective and effective solutions for problems.

A major concern from the point of the poor is not that of minimising the social cost of the reform programme by minimising the likely reductions in foodgrains consumption and nutritional intake but that of halting the reduction that has already been taking place and reversing the direction of change. In such a context a targeted but scaled down PDS may not make any material difference to the status of the poor. The ideal solution could be a package of decentralised policies for food security where the package composition should vary with the nature and causes of food insecurity in the region.

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# All Smoke & No Fire: The Rural Energy Scene in India

Padmini Swaminathan

*An offshoot of the adoption of (western) development paradigm (with its emphasis on energy consumption per capita and the comparison of this figure with that of developed countries) has been an extraordinarily high growth of population in urban areas thereby necessitating the setting up of centralised electric supply systems serving a relatively minor part of the nation's population. An obvious deleterious impact of this is that the rural areas have not received their fair share of investment in energy supply (neither electric nor non-electric) proportionate to the population living there. This scenario, after four and a half decades of planning is, in fact, a documentation of how this pattern has excluded vast sections of the population from its purview.*

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Between 1980 and 1992, the cumulative government expenditure in the renewables sector totalled Rs. 1155 crores. In comparison, the government invested over Rs. 81,200 crores in the power sector, Rs. 33,500 crores in the petroleum sector, and Rs. 15,850 crores in the coal sector. The 8th Plan (1992-97) has done little to redress the inequitable allocation of funds. A total of about Rs. 114,100 crores of government investment is expected in the energy sector. Of this, the power sector receives 69 per cent, petroleum 21 per cent, and coal 9 per cent. In sharp contrast, allocation for the renewables sector is just about 0.8 per cent (TERI, 1994).

The primary objective of most developing countries, including India, is to increase the share and supply of conventional energy (read supply of electricity) to meet development needs. Consequently, Plan after Plan, the investment of the state in highly capital intensive energy forms, particularly large-scale power projects, has increased steadily and enormously (table 1). This, despite the fact that non-conventional energy sources continue to contribute significantly in meeting the energy needs, especially in the rural areas.

The review of policies, and attempts at intervention to increase energy supply to the rural areas, cannot be measured simply by citing number or the quantum of installation of particular facilities (which is what the Plan documents of the State and the centre do). Despite the increase in the quantum of energy supplied by various components to the rural sector, a vast section of the population, for various reasons, has not benefitted,

> **Despite the increase in the quantum of energy supplied, a vast section of the population has not benefitted, particularly as far as energy for cooking is concerned.**

**Table 1:** Plan Expenditure and the Share of the Energy Sector

| Plans | | Total Plan Expenditure (Rs. Billion) | Share of Energy Sector (%) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Power | Oil & Gas | Coal & Lignite | Non Conventional | Total |
| First | (1951-56) | 19.6 | – | – | – | – | 19.7 |
| Second | (1956-61) | 46.7 | 9.7 | 0.8 | 1.9 | – | 12.4 |
| Third | (1961-66) | 85.8 | 14.6 | 2.6 | 1.3 | – | 18.5 |
| Annual | (1966-69) | 66.3 | 14.1 | 2.7 | 1.1 | – | 17.9 |
| Fourth | (1969-74) | 157.8 | 18.6 | 1.9 | 0.7 | – | 21.2 |
| Fifth | (1974-79) | 394.3 | 18.7 | 3.6 | 2.9 | – | 25.2 |
| Annual | (1979-80) | 121.8 | 18.4 | 4.2 | 2.3 | – | 24.9 |
| Sixth | (1980-85) | 1092.9 | 16.7 | 7.8 | 3.5 | 0.1 | 28.1 |
| Seventh | (1985-90) | 2202.2 | 17.4 | 7.3 | 3.2 | 0.3 | 28.2 |

*Source:* GOI 1991.

**Table 2:** Percentage Distribution of Households by Type of Fuel used for Cooking, 1991

| India/State | | Total | Cowdung cake | Electricity | Coal/coke Lignite | Charcoal | Cooking gas | Wood | Biogas | Kerosene | Others |
|---|---|---|---|---|---|---|---|---|---|---|---|
| India @ | Total | 100.00 | 15.39 | 0.31 | 3.47 | 0.77 | 7.94 | 61.50 | 0.49 | 7.16 | 2.91 |
| | Rural | 100.00 | 19.60 | 0.16 | 1.54 | 0.41 | 1.22 | 71.69 | 0.43 | 1.34 | 3.59 |
| | Urban | 100.00 | 3.51 | 0.72 | 8.95 | 1.77 | 26.93 | 32.74 | 0.68 | 23.62 | 1.00 |

**Note:** @ Excludes Jammu and Kashmir.
*Source:* Census of India, 1991.

particularly as far as energy for cooking is concerned (table 2). A vast majority of these sections of the population which depend almost exclusively on woodfuel systems continue to remain both outside the control of government and outside the market economy. While highlighting the complex interplay of factors in operation at the rural level (not reckoned within official review exercises), what the existing literature, culled from diverse sources, reveals is that:

- The entire approach towards provision of even basic facilities to the rural sector has a charity-oriented, social service attitude and not one of the legitimate rights of this sector to a larger share in investment and facilities, given the larger share of population residing in rural as compared to the urban areas

- Much of the debate on household energy requirements has become so engendered that, intentionally, or otherwise, the issue of cooking energy and firewood availability has been relegated to the realm of women's issues and therefore of peripheral importance

- Much of the discussion on woodfuel crises takes place as part of the larger concern for environmental protection; the fundamental question of how these sections of the population are to survive in the absence of alternative sources of energy gets shortshifted in the process.

## The Rural Energy Scenario: Forces & Factors

The bulk of the rural people's inanimate energy requirements is met by non-oil energy sources such as biomass. The predominant use of energy in rural areas is for domestic and agricultural purposes. There are many reasons why rural people find it difficult to obtain the small amounts of oil-based fuels that are often critical to increases in their productivity. These reasons are more associated with the weak bargaining power of rural people in obtaining any inputs supplied by the urban and modern sectors than to any absolute shortage of oil in the world market or to changes in world prices (Barnett, 1990).

A good deal of time, money and effort have been expended in this country in attempts to meet the rural energy demand through non-conventional energy sources. However, very little comprehensive material is available with which to assess the impact of these attempts. Quite a few of the micro level studies have brought out the interplay of complex forces which

need political solutions and interventions of a very high order.

In the first place, systems of landownership and agricultural practices (and changes in these over time) have a direct bearing on the availability and accessibility of energy to the poor. For instance, one study revealed that families owning less than 1 hectare of land used no fire wood; those owning 1 to 2 hectares used an average of 0.2 kg per day, but those with more than 2 hectares averaged 2-3 kg. of firewood use daily. Where no commercial wood resources remain accessible, the poor are forced to burn lower quality crop and animal residues, diverting organic fertiliser from agricultural use. Apart from land ownership, fuel gatherers must also contend with geographic factors and agricultural productivity levels in obtaining non-firewood bio-mass fuels. In desert regions of North India where crop production is low, 85 per cent of biomass energy was found to come from firewood and dung. In hilly regions, the shares of these fuels decreased to 72 per cent. But in the plains where agricultural production is relatively high, firewood and dung contributed only 63 per cent of the total, the rest coming from crop wastes (Batliwala, 1983 and World Bank, 1991).

> **Systems of landownership and agricultural practices have a direct bearing on the availability and accessibility of energy to the poor.**

In a study of a village in Uttar Pradesh, Vidyarthi (1984) has traced the impact on the poor, first, of the abolition of the Zamindari system followed by, increased mechanisation and self-cultivation of holdings. Traditional ties which ensured abundant availability of firewood have given way to contractual relationships characterized by minimum sharing of resources between the large landholders and the poor, affecting the supply of agricultural residues to the latter. Fuel supplies to the poor have also been affected by shifts in the cropping pattern towards crops that do not provide woody agricultural residues. The poor in this village have been forced to resort to the use of the least preferred and possibly harmful spring plants as cooking fuel. Lack of purchasing power due to deteriorating agricultural conditions, increase in the number of landless and marginal landholders, and lack of alternate sources of income have made investment in fuel saving devices and/or purchase of cooking fuels a near impossibility.

Quite a few environmentalists tend to hold the people's insatiable demand for fuelwood and fodder (rather than the large scale destruction of forests to serve the interests of industry and commercial loggers) as being responsible for the spreading ecological disaster (Khan & Ghosh, 1983). That fuel shortage is a symptom rather than a cause of the destruction of forest resources is not being reckoned with and addressed as a serious issue; the result has been the enactment of policies to increasingly privatise land and its products including fuel and the commercialisation of the fuel economy. The important economic buffer which common property resources traditionally provided to the rural poor has eroded drastically (Pandian, 1987; Gadgil & Guha, 1994).

Attempts to alleviate the fuelwood crises by the State particularly, have focussed on increasing the availability of firewood through tree planting schemes, by communities and otherwise (Agrawal, 1986). To a large extent the failure of many community schemes can be traced to the inability of these programmes to address the existing inequalities between households (within the community) in their access to and control over the land in the village. The so called community lands are in fact controlled de facto by the few propertied and powerful among the villages: hence the inability to guarantee benefits under the scheme to the landless and the small landowners makes it difficult for the latter to extend any cooperation to the scheme. Moreover, in their effort to regenerate forests, the Forest Departments have made little, if any, attempts to learn from local men and women about the many non-timber products these forests yield: instead, in an effort to provide the material for industry they have often promoted monoculture reforestation programmes. While these may be more efficient in terms of timber production, they change the species composition of the forest and eliminate species which produce valuable non-timber forest products, thus reducing not only the biological diversity and stability of forest areas, but perhaps even the net economic value of the forest. Certainly they reduce the economic value of the forests to the traditional residents (World Bank, 1991).

The most direct and regressive impact of cooking energy shortage is on women who are mainly responsible for meeting both basic needs and household energy needs. Time allocation studies document the impact on women's time of fuelwood and fodder shortage. These studies show a wide range (from 45 minutes to 5 hours) in the time women spend each day in fuel collection depending on factors such as proximity to forests or to other sources of fuel, type of farming systems, hill, desert and/or plain regions, etc. (World Bank, 1991). The problem of measurement of fuel collection notwithstanding, the important fallout of any increase in fuel collection time is that it has severe implications for other household activities (Cecelski, 1985).

More direct linkages exist between fuel shortages and nutrition. Studies have noted gathering firewood, fetching water, cooking and other domestic tasks account for a substantial share of women's and children's energy output, around 700 and 300 calories per day respectively (Batliwala, 1982).

Worse, there is growing evidence of adverse health effects because of high biomass smoke levels. Much of domestic cooking and space heating in rural areas take place in poorly ventilated houses through the use of traditional chulhas, which have low thermal efficiency and high emission factors, all of which combine to produce very high concentration of air pollutants. Four major categories of ill-health have been identified as health risks associated with pollutants from using unprocessed biofuels. These include: respiratory infections in young children; adverse pregnancy outcomes for women exposed during pregnancy; chronic lung disease and associated heat disease in adults; and cancer (TERI, 1994; Ramakrishna, 1995). While more studies are required to allow quantified conclusions with some measure of confidence, more effort is required to make even a small dent in the direction of Indian energy planning. The latter is still driven (politically and otherwise) by the traditional supply-oriented mentality emphasising the development of power, coal and hydrocarbons without adequate regard to specific end-uses that determine the demand for these energy sources as well as the social and environment costs of providing these services.

> **Indian energy planning is still driven by the traditional supply-oriented mentality emphasising the development of power, coal and hydrocarbons without adequate regard to specific end-uses that determine the demand as well as the social and environment costs of providing these services.**

### Rural Energy in India: Components & Sources

*Rural Electrification (RE)*

Rural electrification as a plan programme was introduced in the First Plan. It was initially envisaged to provide electricity as a social amenity to rural areas and was confined only to a few states. Subsequently it was extended to cover all the states. Later, this programme was integrated with the Minimum Needs Programme. The programme was further strengthened by the formation of the Rural Electrification Corporation in 1969 which now provides over 90 per cent of the funds for rural electrification as concessional loans to the State Electricity Boards.

In a rare display of honesty, the Government of India stands indicted by its own evaluation of the RE programme. the following are extracts which are self explanatory and need no comments:

The Working Group on Energy Policy set up by the Planning Commission in 1977, submitted its Report in 1979, and it had this to say on the progress of RE:

The rapid increase in the number of towns and villages electrified has given an impression that the number of unelectrified houses is fast diminishing. Facts prove that this is not the case. All the towns (over 10,000 population) numbering 2699 in India have been electrified. Of the total number of 5,70,000 villages, about 2,30,000 have been electrified. The number of households electrified has increased from 5.7 million in 1960-61 to 16 million in 1978-79. Inspite of electrifying all towns and about 44 per cent of villages the percentage of households electrified remains at about 14 per cent only. Even with the acceleration in the pace of electrification in the 1970's, the number of new electricity connections to houses has increased at the rate of about one million households a year, while the number of new households has been increasing at the rate of about 2.2 million per year. In other words, the number of non-electrified houses is steadily increasing inspite of the accelerated rural electrification programmes. Studies show that in any electrified village only 10 to 14 per cent of the houses obtain electricity for household purposes, and the rest of the houses do not switch to electricity as the households are not able to pay for the initial investment required to set up the switch board and for the wiring arrangements to receive electricity. Further, the construction materials used in housing also set limit to the electrification. NSS survey of housing (1973) reveals that the percentage of pucca houses is about 65 per cent in the urban areas and hardly 19 per cent in the rural areas. The proportion of houses using electricity for lighting is only about 45 per cent in the urban areas and about 5 per cent in the rural areas (Government of India, 1979, p. 28).

The above assessment was made in 1979. The Eighth Five Year Plan document (1992-1997) sums up the situation for the present:

While increasing share of plan funds are being invested in the production of commercial energy, the share of the rural areas in the total energy produced

in the country has been only of the order of about one fifth though the rural areas account of nearly three-fourths of the total population..."

While commercial forms of energy such as electricity, kerosene and diesel oil are now making inroads in the rural areas, their consumption is still largely confined to the more affluent households...

[However] so far only about 27 per cent of rural households have been electrified, as electrification of a village as per current definition implies that only one or more households in the village have this facility (Government of India, 1992, p. 43-45).

As per the 1991 Census, (Census of India, 1991, Paper 2 of 1993) only 31 per cent of rural households are electrified as against 76 per cent for the urban areas of the country (table 3). This same Census also reveals that only 31 per cent of rural households live in pucca houses as against 73 per cent of the urban area (table 4) giving credence to the observation made by the Working Group on Energy Policy that the construction material used in housing is also an important factor for consideration in any programme of electrification. Table 5 provides the details of the distribution of households by the type of lighting as contained in the National Sample Survey's 44th Round. The scenario presented by the data has several implications:

- For quite some time to come, non-commercial energy will account for a very significant proportion of the total energy consumption particularly in rural India

- Energy policies that do not address the question of the purchasing power of the large numbers of the poor and the consequent reliance of the latter on 'zero' private cost non-commercial energy are bound to fail and/or inevitably end up favouring the elite

- Whichever way one looks at the phenomenon, it is clear that rural India has been in the grip of a very grave energy crisis for a very long time. This needs to be differentiated from the commercial energy crisis that is a consequence of increasing dependence on imported oil (Makhijani, 1977; Reddy & Prasad, 1977)

*Biogas plants*

The promotion of family type and community/institutional type biogas plants is an important component of energy supply to the rural area. By March 1993, approximately 1.8 million family size biogas plants had been installed, representing 15 per cent of the estimated ultimate potential of about 12 million plants. The Ministry of Non Conventional Energy Sources (MNES) has ambitions

**Table 3:** Percentage Distribution of Households having Electricity: 1981 and 1991

|  | Total | | Rural | | Urban | |
|---|---|---|---|---|---|---|
|  | 1981 | 1991 | 1981 | 1991 | 1981 | 1991 |
| India @ | 25.74 | 42.98 | 14.29 | 31.10 | 61.60 | 75.93 |

**Note:** @ Excludes Assam, Jammu and Kashmir.
*Source:* Same as Table 2, p. 38.

**Table 4:** Percentage Distribution of Households Living in Pucca, Semi-pucca and Kutcha Houses

|  |  | Pucca | | Semi-pucca | | Kutcha | |
|---|---|---|---|---|---|---|---|
|  |  | 1981 | 1991 | 1981 | 1991 | 1981 | 1991 |
| India @ | Total | 32.73 | 42.30 | 33.24 | 31.36 | 34.03 | 26.33 |
|  | Rural | 22.57 | 31.20 | 36.87 | 36.33 | 40.56 | 32.46 |
|  | Urban | 64.72 | 73.10 | 21.80 | 17.57 | 13.49 | 9.33 |

**Note:** @ Excludes Assam, Jammu and Kashmir
*Source:* Same as Table 2, pp. 29-31.

**Table 5:** Percentage Distribution of Households by Type of Lighting

| India/State |  | Type of lighting | | | | | |
|---|---|---|---|---|---|---|---|
|  |  | No lighting | Electricity | Kerosene | Others | Not reported | Total |
| India | Rural | 3.21 | 27.04 | 69.17 | 0.45 | 0.13 | 100.00 |
|  | Urban | 2.59 | 74.38 | 22.63 | 0.23 | 0.17 | 100.00 |

*Source:* Govt. of India 1990.

*The Rural Energy Scene in India*

of covering all the potential beneficiaries by the end of the 8th Five Year Plan (CMIE, 1993). The National Programme of Biogas Development (under the aegis of which these plants are set up) has had its performance assessed by various agencies, official and non-official, with varying results. While the Ministry claims success rates of about 80 per cent, other micro-level studies show functioning levels of less than 50 per cent (TERI, 1994).

Limited progress has been made in the promotion of community/institutional biogas plants. Till 31st December 1992, only 865 such plants had been set up, most of them being institutional plants. Community biogas plants have had less success primarily because of their failure to address and resolve the considerably more serious organisational questions relating to waste collection, plant management and benefit distribution (Government of India, 1992).

Lack of proper maintenance and servicing facilities for biogas plants in rural areas continues to be a major problem. In this context the experience of the Chinese biogas programme is instructive (Daxing, et al, 1990; Barnett, 1990). While today the Chinese experiment is regarded as a 'success', there is need to temper this judgement of success by taking a historical view of the growth and development of the programme in China. Between 1973 and 1978 the Chinese emphasized quantity rather than quality of the plants with the result that almost 85 per cent of the plants built ceased operation soon after construction. Since 1978 however, there has been a sea change and it is now recognised that

> building a biogas industry is a long term task, requiring a number of full time organizations... Standards and mechanisms for quality control have become a key feature of the program. This in turn has led to the formation of over 700 specialist biogas service stations and some 7000 construction teams. These are almost commercial firms in that since 1983 they are required to account independently and assume sole responsibility for profit and loss. There is thus greater commercialization and specialization in the Chinese biogas program, and the element of participation is moving toward that between customers and a new class of suppliers (Barnett, 1990, p. 546).

### Improved chulhaas

The National Programme of Improved Chulhaas started in 1983-84, is another important component of the NCSE. As in all other cases 'success' of the programme is measured in terms of the number of chulhaas installed at any point of time. While authorities concerned with programme acknowledge that follow-up

and maintenance of the chulhaas is a problem, there is hardly any evaluation of the functioning of these stoves in particular contexts and environments.

> **Success of the National Programme of Improved Chulhaas is measured in terms of the number installed at any point of time. There is hardly any evaluation of the functioning in particular contexts and environments.**

A microlevel case study of a "functioning" gobar gas plant in village Fateh Singh Ka Purwah, Etawah Dt., U.P. brings out the hiatus in the 'official' perception of a functioning plant and the people's (particularly women's) perception (Malhans & Sanghera, 1982). In the first place the plant requirement of 1524 kilos of dung daily was way above the amount that the village could supply, i.e., 400 to 800 kilos a day. A more serious lapse was the way the timings for provision of gas had been planned in total disregard of the living and working conditions of women:

> "Gas for cooking is provided from 8 to 10 a.m. and from 6 to 8 p.m. A bell is rung 15 minutes before each of the fixed hours to enable women to prepare for cooking. The morning hours did not suit the women, who by 8 a.m. were well advanced in their day's work in the fields and found it very difficult now to reorganize their agricultural activities in accordance with the gas provision timings...

> "Secondly, the timings were insufficient. Three meals are cooked in a day but no gas provision has been made for the third meal. The women said that within these limited hours, all they could cook was a vegetable and wheat chapatis. Dals took too long to cook and maize and bajra chapati did not roast well on a gas burner..."

> "The women were very vocal in denouncing the gobar gas plant. They said that on the one hand, if they did not provide the quota of dung to the plant, they had to pay a fine. On the other hand, the amount of gobar gas provided took care of not even 25 per cent of the day's cooking, so they had to look for wood as a substitute for dung cakes. Few households can afford to buy wood in the market. The result is an increase in the work burden for most women" (Malhans & Sanghera, 1982, p. 11-13).

On the whole the impact of the National Programme on Improved Cookstoves (NPIC) and National Project

on Biogas Demonstration (NPBD) on the rural energy consumption pattern has been negligible given the limited scale of intervention. The two interventions together have been able to address only about 10-12 per cent of households in the last ten years. (TERI:1994).

## Solar technologies

At present, the spread of solar energy technologies is very limited. Among solar thermals, only solar cookers and solar water heating systems have been disseminated to an appreciable degree. Solar technologies have had to contend with high costs and their relative lack of reliability.

The solar energy programme came in for some very adverse remarks from the Comptroller and Auditor General in his report for the year ending March 1992. These comments pertain to both solar photovoltaic and solar thermal programmes. Regarding solar photovoltaics the report says:

"The result of an evaluation study, [however], showed that most of the systems were not working mainly due to lack of proper maintenance, poor performance of the systems and apathy of local users... Average failure rate of street lighting ranged from 33 to 100 per cent while that of domestic lighting ranged from 25 to 94 per cent. In five states surveyed for water pumps, the failure rates ranged between 41 per cent and 100 per cent. The low level of installations of TV systems showed that this was not popular with users. There were cases of improper site selection, overstocking, idle equipment/systems etc." (Teddy, 1994-95; CMIE, 1993).

The picture is similar in solar thermal appliances. Many of the water heating systems (domestic and commercial) were not functioning properly due to technical problems, wrong site selection, non-maintenance and non-availability of water.

In the case of solar cookers, the report mentions: "in Uttar Pradesh, sales were confined to urban areas whereas the main object was to reach the rural people, and, in West Bengal free cookers distributed were used as box/mirror since there was no awareness generated for their proper use" (Teddy, 1994-95; CMIE, 1993).

With regard to generation of power through wind, thus far, the average capacity utilization of all such installations continues to be low for reasons which we have not been able to decipher.

## Issues at Stake

The non-homogenous and non-articulated nature of the Indian economy contributes to the creation of an environment where investments in high productivity areas of energy investment do not necessarily induce significant changes in low productivity areas. The insignificant attention paid to these low productivity sectors (in terms of investment in money and time) has made the latter incapable of capturing the downstream developmental effects of energy investments. We have documented the low penetration of the conventional sources of energy into the rural areas, particularly among the poorer sections of the rural population. Emphasis on non-conventional sources of energy gathered momentum precisely because it was expected to meet most of the varied requirements of the rural sector. Among the several components making up the non-conventional sources of energy, only two, namely biogas plants and improved chulhaas directly address the majority of the rural poor. Even these are hedged by a whole host of problems which the system is not able to cope given its present set up. The other components, namely solar technologies, are beyond the reach of not just the poor.

> **The non-homogenous and non-articulated nature of the Indian economy contributes to the creation of an environment where investments in high productivity areas of energy investment do not necessarily induce significant changes in low productivity areas.**

Given the above scenario, the underlying issues at stake not being addressed (or rather not being addressed simultaneously) include the following:

- Energy planning in the country overall, and in particular for the rural areas, is not based on an adequate understanding of the socio-economic factors that lie at the root of the rural energy problems. Given the persistence of the underlying inequalities in wealth and income distribution, technical solutions alone can hardly be expected to make a dent in ameliorating the problem

- The information base that is needed to devise comprehensive energy plans is being generated at levels and by bodies that, as of now, hardly matter to the mainstream planning process — namely, voluntary organizations and by women's groups

- Many of the case studies cited reiterate the importance of understanding the users' needs. Concomitantly one of the major reasons for failure and/or limited impact of intervention policies has to do with the utter disregard that these interventions have shown for the needs of the users and/or the conditions under which the users live and work

- While the Eighth Five Year Plan talks of the development of 50 models of chulhaas (including 40 fixed types and 18 portable types) to cater to the needs of different areas and regions, there is hardly any documentation of the investments made thus far in developing human and institutional capabilities. By now it is well known that adaptation of some technologies is often a necessary condition for their diffusion; the importance of technical adaptation is also derived from the recognition that increase in productivity through adaptation is achieved through the phenomenon of incremental technical change over time. The latter has important policy implications: notably the need to consciously invest in local skills that foster such change. The issue for planning is how to develop and incorporate these capabilities in programmes of diffusion and technical change.

- There is hardly any information in any of the official documents (that we have looked into thus far) on the nature of R&D (if any) being undertaken on NCSE. (We have already shown in table 1 the dismal amount expended by the Central Government on renewables as against the amount expended on conventional sources of energy). The issue of R&D, however, assumes critical significance for several reasons:

  - For a long time to come the rural and remote areas of the country in particular will have to depend on NCSE for most of their very basic survival requirements

  - As of now, crucial components of the energy technologies are in the hands of transnational corporations, access to which may become complex and therefore more difficult in the years to come

  - Even if the above issue is solved, issues of local adaptation, assimilation etc., still require enormous investments in facilities as well as in human resources in order to (successfully) absorb imported and improvised technologies.

The options available (technological and otherwise) for providing energy services to rural areas are still very limited. As a report by TERI points out, "while aggressive promotion exercises had created a general impression that renewables were the panacea for India's energy problems, the reality is that ambiguities persist in the identification of strengths and limitations of each RET (renewable energy technology). Substantial efforts need to be devoted to a serious assessment of what current RETs are able to achieve and to arrive at a realistic estimate of the potential of these technologies in the overall Indian energy system" (TERI, 1994, p. 163).

## By Way of Conclusion

The major energy challenge facing this country is the provision of domestic energy, particularly to the rural areas. In this context, there is every reason to believe that renewable energy sources could play a major role in the longer run. (The complex interplay of factors in the rural areas makes it a priori unlikely that any programme even if targetted will make much of a contribution in the short run). But decisions (even if politically difficult) must be taken now to ensure that the country will have the technical and other means to convert renewable sources into useable energy and to make it available to the rural population. Further, as of now, the indicators chosen to monitor performance are defined in terms of the number of plants installed and/or facilities provided. Consequently, the tendency is to over-estimate the number of plants built with absolutely no consideration for the quality of the construction and/or its periodic maintenance and repair. Political expediency makes it difficult for the leadership to admit the failure of particular schemes or devices with the result that inputs from whatever little evaluations are carried out are not incorporated into current practices. While initial failures will be frequent, there can be nothing more tragic for the country if lessons from these failures produce no learning for the future.

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# Reforming the Trade Sector: Perspectives for the Ninth Plan

## Saikat Sinha Roy

*The external trade sector has been undergoing reforms since the mid-eighties encompassing the Seventh and Eighth Plan periods. The Ninth Plan, in all likelihood, would carry the process forward. In doing so, the emerging global trading framework has to be taken into consideration in conjunction with the outcomes for the reforming trade sector during the past two Plans.*

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The reform process initiated in India since the mid-eighties pursued the product market reforms by removing quantitative restrictions and also lowering both peak and average tariffs on imports of, especially, capital goods and intermediates. The structural adjustment programme (SAP) also aims at product market reforms among other objectives[1]; thus, encompassing trade sector reforms from the early nineties onwards. The relaxation of trade restrictions in an economy results in changes in the volume of trade,[2] with trade reforms correcting for the anti-export bias inherent in the import substituting regime, making capital goods and intermediates available at world prices and allowing competition at the margin. These policy initiatives from the mid-eighties made a marked departure from those of the earlier period by not having an asymmetric emphasis on either import substitution or export promotion[3] Nayyar (1994). With trade reforms, the issue of export growth gained momentum, to which emphasis was further added following stabilisation in the early nineties.[4]

The main issue which the Ninth Plan addresses would then be to aim at sustained growth of exports taking into account the changing direction of global trade.

1. The structural adjustment program intends to remove the microeconomic obstacles existing in different markets for efficient allocation of resources, (Corbo & Fischer, 1995).

2. As Rodrik (1992) illustrates, trade liberalisation leads to excess profit effect, scale efficiency effect and technical efficiency effect along with volume of trade effect, all of which are supposed to bring about welfare changes.

3. The Seventh Plan (1985) also emphasises that if export earnings are increased to a significantly higher level on a sustainable basis, not only will the management of BOP be made easier but the scale of operations at the sectoral level also could be increased, thereby reaping economies of scale and reducing costs and prices which would, in turn, expand the domestic market.

4. The growth of the economy often does not resume by itself following stabilisation unless the export sector becomes a strong, driving force (Dornbusch, 1990).

## Ninth Plan: Perspectives

Sharma (1996) has provided some perspectives for the Ninth Five Year Plan drawing lessons from recent export performances. The study finds that for exports to grow reforms should continue during the Ninth Plan removing existing constraints on export growth. The study is of the view that during the Ninth Plan, much would depend upon the growth performance of the economy.[5] Outward orientation would be the other major factor and Sharma foresees that export-to-GDP ratio would rise continuously from around 12 per cent in 1996-97 to 16 per cent in 2001-2 with exports estimated to grow at between 12.3 and 20 per cent per annum under four different alternative hypothetical scenarios. Such high growth of exports should be sufficient to maintain a sustainable BOP over the medium term.

The Ninth Plan perceives, according to the Approach Paper (GOI, 1997), a judicious mix of all macroeconomic policies for the development of the external sector. For sustained high export growth, the Approach Paper puts forward policy initiatives in terms of removal of remaining quantitative restrictions on imports, implementation of special schemes for exporters to allow for duty free access to imported inputs, preferential access to exporters for external commercial borrowing approvals. In addition, Sharma (1996) and the Approach Paper (GOI, 1997) outline certain policy initiatives in terms of trade information dissemination, development of infrastructural facilities, quality upgradation and packaging for penetrating new markets, market development though creation of awareness of Indian products, promotion of exports of agricultural and allied products and provision of improved storage facilities for such products. However, the study fails to identify new products and new markets in the context of post-Uruguay Round scenario.[6] The present study is an attempt in that direction, though it would refrain from identifying products for specific markets.[7]

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5. This was premised upon the fact of export growth from India being largely determined by such supply side factors as GDP and industrial production and the increasing export orientation of the economy, despite the favourable international demand and depreciating exchange rate that prevailed during the period.

6. The Approach Paper to the Ninth Plan (GOI, 1997) does not look into this dimension of international environment. However, it takes account of various other developments in the world economy on which external sector performance will depend, which are, the state of international commodity prices including that of oil, world growth, and the state of the international capital market which have an important bearing on our exports, imports, invisible earnings (especially remittances), foreign investment flows and non-resident deposit flows.

7. An attempt to identify market-wise products has already been done by the Ministry of Commerce, Government of India.

## Contours of Liberal Trade Order

To focus on the directions of external sector reforms to be outlined in the Ninth Plan, the highlights of the earlier plans are to be considered. The policies towards external sector reforms can be broadly classified into two: exchange rate reforms and reforms in the tradeable sector. Simplification of import procedures, reduction or elimination of quotas and rationalisation of tariff structure are the most common elements of trade sector reforms. The Seventh and Eighth Plans conform to the initiatives in such directions. More importantly, these plans have a new long-term perspective on trade policies and industrialisation, which contrasts with the approach of the earlier planning era.

The Seventh Five Year Plan laid special emphasis on improvements in productivity and efficiency which are critically linked to higher exports growth essential for the management of the economy's BOP prospects. After the mid-eighties the highlight was import liberalisation through delicensing of imports and replacement of quantitative restrictions on imports by tariffs. Tariffs even at high rates are believed to bring competition at the margin, while quotas and licenses prevent it. Tariff reduction in the Seventh Plan period was mostly in the capital goods sector.[8] Moreover, the Seventh Plan document projected an annual growth of 7 per cent in the volume of exports during the plan period with engineering goods, chemicals and allied products, readymade garments and gems and jewellery alone accounting for over half of the projected increase. Thus for breakthrough in exports, the Seventh Plan postulated the integration of export policy with all other policies programmes which affect productivity and costs.

### Directions of the Eighth Plan

Despite an unsustainable BOP position in the early nineties, liberalisation was carried on and growth of exports was found to be a necessity for the purpose. The Eighth Plan emphasised trade sector reforms and hence, an yearly export growth of 13.6 per cent involving high growth of exports in certain kinds of manufactures (Eighth Five Year Plan, 1992). Both the plans after the mid-eighties perceived growth in exports of similar kind of groups of manufactures for long term growth in aggregate exports indicating no significant change in the commodity composition of exports consequent upon trade reforms. This is one of the major drawbacks of the earlier plans. Moreover, the imperatives of the global trading system prior to the Uruguay Round were overlooked.

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8. The process of reducing import duties on general machinery began since the mid-eighties.

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> **Both the plans after the mid-eighties perceived growth in exports of similar kind of groups of manufactures for long term growth in aggregate exports indicating no significant change in the commodity composition of exports consequent upon trade reforms. This is one of the major drawbacks of the earlier plans.**

The key objective of integrating the domestic economy with the rest of the world, as perceived in the Eighth Plan, was thought to be in terms of further pruning the negative list of imports and exports and gradual reduction in both the levels and dispersion of tariff rates. Prior to reforms in the nineties, the nominal as well as effective protection rates for most categories of products were very high. The objective of the policies of the Eighth Plan was to bring down average tariffs to 25 per cent within a period of 3 to 4 years in a phased manner. Any protection deemed necessary for domestic industry should basically be met through the exchange rate and tariffs. The Export-Import Policy, 1992-97, attempting to restructure trade policy as part of the structural reforms process, liberalised imports further by drastically reducing the existing areas of quantitative restrictions and attempted to reduce tariff rates on the imports of all items. The successive Central Government Budgets during the nineties resorted to lowering of peak import duties, which was brought down to a peak level of 110 per cent in the 1992-93 Budget to 40 per cent in 1995-96 Budget. Alongwith the decline in peak rate of tariff, the average tariffs, both weighted and non-weighted, also declined. The duty structure was also rationalised by decreasing the dispersion of tariffs rates, which was also perceived in the Eighth Plan. Thus goods trade was made freer than before, with liberalisation focusing on the entire gamut of capital goods, intermediates and project imports.[9] The reduction in tariff rates got due recognition from Uruguay Round of Negotiations, though the degree of reduction in the Indian case was much sharper than the norm.[10] Subsequently, doses of liberalisation of consumer goods in terms of removal of quantitative restrictions and lowering of tariffs was also on the agenda of the Eighth Plan, which is an imminent policy initiative to be taken into account during the Ninth Plan.[11] The Approach Paper to the Ninth Plan has proposed to achieve international levels of tariffs, through carefully phasing out the changes.

By the mid-eighties, exchange rate system in India has already moved towards a managed float and the rupee was found to be depreciating against all major currencies (Pradhan, 1993). The exchange rate of the rupee was revised downwards in 1991, which marked the culmination of a sequence of policy changes following the macroeconomic instability of the early nineties.[12] With a brief stint with dual exchange rate system in the middle under the Liberalised Exchange Rate Management Systems (LERMS), the exchange rate of the rupee was unified and made floating,[13] which provides the base for a phased shift to full convertibility of the rupee.[14] The unification of exchange rate also meant an effective devaluation of the rupee. However, the rupee was found to be stable against US dollar at Rs. 31.37 per US$ since July, 1993 through fiscal 1994-95, with marginal appreciation in the rupee in late 1994-95. Comprehensive trade reforms require one of the two conditions: either there should be real exchange rate depreciation or else the economy must have access to foreign exchange for a substantial period of time to support liberalisation (Dornbusch, 1992).

*Policy directions*

Prior to 1991, a large number of items were subjected to export controls, which were lifted for most products in the nineties. However, the remaining product categories are mostly agricultural products and minerals. Also export taxes levied on some minerals and agricultural items were abolished prior to 1991, which gained momentum after the Eighth Plan was put in place. The liberalisation of

9. Import duties on key raw materials including steel, coal, non-ferrous metals and chemicals were reduced and for selected capital goods especially for export-oriented machinery during the nineties.

10. The Uruguay Round proposed to reduce tariff rates by one-third on a trade-weighted basis for industrial products (UNCTAD, 1994).

11. The policy promises to prune the negative list of imports further by permitting freer imports of even consumer goods depending upon the degree of improvement of India's BOP over time. In 1994-95, the imports of consumer goods have been indirectly or selectively liberalised via Special Imprest Licence available to selected categories of exporters.

12. Following macroeconomic instability there was two step downward adjustment of exchange rate of the rupee by around 20 per cent against all the trading partner currencies (table 9).

13. The rupee was made partially convertible on trade and current account from 1992 Budget, which was replaced by full unification of the exchange rate of the rupee with effect from March 1, 1993 and from 1994-95, rupee had become fully convertible on current account.

14. The Eighth Plan highlights this aspect of the reforming exchange rate system in India. This can be achieved once the remaining controls and restrictions of the current account transactions have been eliminated. (GOI, Economic Survey, 1993-94).

trade in agriculture is likely to receive top priority in the Ninth Plan.

Provision of fiscal incentives such as direct export subsidies targeting specific sectors prevailing during the eighties, was streamlined during the nineties. These specific subsidies in the form of cash compensation to exporters were done away with and the REP licence scheme was replaced by eximscrips (Pradhan 1991),[15] which were abolished later.[16] These scrips were replaced by partial convertibility, when export profitability is estimated to have declined (Kathuria 1994). Specific subsidies were replaced by more general ones such as tax exemption of export profits and duty drawback schemes. The duty drawback scheme was strengthened during the nineties by enlarging its coverage. Moreover, profits from exports were fully exempt from income tax along with International Price Reimbursement Scheme for certain products such as steel and steel products and natural rubber.

As part of the package on trade reforms during the Eighth Plan, the government liberalised capital flows in the form of foreign direct investment rather than solely depending on external commercial borrowing for financing of current account deficits. The specific measures in this direction are automatic approval of foreign technology collaboration as well as foreign equity participation upto 51 per cent in certain areas; delinking technology transfer from equity investment to impart flexibility in the sourcing of technology imports; automatic clearance for import of capital goods in cases where foreign exchange flows are through foreign equity participation. The policy changes of the nineties in the trade sector did not show any marked departure from what was initiated in the mid-eighties and the trade reform process was sequential.[17] The trade policy measures announced

after the mid-eighties through the nineties were on a long term basis to ensure stability in the measures followed.

> **Gains from trade liberalisation could be realised through lesser distortionary structure of relative prices which reallocates resources and thereby, results in higher levels of trade, especially exports.**

Gains from trade liberalisation could be realised through lesser distortionary structure of relative prices which reallocates resources and thereby, results in higher levels of trade, especially exports. Moreover, as Dornbusch (1992) opines, access to cheaper inputs creates export opportunities, which carry rents and profits that can be invested in capital goods, which in turn yield productivity gains. However, such gains by reducing tariff is valid only for small countries under perfect competition. The extent of increment in exports is also dependent on the degree of reforms and the extent of resource reallocation (Thomas et al, 1991). But such qualifications remain largely inadequate unless emerging patterns of international trade are taken into account.

*Implications of Uruguay Round*

In the post 1985 period, the whole world has moved towards a liberal trade order with the completion of the Uruguay Round of Multilateral trade negotiations in 1993. This has, in effect, provided future directions to world trade. The high most-favoured nation (MFN) tariffs, which have been often considered an important factor restricting developing countries access to industrial markets, have been attempted to reduce and provide market access in the successive rounds of negotiations, even prior to the mid-eighties. In these rounds of negotiations, developed countries benefited from tariff cuts on industrial products traded among themselves, while many products of export interest to developing countries were exempted from across-the-

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15. The study by Pradhan (1991) found that with changes in exchange rates and growth, the rates of incentives, the burden of export incentives appear to be high and thus cash compensation and import licences appear to be redundant. The scrips in place of varied REP rates were made available to all exporters at a uniform rate of 30 per cent of f.o.b. value with a higher rate of 40 per cent for selected value-added products.

16. As noted by the Economic Survey (1992-93), the scrips also had to be issued case by case like import licences and involved administrative complexity.

17. A gradual path to trade liberalisation according to Rodrik (1992), should occur in two steps: the country should move from quotas and licences and other non-tariff barriers to a uniform high tariff of 50 per cent. As the external balance can support liberalisation without the risk of foreign exchange crises, tariffs can be taken down to 10 per cent. Following Rodrik's outline, India's trade sector reforms can be said to be gradual, though tariff rates are not yet brought to 10 per cent level

> **One of the significant achievements of the Uruguay Round is with respect to market access in terms of tariffication of all non-tariff barriers and the significant reduction of the levels of tariffs.**

board commitments.[18] It is against this background that the Uruguay Round achievements are to be analysed.

One of the significant achievements of the Uruguay Round is with respect to market access in terms of tariffication of all non-tariff barriers and the significant reduction of the levels of tariffs. As observed by Smeets (1995), the average reduction of tariffs on industrial products was around forty per cent on trade-weighted basis, which also includes all those tariffs resulting from the tariffication process.[19] However, significant variations in the degree of tariff reductions exist across product category.

The Uruguay Round of tariff offers as proposed by India and the market access prospects for India's exports are to be analysed in greater detail (tables 1 and 2). The percentage of India's manufactured imports which are GATT bound has definitely increased after the Uruguay Round not only indicating India's commitment to liberalise manufactured trade further but also indicative of bringing in larger number of imports within the purview of the multilateral trade negotiations. In the post-Uruguay Round, the applied rate has been the lowest for the imports of mineral products and precious stones. Wood pulp, paper and furniture also entail a low tariff rate of 14.9 per cent. However, the average is 30 per cent. The applied tariff rates in the post-Uruguay Round are found to be higher for electrical machinery, textile and clothing, leather, rubber and footwear and metals, than that for the industrial sector as a whole.

The highest tariff reduction in the Uruguay Round is observed for Wood pulp, paper and furniture as against the lowest reduction of below 10 per cent in case of non-electrical machinery with a post-Uruguay Round applied rate at 31 per cent. For transport equipment also, the applied rate is marginally above 30 per cent following a reduction of around 15 per cent. For mineral products the rate has been brought down to 5.5 per

cent following a reduction of 23 per cent. Thus, the proposed cuts on tariffs for India's imports have been substantial revealing India's commitment towards trade liberalisation.

**Table 1:** MFN Tariff Rates of India's Manufactured Imports After the Uruguay Round

| Product Category | Percentage of Imports GATT Bound | | Levels and changes weighted by imports from World excl FTA | |
| --- | --- | --- | --- | --- |
| | Total Pre-UR | Total Post-UR | Post-UR applied rate | Tariff Reduction |
| Wood Pulp, Paper, Furniture | 22.3 | 98.2 | 14.9 | 29.2 |
| Textiles and Clothing | 30.8 | 74.7 | 42.4 | 20.0 |
| Leather, Rubber, Footwear | 0.2 | 76.9 | 39.9 | 23.1 |
| Metals | 0.5 | 52.7 | 38.3 | 19.5 |
| Chemicals & Photographic Supplies | 2.6 | 83.7 | 36.4 | 20.0 |
| Transport Equipment | 35.5 | 89.6 | 30.9 | 15.4 |
| Non-Electrical Machinery | 22.7 | 99.8 | 31.0 | 9.2 |
| Electrical Machinery | 8.9 | 72.1 | 48.5 | 17.4 |
| Mineral Products, Precious Stones | 9.3 | 26.8 | 5.5 | 23.2 |
| Manufactured Articles n.e.s. | 15.7 | 82.3 | 43.4 | 16.3 |
| Industrial Goods | 11.9 | 69.3 | 29.0 | 16.5 |
| All Merchandise Trade | 11.6 | 58.5 | 30.9 | 16.5 |

*Source:* World Bank (1996).

In case of Indian exports, however, the percentage of exports affected due to the Uruguay Round of agreements has been lower, the lowest of 7.6 per cent being in case of mineral products and precious stones. For transport equipment also, only 22 per cent of exports from India are affected after the Uruguay Round. As illustrated in table 2 the weighted bound and applied tariff rates faced by India's exports have witnessed a substantial reduction in case of mineral products and precious stones, non-electrical machinery, wood pulp, paper and furniture, with the bound rate being higher than the applied rate in most cases. However, in case of textile and clothing, leather, rubber and footwear and transport equipment the reduction is found to be of a lesser degree and

18. Erazan and Karsenty (1989) show that in the post-Tokyo Round the tariff rates prevailing in the EEC, the US and Japan range between 0 to 10 per cent in case of most of the products. However, there are large number of products with tariff rates above 10 per cent. These products are textiles and clothing and miscellaneous manufactures including leather products and footwear. After the Tokyo Round, many of these commodities were also subjected to non-tariff measures of trade restrictions and the GSP coverage is narrower on them. The study simulates that the existence of NTMs, even compete elimination of tariffs, could lead to meagre results.

19. It is found that for the EEC, Japan and the US, the three major destinations of India's exports, the reduction in MFN tariffs on industrial products was also by similar magnitudes. Such impressive results were achieved despite tariffs being negotiated on across-the-board reduction formula basis (UNCTAD, 1994).

hence, the average tariffs continue to be relatively higher than for other commodity groups. It is worth mentioning here that these products are particularly of export interest to India accounting for nearly half of the export basket. Even though tariff offers are made across-the-board, the market access prospects accruing to the developing countries and, in particular, to India also seem exaggerated.[20] Moreover, textile and clothing exports face quantitative restrictions from developed countries in terms of multi-fibre arrangements, which have been proposed to be phased out by 2005. So, trade policies in the Ninth Plan have to take these dimensions into account to reap the benefits of the emerging trade patterns.

**Table 2:** Binding and Levels of MFN Tariff Rates Before and After the Uruguay Round Applicable on India's Manufactured Exports

|  | Percentage of Exports Affected | Post-UR Applied Rate | Tariff Reduction | Post-UR Bound Rate |
|---|---|---|---|---|
| Wood Pulp, Paper Furniture | 53.2 | 7.3 | 4.5 | 2.3 |
| Textiles and Clothing | 79.4 | 10.3 | 2.4 | 10.4 |
| Leather, Rubber, Footwear | 66.9 | 5.7 | 1.9 | 6.0 |
| Metals | 27.0 | 1.6 | 3.0 | 2.5 |
| Chemicals & Photographic Supplies | 49.7 | 5.0 | 4.5 | 8.2 |
| Transport Equipment | 22.0 | 10.9 | 2.7 | 11.1 |
| Non-Electrical Machinery | 50.1 | 3.9 | 4.0 | 6.1 |
| Electrical Machinery | 52.3 | 6.9 | 3.1 | 8.6 |
| Mineral Products, Precious Stones | 7.6 | 0.4 | 6.2 | 0.4 |
| Manufactured Articles n.e.s. | 34.3 | 2.9 | 4.3 | 5.6 |
| Industrial Goods | 42.5 | 4.8 | 2.8 | 5.4 |
| All Merchandise Trade | 40.4 | 4.4 | 3.0 | 5.5 |

*Source:* World Bank, 1996.

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20. The view of beneficial effects of Uruguay Round tariff reductions on developing country exports has been perceived in the Final Draft of the negotiations and has been supported in the literature thereafter (see, for instance, Smeets, 1995). However, UNCTAD (1994) expresses the view that even if allowances are made for preferential imports from developing countries under the GSP, post-Uruguay Round tariffs remain high.

> The market access prospects accruing to the developing countries and, in particular, to India also seem exaggerated. Moreover, textile and clothing exports face quantitative restrictions. Trade policies in the Ninth Plan have to take these dimensions into account.

## External Sector Performance during Reforms

The performance of the macro economy has not been uniform since the mid-eighties from when trade sector reforms have been undertaken in India with vigour. The end result of reforms is measured by growth in economic activity. Since the mid-eighties, as can be seen from table 3, overall GDP was found to be growing along with manufacturing. But this trend has been existing since the early eighties. It is found that the rate of GDP growth has been, on the average, above 4 per cent per annum since the mid-eighties, with manufacturing growth being higher than the corresponding rates for overall GDP. The performance improved over the years reaching high rates of growth in the late eighties. A single year in the early nineties has been the only exception to this pattern. During the phase of macro-economic stabilisation, manufacturing activity relatively stagnated. The revival in manufacturing growth rate during the nineties has often been attributed to growth in the capital goods sector despite a surge in capital goods imports, thus illustrating complementarity in production and imports of capital goods.[21] However, manufacturing growth is not the same throughout and thus, it will be too naive to attribute the high average growth to trade sector reforms enunciated during this phase of the plan period.

The liberal trade regime from the mid-eighties onwards is likely to have had a significant impact on the external sector and hence, balance of trade remains the mainstay of the post-reforms economy. Not only is this parameter the yardstick for the success of the reforms, but it also provides future directions. Net trade remained negative throughout, as can be seen from table 3. It can also be observed that deficit trade balance as a proportion of GDP was around 3.34 per cent in 1985-86 and it remained above one per cent during the eighties. The persisting trade deficit during this phase of partial liberalisation led to severe strains

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21. For a full account of manufacturing growth during the period, see Chandrasekhar (1996). The study contests this fact of complementarity while Narayana and Sinharoy (1996) have tried searching for an alternative explanation to this phenomenon.

**Table 3:** Macro Indicators of the Indian Economy, 1985 to 1994

| Year | Growth of GDP | Growth of Mfg. | TB/GDP Ratio | Tarde/GDP Ratio | Exp./Imp. Ratio | Export/GDP Ratio | Export Rs. | Growth $ | World Share of India |
|---|---|---|---|---|---|---|---|---|---|
| 1985/86 | 4.1 | 4.5 | (−)3.34 | 11.65 | 55.42 | 4.15 | −7.2 | −9.9 | 0.49 |
| 1986/87 | 4.3 | 6.9 | (−)2.61 | 11.11 | 61.96 | 4.25 | 14.3 | 9.4 | 0.46 |
| 1987/88 | 4.3 | 6.6 | (−)1.97 | 11.38 | 70.46 | 4.70 | 25.9 | 24.1 | 0.47 |
| 1988/89 | 10.6 | 8.7 | (−)2.02 | 12.25 | 71.66 | 5.11 | 29.1 | 15.6 | 0.49 |
| 1989/90 | 6.9 | 10.5 | (−)1.68 | 13.79 | 78.29 | 6.05 | 36.7 | 18.9 | 0.53 |
| 1990/91 | 5.4 | 7.0 | (−)1.99 | 14.14 | 75.36 | 6.08 | 17.7 | 9.2 | 0.53 |
| 1991/92 | 0.8 | −1.7 | (−)0.62 | 14.90 | 92.04 | 7.14 | 35.3 | 1.5 | 0.51 |
| 1992/93 | 5.3 | 4.4 | (−)1.37 | 16.60 | 84.71 | 7.61 | 21.9 | 3.8 | 0.53 |
| 1993/94 | 6.0 | 7.1 | (−)0.42 | 17.83 | 95.42 | 8.71 | 29.9 | 20.0 | 0.58 |
| 1994/95 | 7.2 | 9.5 | (−)0.85 | 20.11 | 91.89 | 8.67 | 18.5 | 18.4 | 0.59 |
| 1995/96 | 7.1 | 11.9 | (−)1.66 | 23.23 | 86.69 | 10.79 | 28.6 | 20.8 | 0.61 |
| 1996/97 (Apr-Dec) | – | – | – | – | – | – | 14.9 | 6.4 | – |

**Note:** "TB" indicates trade balance.

*Source:* Calculated from Government of India, Economic Survey, 1996-97, and IMF, Yearbook of International Financial Statistics 1996.

on the payments situation in 1991.[22] The trade balance position undoubtedly improved thereafter, but with fluctuations. The improvement in trade balance is also reflected in the exports-to-imports ratio being more than 90 per cent in most of the years of the Eighth Plan period. Thus, with a relatively comfortable BOP position, India can remove quantitative restrictions on imports of agricultural commodities and certain industrial goods as committed in the Uruguay Round. This issue of the removal of quantitative restrictions has to be dealt with in the Ninth Plan. Such deregulation can only be in phases giving due consideration to the strains that develop in the external payments situation during the phase-out period.

> **With a relatively comfortable BOP position, India can remove quantitative restrictions on imports of agricultural commodities and certain industrial goods.**

22. The literature has instructive explanations for such a phenomenon. Sanyal (1990) is of the view that the removal of import restrictions in the context of developing economies puts immediate pressure on the BOP, though such a process might be beneficial for the long run. Dornbusch (1992) opines that such pressure on external payments can arise from the export growth not being commensurate with the growth in imports even if real depreciation is undertaken.

For the external sector, the improvements over the years during the Seventh and the Eighth Plans have been quite remarkable, particularly in the case of exports growth. It is striking to note that while exports in dollar terms witnessed negative growth in 1991-92, there has been significant growth in rupee exports. This apparent contradiction reflects the substantial depreciation of the rupee during the year. The turnaround in dollar value of exports from 1993-94 is comparable to the high rates achieved during the late eighties. However, high growth could not be sustained with the rate slowing down considerably in 1996-97 despite continuity of reforms.

The growth in exports is also reflected in the increasing exports-to-GDP ratio during the period, which increased from 4.15 per cent in 1985-86 to 10.79 per cent in 1995-96, despite an increasing GDP. This fact might lead one to conclude that growth in supply might have led to exports growth (Sharma, 1996). In addition, there has been significant increase in the total trade to GDP ratio signifying the growing importance of trade in domestic production during the period. The rise in this ratio is in accordance with the target to be achieved by the end of the Eighth Plan.

Moreover, during this period of more than a decade, the long-term declining trend in India's share of total world exports was reversed. The share increased by more than 0.1 per cent during the period reaching around 0.6 per cent in 1995. Prime objective should therefore be to raise this ratio to one per cent by the end

of the Ninth Plan period. However, this would still fall far short of the corresponding ratios for the dynamic Asian region. To achieve this end, commodity groups are to be identified which can have better market access prospects in future.

> **The long-term declining trend in India's share of total world exports was reversed. Prime objective should therefore be to raise this ratio by the end of the Ninth Plan period. Commodity groups are to be identified which can have better market access prospects in future.**

## Commodity Composition

With unprecedented growth in total exports resulting in India's increasing share in world exports, the commodity composition and market direction of India's exports merit observation (table 4). During the decade, 1985-86 to 1995-96, there has been nearly a twenty per cent rise in the share of manufacturing with more than 10 per cent decline in the share of agricultural and allied products in the export basket. Among agricultural commodities, the shares of tea and mate, raw cotton and processed food exports in total have been found to be declining while the proportion of rice exports has been fluctuating. Fish and fish preparations is the only commodity group with increasing presence in the export basket during the period.

**Table 4:** India's Principal Exports, 1985/86 to 1995/96

(in per cent)

| Commodity/Year Group | 1985/86 | 1990/91 | 1992/93 | 1994/95 |
|---|---|---|---|---|
| Agricultural & allied products | 27.70 | 19.41 | 17.61 | 16.59 |
| Tea and Mate | 5.75 | 3.29 | 1.82 | 1.18 |
| Oil Cakes | 1.23 | 1.87 | 2.88 | 2.17 |
| Cashew | 2.07 | 1.37 | 1.40 | 1.51 |
| Spices | 2.55 | 0.73 | 0.73 | 0.74 |
| Sugar etc. | 0.15 | 0.12 | 0.66 | 0.07 |
| Raw Cotton | 0.62 | 2.60 | 0.34 | 0.17 |
| Rice | 1.80 | 1.42 | 1.82 | 1.46 |
| Fish & Preparations | 3.75 | 2.95 | 3.25 | 4.28 |
| Fruits Veg Pulses | 1.14 | 0.66 | 0.68 | 0.73 |
| Processed Food | 0.75 | 0.65 | 0.69 | 0.34 |
| Ores & Minerals | 7.21 | 4.60 | 3.38 | 3.07 |
| Iron Ore | 5.31 | 3.22 | 2.06 | 1.57 |
| Manufactured Goods | 58.50 | 72.91 | 76.06 | 78.24 |
| Textile Fabrics & Manufactures | 16.48 | 20.99 | 23.28 | 24.12 |
| Cotton Y, F, M | 5.27 | 6.45 | 7.28 | 8.48 |
| RMG of all | 9.79 | 12.32 | 12.91 | 12.46 |
| Jute & Manufactures | 2.40 | 0.92 | 0.66 | 0.57 |
| Leather & Manufactures | 7.07 | 7.99 | 6.89 | 6.12 |
| Gems and Jewellery | 13.80 | 16.12 | 16.57 | 17.09 |
| Chemicals | 4.57 | 6.48 | 7.43 | 9.24 |
| Machinery & Transport Equipment | 6.46 | 8.01 | 7.21 | 7.56 |
| Metal and Manufactures | 2.30 | 3.93 | 5.92 | 5.46 |
| Iron and Steel | 0.01 | 1.56 | 2.47 | 2.80 |
| Others | 0.58 | 0.17 | 0.12 | 0.15 |

**Note:** Chemicals include 'Basic Chemicals' and 'Plastics and Linoleum Products'.

*Source:* DGCI&S, Vol. 1, March issues, various years.

Among manufactures, textile fabrics and other textiles continue to occupy a significant proportion. The share of total textiles has been found to be increasing by nearly 8 per cent along with the improving share of the cotton yarn, fabrics and made-ups sub-group. Though the share of ready-made garments exports increased during the eighties, it stagnated from 1990-91 onwards. Likewise gems and jewellery, another predominant group in the export basket, also increased its share with the rise being more prominent during the eighties than in the nineties.

The exports of chemicals and iron and steel have improved their respective proportions substantially. This is in sharp contrast to machinery and transport equipment exports, whose share fluctuated significantly during the decade. There has been decline in the shares of two major commodity groups, viz. jute and manufactures and leather and manufactures while the share of the former has been declining over the past four decades, the fall in the share of the latter is a recent phenomenon of the nineties. In fact, even if the shares of manufactures improved, there is no perceptible change in the commodity composition of India's exports due to trade reforms. Even in the case of manufactures, except the growing presence of chemicals and iron and steel exports, the past trend continues. More importantly, the share of agriculture and allied commodities declined, despite increasing emphasis on exports from this sector in the recent trade policy changes. Nevertheless, exports have grown significantly during the previous two Plan periods.

> There is no perceptible change in the commodity composition of India's exports due to trade reforms. Nevertheless, exports have grown significantly during the previous two Plan periods.

Despite unprecedented growth, the shares across product groups in respective world exports are observed to be low. Among chemicals export, only synthetic dye, natural indigo and lakes, nitrogen function compounds and organic-inorganic compounds account for a high share of the respective world total (table 5). For the gems and jewellery group, though the respective shares are above unity, it is the former which accounts for a significant proportion of world trade. Even in case of iron and steel and leather and manufactures export, only the products lower down the value-added chain account significantly in total world trade. In the above unity. In addition, India's share in the world trade of high-tech commodities such as automatic data processing equipment, telecom equipment and office machines is insig-

nificant. It is the quantum exports of these products and the quick transformation of the export basket which has kept the South-east Asian economies competitive and placed them on a higher export growth path during the period after the mid-eighties.[23]

> India's share in the world trade of high-tech commodities is insignificant. It is the quantum exports of these products which has kept the South-east Asian economies competitive.

Table 5: Share of Selected Exports from India in the Respective World Total, 1995

| Product Group | Share in per cent | Product Group | Share in per cent |
|---|---|---|---|
| Hydrocarbon etc. | 0.22 | Textile Yarn | 3.10 |
| Alcohols Phenols etc. | 0.42 | Cotton Fabrics Woven | 3.41 |
| Carboxylic Acid etc. | 0.59 | Woven Man-made Fibre Fabric | 0.82 |
| Nitrogen Function Compound | 1.17 | Other Woven Textile Fabric | 2.46 |
| Organic-Inorg Compounds | 0.99 | Knitted Fabric | 0.76 |
| Synth dye Natural Indigo Lakes | 3.53 | Lace Ribbons Tulle etc. | 1.20 |
| Leather | 3.36 | Special Textile Fabrics | 0.27 |
| Leather manufactures | 6.90 | Textile Articles nes | 5.67 |
| Footwear | 0.80 | Floor Coverings | 7.86 |
| Pearl Prec Semi-P Stones | 12.65 | Men's Outwear Not Knit | 0.87 |
| Gold Silverware Jewellery | 2.85 | Women's Outwear Not Knit | 5.12 |
| Pig Iron etc. | 3.13 | Under Garments Not Knit | 5.72 |
| Iron and Steel Shapes | 0.76 | Outwear Knit Non-elastic | 1.65 |
| Iron and Steel Wire | 0.63 | Under Garments Knitted | 2.27 |
| Iron and Steel Castings Unworked | 2.38 | Textile Clothing Accessories nes | 2.36 |
| Steam Boiler & Auxillary Plant | 0.72 | Telecom Equipment | 0.09 |
| Road Motor Vehicles nes | 0.01 | Office Machines | 0.04 |
| Cycles Motorised or not | 1.62 | Automatic Data Processing Equipment | 0.07 |

Source: UN, 1995.

23. A detailed description of this process is available in UNCTAD, 1996.

**Table 6:** Direction of India's Exports, 1985/86 to 1994/95

(in per cent)

| Countries | 1985/86 | 1990/91 | 1992/93 | 1994/95 |
|---|---|---|---|---|
| OECD | 50.8 | 53.5 | 60.5 | 58.7 |
| EU | 17.7 | 27.5 | 28.3 | 26.7 |
| – Belgium | 2.1 | 3.9 | 3.7 | 3.8 |
| – France | 1.9 | 2.4 | 2.5 | 2.2 |
| – Germany | 4.7 | 7.8 | 7.7 | 6.6 |
| – Netherlands | 1.5 | 2.0 | 2.2 | 2.2 |
| – UK | 4.8 | 6.5 | 6.5 | 6.4 |
| Canada | 1.2 | 0.9 | 1.0 | 1.0 |
| USA | 18.1 | 14.7 | 19.0 | 19.1 |
| Australia | 1.1 | 1.0 | 1.2 | 1.3 |
| Japan | 10.7 | 9.3 | 7.7 | 7.7 |
| OPEC | 7.7 | 5.6 | 9.6 | 9.2 |
| – Iran | 0.9 | 0.4 | 0.6 | 0.6 |
| – Iraq | 0.3 | 0.1 | 0.0 | 0.0 |
| – Kuwait | 1.1 | 0.2 | 0.6 | 0.5 |
| – Saudi Arabia | 2.0 | 1.3 | 2.2 | 1.7 |
| Eastern Europe | 21.1 | 17.9 | 4.4 | 3.6 |
| – USSR | 18.4 | 16.1 | 3.3 | 3.1 |
| Developing Countries | 13.4 | 16.8 | 20.8 | 23.9 |
| – Africa | 2.7 | 2.1 | 2.7 | 2.5 |
| – Asia | 10.6 | 14.3 | 17.4 | 20.1 |
| – Latin America & Caribean | 0.2 | 0.4 | 0.7 | 1.3 |
| Others | 7.1 | 6.2 | 4.7 | 4.6 |

**Note:** FRG figures from 1990/91 onwards correspond to that of unified Germany. Former USSR figures are that of Russia from 1992/93.
*Source:* DGCI&S, various years.

For textile and clothing exports, the proportion in total world share has been the highest for floor coverings. The share has also been more than unity for many groups such as textile yarns, cotton fabrics, other woven textile articles n.e.s. and textile clothing accessories n.e.s. More value-added product groups such as woven man-made fibre fabric, knitted etc. fabric and special textile fabrics along with non-knitted men's outwear and knitted outwear and knitted outwear account for relatively low share of world exports. The trade in such products by developing countries have been facing MFA restrictions from the developed world. For the Indian textile sector to take advantage of the post-MFA phase of world textiles trade, specific policies have to be framed in the Ninth Plan. In this regard, the first step would be to focus on more value-added items, which definitely require assured quality and better designs. Thus, for India to have a competitive and buoyant export sector, the commodity composition of exports has to change in favour more value-added items and high-tech products. For such products, a quantum rise in the respective shares of world exports is to be achieved by the conclusion of the Ninth Plan period. Such products could be targeted by bringing in technology through FDI from Japan and other East and South-east Asian economies. Such targeting of sectors must be done with due consideration to the existing and emerging patterns of world demand.

> For India to have a competitive and buoyant export sector, the commodity composition of exports has to change in favour more value-added items and high-tech products.

## Market Direction

An interesting pattern of India's export growth emerges if the markets for exports are analysed (table 6). The OECD, is the largest destination, though its share declined marginally in the nineties compared to the period before 1992-93. European Union market also stagnating during the nineties with most of the prominent EU trading partner countries have stagnating or declining shares during the specified period. The declining importance of Japan as a market for Indian exports during this period is noteworthy. The share of the East European destinations is on the decline while the African economies maintain a low and stagnating market share.

The falling shares of these markets have been compensated by the significantly rising proportion of Asian developing economy destinations. The proportion of these markets rose from 10.6 per cent in 1985-86 to 20.1 per cent in 1994-95. This is the most significant market development during trade reforms period. Apart from this the respective shares of the USA and OPEC markets have improved, but stagnated during the nineties, with the USA remaining one of the major destinations for India's exports.

> **The rising proportion of Asian developing economy destinations is the most significant market development during trade reforms period. significant market development during trade reforms period.**

The increasing share of manufactured exports can be an outcome of growing world trade and the growth pattern in these destination economies during the period. To be precise, growth in world output and trade was strong after the mid-eighties, (table 7) in contrast to the low or negative growth of world trade during 1980-85.[24] It be seen that growth in world production increased by around 3 per cent during 1985 to 1990, which sharply contrasts with the fall in output during the immediate post oil shock period. However, growth of world output slowed down during the quinquennium 1990-95.

Despite the lower growth of world merchandise trade during the nineties relative to the period 1985-90, growth of imports was sustained in the dynamic Asian

**Table 7:** Growth in World Trade Across Commodity Groups

(in per cent)

| Commodity Groups | 1980-85 | 1985-90 | 1990-95 |
|---|---|---|---|
| Total Exports | −1 | 12 | 8 |
| *Manufactured Exports* | 2 | 16 | 9 |
| – Iron and Steel | −2 | 9 | 7 |
| – Chemicals | 1 | 14 | 10 |
| – Machinery & Transport Equipment | 3 | 15 | 9 |
| – Office Machines & Telecom Equipment | 9 | 18 | 15 |
| – Automotive Products | 6 | 14 | 7 |
| – Textiles | −1 | 15 | 8 |
| – Clothing | 4 | 17 | 8 |
| World Total Production | 2 | 3 | 2 |
| – Manufacturing | 3 | 4 | 1 |

*Source:* WTO, Vol. II, 1996

region with the imports growing significantly in the NIES and also China with highest growth of imports in these countries during 1994 and 1995 (WTO, Annual Report, 1996, Vol. I). The GDP in these East Asian economies also grew at high rates during the period and have, thus, become the epicentre of World growth and trade.[25] The shift in the focus of India's destination of exports to these growing economies over this decade is a move in the right direction. However, India's trade with China has not grown significantly during this period though china has opened its economy to world trade. During the Ninth Plan, trade possibilities with China have to be explored by identifying exportables, especially manufactures. Moreover, trade with other East Asian nations has to be strengthened, which will, in a way, reduce the excessive dependence on the slowly growing OECD economies as export destinations.

> **The shift in the focus of India's destination of exports to these growing economies is a move in the right direction. However, India's trade with China has not grown significantly. During the Ninth Plan, trade possibilities with China have to explored.**

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24. Krugman (1995) finds that the share of world trade in GDP during the period after the mid-eighties has surpassed the peak reached during the seventies.

25. Krugman (1995) views that Hong Kong and Singapore have become supertrading nations over the period and, for the NIEs and China, trade expanded consequent upon the growth of labour-intensive production due to the slicing up of the value chain.

The growth in world trade of aggregate manufactures and most manufactured product groups was significant with highest growth recorded in case of high-tech products such as office machines and telecom equipment. Though the growth in total world trade slowed down during the nineties, significant growth of world trade in high-tech products and chemicals continued unabated. As a result, as can be observed from table 8, the commodity composition of imports is broadly the same across various destination countries in 1995. Most of these economies are large importers of manufactures in general and machinery and transport equipment in particular. More importantly, these economies import products such as office machines and telecom equipment in significant proportions. However, after the mid-eighties, exports of high-tech products from India did not register growth commensurate with the growth in world trade of such products. Moreover, products such as textiles and clothing and other consumer goods, which are exported on a large quantum scale from India, do not figure in large proportions in the import baskets of these destination countries. Thus, there exists a mismatch between India's export interests and the present trends in global trade. This is further accentuated by the Uruguay Round offers for India's exports. During the Ninth Plan, policies should be designed to evolve an export basket which conforms to the emerging pattern of global trade. For such a rapid transformation, foreign investment has to be brought in to such technology-intensive sectors and the nexus between investment and trade has to be established as was done in dynamic Asian economies.[26]

> **There exists a mismatch between India's export interests and the present trends in global trade. During the Ninth Plan, policies should be designed to evolve an export basket which conforms to the emerging pattern of global trade.**

## Exchange Rate Dynamism

During economic reforms, improvement in external trade is thought to be brought about by exchange rate adjustments. The Approach Paper to Ninth Five Year Plan (1997) has perceived an exchange rate system which has to be used "judiciously to achieve steady and sustainable growth of trade, investment and competitiveness." The exchange rate of the rupee, both nominal and real, are found to be depreciating in all the years during 1985-86 to 1996-97. The nominal effective exchange rate (NEER) of the rupee, as can be seen from the table 9, depreciated at very high rates during the early nineties. In 1994, the NEER depreciation was found to be marginal.[27] The real effective exchange rate (REER), has also depreciated at significant rates in most of the years. The devaluation in July, 1991 gets gets fully reflected in unprecedented large negative changes in both NEER and REER.[28] During the nineties, the rates of depreciation in REER have come down, especially in 1995 and 1996. Along with exchange rate depreciation, there has been growth of exports during the period and export growth slowed when the extent of depreciation lowered. Though exchange rate seems to have influenced exports growth, it is difficult to maintain whether such growth in exports has been solely contributed by exchange rate depreciation. Nevertheless, export growth requires exchange rate to depreciate, but it may not be the sufficient condition for such growth.

**Table 9:** Exchange Rate Depreciations, 1985-96

(in per cent)

| Year | NEER (1985 = 100) | REER (1985 = 100) | Growth of Unit Value of Exports |
|---|---|---|---|
| 1985 | −2.7 | −1.6 | 0.59 |
| 1986 | −11.5 | −8.0 | 4.68 |
| 1987 | −7.6 | −7.1 | 8.94 |
| 1988 | −6.1 | −3.9 | 18.97 |
| 1989 | −6.2 | −5.4 | 19.40 |
| 1990 | −5.2 | −4.0 | 5.78 |
| 1991 | −19.4 | −13.4 | 26.28 |
| 1992 | −14.3 | −6.2 | 14.05 |
| 1993 | −8.3 | −4.4 | 12.32 |
| 1994 | −1.0 | −6.8 | 4.43 |
| 1995 | −7.2 | −1.7 | −2.22 |
| 1996 | −5.2 | −2.2 | n.a. |

**Note:** The indices from 1993 onwards are based on FEDAI indicative rates

*Source:* RBI Bulletin, various issues.

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26. UNCTAD (1996) has developed a framework of investment-trade nexus in dynamic Asia and Chandrasekhar (1997) has provided insights on such a nexus in the phase of capitalist development. Chandrasekhar (1997) is also of the view that large magnitudes of FDI in this economies was a result of targeted relocation of industries from industrially more developed economies.

27. The nominal rate started appreciating in some quarters of 1992-93 and in 1993-94, the extent of depreciation was found to be marginal.

28. Though such rates of change are high, it could have been higher but due to the inclusion of many high inflation countries in the weighting diagram of the index constructed, which nullifies the effect of nominal devaluation to a large extent.

The exchange rate depreciation, on the other hand, has led to higher unit value realisation of exports.

The marginal depreciation in the rupee rate or even appreciation in certain quarters during the nineties have often been attributed to the large inflow of foreign capital through FIIs. Thus, there exist conflicting tendencies of exchange rate: on the one hand, export growth requires depreciating exchange rate, while on the other, exchange rate is likely to appreciate consequent upon inflows of foreign capital. It is in this context full convertibility of the rupee has to be addressed in the Ninth Plan as the move might jeopardise all attempts for higher export growth and accentuate the already existing slowing down of exports.

## Summary & Implications

To conclude, exports grew at high rate during the trade reforms period of the Seventh and the Eighth Plans, though the rate could not be sustained. New markets have emerged in the dynamic Asian region, which did not provide enough stimuli to bring about a change in the commodity composition of exports. The earlier plans increasingly on the external sector, but failed to take the dimensions of the emerging global trade into account. For a buoyant export sector, it is thus imperative to look for new products which is in conformity with emerging global trade. As exports performance across sectors varied, it is also crucial that a sector specific approach to export promotion is adopted as against general policy measures, as put forward by Balakrishnan (1993). Some macro level policy initiatives like capital account convertibility, the Ninth Plan has to initiate with caution.

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# Regional Development & Planning in India

## K.R.G. Nair

*Interstate disparities have a marked impact on the success of national plans. To remove the economic imbalances existing in the less developed states, the author suggests the inclusion of the regional dimension in our future plans.*

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People inhabiting the different geographical regions of a nation, however small it is, often have varied social and cultural backgrounds. The political conditions, historical experiences and resource endowments of these regions are generally found to be quite dissimilar. It is much more so in a nation of sub-continental dimensions like India. It is hence, hardly surprising that there exist considerable differences in the levels of the living of the people in the different regions of India.

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Such inter-regional differences[1] cause concern in any part of the world. Even in the most developed nations where keeping the wolf from the door is not a problem, relative regional poverty does exist and often gets highlighted as the burning issue of the lagging regions. There is considerable historical evidence to show that adequate attention to this issue is crucial for the very survival of a nation, particularly if it has a federal political set-up. In the absence of special policy measures there is a tendency for such disparities to increase in the process of national economic development (Hirschman, 1961; Myrdal, 1958; Williamson, 1965). A number of earlier studies, indicate that the Indian experience in this regard till the eighties has been exactly along similar lines. In the light of this, a study was attempted to examine the relationship between regional disparities and economic planning, particularly since the eighties in India.

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1. The existence of these have been brought out by many including Dholakia (1985) and Nair (1982).

## The Study

The states of India were taken as regions for the purpose of this study.[2] No state is perfectly homogeneous in terms of agro-climatic, industrial or sociological factors. But since the reorganisation of States in the mid-fifties, there is considerable homogeneity in terms of language within each state. Hardly any Indian state can be considered a nodal region in the sense of having no inter-state economic linkages. However, states are the politico-economic decision-making and planning units of the Indian federation. Besides they are also the regional units for which data are collected in India. A number of small hill states are given special consideration in planning. This is often because of their strategic geographical positions bordering other countries and not solely on considerations of regional development. Such special category states were hence excluded from this study and only fifteen major indian states[3], covering 95.9 per cent of the Indian population in 1991 were taken up for study.

### Indicator of economic development

Per capita net domestic product (N.D.P.) is considered indicative of efficient resource use of the concerned nation. The extent to which per capita N.D.P. can be considered indicative of the level of living in very open national economies, is in doubt because of the importance of net income from abroad in such economies. The different regions of any nation are much more open from this point of view leading to considerable differences between the income originating and that accruing. Hence per capita N.D.P. is not a good indicator of the level of living at the regional level (Nair, 1982). However, region can ill afford to utilise its resources inefficiently. Further, while the people of a less developed region may, for some time, not mind transfers from other regions to pull up their level of living, few regions can sustain themselves in the long run as post office economies. Moreover, to live on such "doles" is a prospect not much relished by the people in the lagging region. In view of this, N.D.P. with all its limitations was taken as broadly representative of the level of economic development of region.

### Data used

Estimates of per capita state domestic product (S.D.P.) brought out by the Central Statistical Organisation (C.S.O.) were used for analysis. This was because a number of critical surveys of state income data in India including the one by Nair (1987) have found that the alternate S.D.P. estimates brought out by the State Statistical Bureau (S.S.B.) are not comparable between the states. The SSB estimates can of course be used for analysing inter-temporal changes in a particular state, but not for an analysis of the inter-state type as attempted here. In fact, both the Planning Commission and the Finance Commission use CSO estimates in making regional allocations.

The difficulty with the CSO estimates is that they are not available in the form of a regular time-series. The CSO did prepare and publish estimates of S.D.P. for a few years in the late 70's and the early 80's, but this practice has since been discontinued. Now CSO estimates are prepared for the use of a particular Finance Commission or for formulating a particular Five Year Plan and are brought out only in summary forms and that too in the report of the relevant Finance Commission. On top of it, they are available only at current prices. But despite all these limitations, these estimates were used for the study as inter-state comparisons can be meaningfully done only on their basis. Other regional data used in the study are also the ones brought out by the official bodies of the Government of India – the Planning Commission and the Finance Commission.

### Methodology

In the absence of comparable time-series of data on the development at the regional level, no sophisticated econometric exercise was attempted. On the basis of a few elementary statistical devices, some rather broad and general inferences were sought to be obtained. The states were ranked in terms of the variables under study. To have a general idea of the extent to which the relative positions of the different states are similar to each other in terms of the different variables, rank correlation coefficients were calculated.

## Inter-State Disparities

It is interesting to visualise the situation regarding the relative level of economic development of the different states of India in the 90's, after the nation has experienced around four decades of development planning. This is brought out in table 1 which gives certain indicators of economic development in the 90's for the states of India considered here. The per capita S.D.P. figures show that the relative economic position of the major states of India has hardly undergone any change over time. Bihar, Madhya Pradesh, Orissa, Rajasthan and Uttar Pradesh continue to occupy the lower rungs

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2. For a discussion on the choice of regions, see among others, Nair (1994).

3. The states considered are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal.

of the economic ladder. The top positions in this regard, continue as in earlier years, to be occupied by the four economic giants—Punjab, Haryana, Gujarat and Maharashtra.

**Table 1:** Indicators of Economic Development of the states of India in the 90's

| S. No. | State | Per Capita S.D.P. 1987-90 (Rs.)** | % Rural Poor 1987-88*** | Index of Economic and Social Infrastructure** |
|---|---|---|---|---|
| 1. | Bihar | 2135 | 52.63 | 92.04 |
| 2. | Uttar Pradesh | 2867 | 41.10 | 111.80 |
| 3. | Orissa | 2945 | 57.64 | 74.46 |
| 4. | Rajasthan | 3092 | 33.21 | 70.46 |
| 5. | Assam | 3195 | 39.35 | 81.94 |
| 6. | Madhya Pradesh | 3299 | 41.92 | 65.92 |
| 7. | Andhra Pradesh | 3455 | 20.92 | 99.19 |
| 8. | Kerala | 3532 | 29.10 | 205.41 |
| 9. | West Bengal | 3750 | 48.30 | 131.67 |
| 10. | Karnataka | 3810 | 32.82 | 101.20 |
| 11. | Tamil Nadu | 4093 | 45.80 | 149.86 |
| 12. | Gujarat | 4602 | 28.67 | 123.01 |
| 13. | Haryana | 5284 | 16.22 | 158.89 |
| 14. | Maharashtra | 5369 | 40.78 | 121.70 |
| 15. | Punjab | 6996 | 12.60 | 219.19 |

**Note:** The states are arranged in ascending order of per capital S.D.P.

*Source:* ** Report of the Finance Commission.

*** Lahadawala Committee report. See Planning Commission (1993)

The percentage of rural poor, and the index of economic and social infrastructure in the states enable us to have a more detailed picture regarding the nature of regional economic development in India in the 90's. The less developed states of India seem also, to be pockets of poverty, whereas the economic giants are, in general, much less poverty-stricken[4]. Similarly low per capita S.D.P. states are also, in general, the ones with less infrastructural development, whereas the high per capita S.D.P. states have, relatively better developed infrastructure facilities[5]. The table also highlights the case of Kerala where infrastructural development and poverty removal have been far in excess of what is warranted, from the general experience by the level of per capita S.D.P.

These inferences get further substantiated by table 2, which gives the ranks of the states in terms of the

4. The exceptions are Rajasthan and Maharashtra.

5. Uttar Pradesh is the odd state out in this regard.

three indices of economic development, considered here. The ranks are in ascending order of per capita S.D.P. and also of the index of economic and social infrastructure and in descending order of the percentage of rural poor. It is interesting to note that the rank correlation coefficient between per capita S.D.P. and the percentage of rural poor is as high as 0.72 while that between per capita S.D.P. and the percentage of rural non-poor is lower at 0.58[6]. There are thus broad indications that planning in the most developed states has concentrated more on poverty removal and less on the development of infrastructure. On the other hand, planning in the less developed states seems in general to have focussed more on infrastructural development than on poverty removal.

> **Planning in the most developed states has concentrated more on poverty removal and less on the development of infra-structure. Planning in the less developed states seems to have focussed more on infrastructural development than on poverty removal.**

**Table 2:** Ranking of the Indian States in the 90's

| State | Rank in Per Capita S.D.P. | Ascending Order of Index of Infrastructure | Rank in Descending Order of % Rural Poor |
|---|---|---|---|
| Bihar | 1 | 5 | 2 |
| Uttar Pradesh | 2 | 8 | 6 |
| Orissa | 3 | 3 | 1 |
| Rajasthan | 4 | 2 | 9 |
| Assam | 5 | 4 | 8 |
| Madhya Pradesh | 6 | 1 | 5 |
| Andhra Pradesh | 7 | 6 | 13 |
| Kerala | 8 | 14 | 11 |
| West Bengal | 9 | 11 | 3 |
| Karnataka | 10 | 7 | 10 |
| Tamil Nadu | 11 | 12 | 4 |
| Gujarat | 12 | 10 | 12 |
| Haryana | 13 | 13 | 14 |
| Maharashtra | 14 | 9 | 7 |
| Punjab | 15 | 15 | 15 |

*Source:* Based on Table 1.

6. The ranks considered are in descending order of the percentage of rural poor. Hence, this statement.

## The Pre-eighties Scenario

Detailed critical surveys of planning in India (by many including Nair, 1982) reveal a number of interesting aspects about planning to remove inter-state economic imbalances in India. All Five Year Plans during the period under consideration stress the importance of removing regional imbalances in India. But mere lip-service seems to have been paid in this regard if we take into account the policies formulated and actually implemented.

There are, in fact, adequate grounds to believe that the Indian planners thought that there exists a trade-off between economic growth at the national level and the removal of inter-state economic imbalances. This resulted in the curious situation of attempts, till the late sixties, to remove regional imbalances without even identifying the less developed regions. This anomaly did get rectified and the less developed regions, identified by expert committees, only much later.

Planning at the regional level proceeded under the unrealistic assumption that industrialisation is synonymous with economic development. The regions identified as less developed, were so categorised on the basis of the level of their industrial development. Attempts were made to economically improve the less developed regions by locating heavy industries belonging to the public sector, in them. Such an approach ignored the fact that industrialisation can succeed only if industrial development is taken up in an integrated manner. This means considering both the large and the small sectors together, taking into proper account the inter-industry linkages and inter-regional spillovers.

> Planning at the regional level proceeded under the unrealistic assumption that industrialisation is synonymous with economic development.

Further, even as regards the avowed policy of the removal of inter-state disparities in industrial development, there was many a slip between the cup and the lip. The policy was to have been carried out on two fronts — firstly, the government lending institutions were to give finance at concessional rates to the less developed regions and secondly, the licensing policy of the government was to be tilted in favour of the less developed regions. The policy, however, was not much of a success on either count. Detailed analysis shows that it is the more developed states of India, which have cornered the lion's share, per capita, of concessional finance and of licenses issued[7].

## Position Since the Eighties

The same half-hearted and hesitant approach towards reducing regional imbalances continues to bedevil Indian planning even after the eighties. The Sixth Five Year Plan did have the reduction of regional disparities as one of its ten objectives. Two riders were however, hastily added in the document. These were that this reduction should not be at the cost of national economic growth nor at the cost of the growth of the more developed regions. By the time of the Eighth Five Year Plan, tailored to manage the transition from a centrally planned economy to a market-led one, the elimination of regional disparities got totally wiped out from the four-fold focus and even from the set of six objectives.

The post eighties period however, witnessed a welcome change in the type of policies adopted to lessen regional imbalances. The established viewpoint that industrialisation is the panacea for removing the economic backwardness of the less developed regions was under scrutiny. The Sixth plan began this process by lauding the recommendations of the National Committee on the Development of Backward Areas (NCDBA)[8]. The NCDBA had categorised the less developed regions into groups and had suggested different types of regions. The Seventh Five Year Plan categorically stressed the need to extend the Green Revolution to new areas, particular emphasis being laid in this regard on rice cultivation in the eastern region. It also emphasised the need to promote human resource development in the less developed regions.

A comparison of the per capita allocations of plan expenditure from the Sixth to the Eighth Plans clearly reveals this change in emphasis. Plans relating to agriculture and human resource development are, by and large, under the purview of the states. An analysis is hence made here of the extent to which the allocation of state plan expenditure (SPE) in the different Plans have been regionally equitable. Table 3 gives the per capita SPE figures for the Sixth, Seventh and Eighth Plan periods for states arranged in ascending order of per capita S.D.P. in the eighties. It is seen that the values of

7. This is only partly explained by the fact that there were fewer takes per capita for these facilities in the less developed regions. A more important reason seems to be that, at times, the criteria for economic backwardness used for these purposes, were state-specific.

8. This committee is also known as the Sivaraman Committee and submitted its report in 1981. See Planning Commission (1981).

per capita SPE allocations are much higher for the high per capita S.D.P. states. There is, however, a slow but perceptible change in this over the three plan periods. The inter-state inequity in per capita SPE has been becoming less over time. This is all the more apparent if we consider the fact that the correlation between the ranks of the states in terms of per capital S.D.P. and of per capita SPE is becoming less over time. In fact, the values of these rank correlation coefficients are 0.84, 0.58 and 0.50 respectively.[9]

**Table 3:** Allocation of State Plan Expenditure in The Different States of India After The 80's

| S. No. | State | Per Capita State Plan Expenditure (Rs.) | | |
|---|---|---|---|---|
| | | VI Plan | VII Plan | VIII Plan |
| 1. | Bihar | 461.24 | 729.41 | 1505.15 |
| 2. | Assam | 580.40 | 1055.28 | 2080.32 |
| 3. | Uttar Pradesh | 527.69 | 942.36 | 1509.60 |
| 4. | Rajasthan | 591.07 | 875.66 | 2613.04 |
| 5. | Madhya Pradesh | 728.25 | 1341.51 | 1677.24 |
| 6. | Orissa | 568.83 | 1023.89 | 3158.56 |
| 7. | Andhra Pradesh | 578.90 | 971.06 | 1578.71 |
| 8. | Tamil Nadu | 650.69 | 1187.78 | 1825.99 |
| 9. | Kerala | 609.04 | 825.15 | 1876.29 |
| 10. | Karnataka | 609.85 | 942.38 | 2734.55 |
| 11. | West Bengal | 641.26 | 755.77 | 1433.61 |
| 12. | Gujarat | 1079.50 | 1760.00 | 2783.83 |
| 13. | Maharashtra | 983.59 | 1672.51 | 2346.09 |
| 14. | Haryana | 1393.19 | 2244.58 | 3462.94 |
| 15. | Punjab | 1165.57 | 1956.52 | 3239.64 |

**Note:** The states are arranged in ascending order of C.S.O. estimates of per capita S.D.P. in 1980-81. The state plan expenditure data are from the respective plans. Per capita expenditure figures for Sixth and Seventh Plans are obtained using 1981 population figures, while for Eighth Plan, the 1991 populations figures are used.

## The Ninth Five Year Plan

The approach paper to the Ninth Five Year Plan can be taken as broadly indicative of the final proposals. Its perusal clearly indicates, however, that the Ninth plan is not likely to be qualitatively any different in its approach to the issue of reducing the inter-state economic disparities in India.

It is true that tears are shed in profusion in the approach paper about the increased inter-regional

economic disparities in India. There is candid admission that despite balanced regional development being formally an essential component of the development strategy in India, states like Bihar and Uttar Pradesh have not experienced economic growth. The adverse impact that this has on the people living below the poverty line in these regions is also specially accepted. There is also clear recognition that the private sector functioning through the free-market mechanism will be attracted more to the developed regions.

All this, however, seems to be mere repetition of the lip-service that used to be paid even earlier by the Indian planners in this regard because the removal of regional imbalances is not included as one of the nine objectives of the Ninth Plan[10]. The redeeming feature is, the continuation of the shift in emphasis from mere industrialisation to agricultural and rural development to remove regional economic backwardness. There is also stress on improvements in connectivity for this purpose. A plea is hence made for public investment in infrastructure in the less developed states. But almost immediately the half-hearted and hesitant view in this regard, possibly because of the fear of a trade-off between national economic growth and reduction of regional imbalances, prevails. A rider is therefore put that public investment in infrastructure in the less developed states should not be at the cost of resource generation by the state concerned.

> **The redeeming feature is, the continuation of the shift in emphasis from mere industrialisation to agriculture and rural development to remove regional economic backwardness.**

## Inferences

In any federal set-up, the existence of considerable economic disparities between the federating units is fraught with serious adverse consequences. This is all the more so at this juncture in India because regional political parties have come up and we are entering the age of coalition governments at the centre. The states are the federating units in India and our analysis shows the existence of widespread inter-state economic disparities in India even in the 90's, after four decades of development planning. It is, in fact, officially admitted that these disparities have actually increased over time.

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9.  The per capita S.D.P. of the 80's is used for calculating ranks for the VI and VII Plan periods, while per capita S.D.P. figures for the 90's are used or this purpose for the VIII Plan.

10. It is of course mentioned that reduction of regional disparities has to be an important dimension of state policy.

Faith is being placed in the market mechanism to bring about optimum solutions to economic problems. It is, however, universally accepted that the invisible hand cannot by itself, reduce inter-state economic disparities in India in the foreseeable future. The Indian planners have also overtly held such a viewpoint. There, however, is a lurking fear in their minds that a trade-off exists between economic growth at the national level and the removal of inter-state economic imbalances[11].

Inter-state economic disparities cannot be reduced unless this unfounded fear is removed. a regional dimension can then be introduced in Indian planning. This would mean that one of the goals in our future plans has to be the reduction of the percentage of people below the poverty line in the less developed states to a targeted level. This has actually been done by a number of countries already. Even

> **One of the goals in our future plans has to be the reduction of the percentage of people below the poverty line in the less developed states to a targeted level.**

three decades back, Williamson (1965) had pointed out instances of this kind in Latin America. Hansen (1974) has mentioned the case of a number of European countries which have successfully carried out similar exercises. More recently and nearer home, Indonesia has done it, as has been pointed out by Stelder (1993). There is thus every reason for India also to do so at the earliest.

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11. The fact that this fear is unfounded has been shown by many, including Raj Krishna (1980).

# Management Education — An Introspective Note

## Subrata Chakraborty

*The paper takes a close look at management education in India, the way it is at present, the purpose it currently serves, juxtaposing the analysis with the purpose it currently serves and the knowledge and skill needed for bringing growth and development to people in our country. The paper identifies certain knowledge and skills necessary for students to work as catalysts of change, pointing out side by side the gaps that exist now. It argues towards the need for urgently refocusing our research efforts in management grapple with the current realities in business and society experience. The objective is to open a dialogue on the state of our management education and how it can possibly be made more purposeful to meet the expectations of our society as depicted through the country's ninth five year plan paper.*

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Acquisition of knowledge and its purposeful application in work were seen as important from the beginning of human civilization. However, how to effectively acquire knowledge and what may be some of the ways to build abilities relating to its successful development remained unclear for long. Even today many grey areas remain in our understanding of the various interrelationships that operate between knowledge and work. Instituting formal systems of education and research, nations all over the world have been trying to identify their knowledge needs, find ways to transmit knowledge to wider sections of their people, and generate strategies for the gainful deployment of knowledge in actual work. The overall objective is broadly the same for all, that is, to forge ahead as a nation through the effective conduct of various socio-economic activities and, achieve growth and development. Knowledge, therefore, is not to be seen as a virtue, nor its acquisition as a mere act of piety. Today it is built consciously and used systematically to realize individual and national goals.

### Perusal of Knowledge: Method & Goals

The emergence of umpteen new varieties of socio-economic activities has created demands for many alternative forms of knowledge. In addition, the rising expectations of people also push countries, to go in search of differentiated knowledge and skills so as to be able to create a glorious future. This has become a compelling need, as much for the countries in the developed world as it probably is for the developing nations.

India, having achieved her independence only 50 years back, is one of the relatively recent aspirants to join the group of developed nations. Currently we remain somewhat confused about what can get us growth and development speedily, and at the same time, in a more equitable manner. On the one hand is

the urge to copy the approaches used by those who are already developed, while on the other exist the problems, typically our own, in social, economic and political arenas rendering our attempts half-hearted and efforts disconcerted. India's knowledge needs are different from those of other countries. We have tried alternative approaches and made many adjustments going through the process of learning and execution. Presently a more dynamic form of mixed economy is being attempted seeking greater integration between domestic and international sectors consistent with our own interests of greater employment generation, improved balance of trade, improved throughput and technological independence. Given the nature of our problems and the multifacetedness of our needs, genuine and concerted efforts from all sectors of economy would be necessary to achieve our goals.

Towards this end, education is an investment for building the much needed human capital. Careful planning of educational activities is not just important, but a necessity for survival. More often than not, education processes in our country tend to follow the approaches adopted elsewhere, especially those used in the developed world without undertaking any detailed evaluation of their real utility in our context. Such a tendency continues to exist to a varying extent for all types of education offered; however it is probably most predominant in the case of manage-

> **Education processes in our country tend to follow the approaches adopted elsewhere, especially those used in the developed world without undertaking any detailed evaluation of their real utility in our context.**

ment education where attempts are repeatedly made to fit the models, methods, and approaches developed by the western schools to our work situations. Unfortunately, use needs being context specific, models developed in one part of the world require validation before they are taken up for implementation in another situation. For management approaches, such validation needs are much more because of the interplay of various factors. Scholars, while differing in their views on the specificities of various socio-economic concerns have broadly agreed on what educational processes should strive to achieve. These are: to maintain unity between man and nature; to prepare the social psyche in an increasingly globalized world; to resolve contradictions arising out of global integration and its simultaneous fragmentation;

to balance tradition and modernity; and to bridge the gap between knowledge and work (Raza & Tilak, 1986).

> **Educational processes should strive to maintain unity between man and nature; to prepare the social psyche to resolve contradictions to balance tradition and modernity; and to bridge the gap between knowledge and work.**

Being general, the above concerns may not easily lend themselves to clear and step-by-step operationalization. However they contain thoughts which could lead to more refined understanding of things.

## Management Education in India

As in several other countries, management education in India too began with the objective of developing certain abilities in our people to manage our affairs well. Copying the western ideology, management education in this country begin with a focus on business and industry. Making a small beginning in the early fifties, the activity seems to have come a long way in the past 40 odd years. Today, management education has literally become a household name, like medicine and engineering education. Fresh initiatives to set up management schools are reported regularly, many such coming from the private sector. Going by the AICTE recognition list, the number of schools has crossed the five hundred mark. It appears that we may soon be reaching the saturation point, at least in quantitative terms, eventhough the burgeoring demand for good quality management education may still remain unmet.

The quantitative growth is due to the interest shown by prospective students who come with the hope of getting relatively better job careers irrespective of the quality and the cost of what is being offered. Perhaps being blinded by this phenomenon, management education today is complacent and does not feel the necessity of examining the real utility of what is offered. There is thus a tendency to do more of what we have been doing rather than thinking in terms of aligning the efforts more closely with what the business and society may expect.

Going by what happens in class rooms, our main thrust in management education had been on providing students with exposure to a variety of management

tools. Broadly these tools fall in two categories, those that are function focused like, marketing, finance, manufacturing etc. and others, that are drawn from certain basic disciplines like, sociology, psychology, accountancy, statistics, computer science and so on. No doubt, several of these tools are time tested and have been found helpful in developing skills of certain kind. However, discussion of tools in a management curricula assumes significance primarily from their contextual relevance. Contextual analysis, relating to the utility or otherwise of a tool, is of far greater importance than just the content related matters. In fact, contents are usually available in standard literature which students can read and understand on their own. Instead of that several precious class room hours are spent on discussion of contents, providing little opportunity for any wholesome context related discussions. Typically, students end up receiving inputs which are mostly about the contents of various tools with little or no exposure to the contextual ramifications of those. As a result, they merely get to know what the tool is like and what are the technical reasons for it to work, rather than having a grip on it knowing where it works and what makes it work in that situation. The focus thus remains almost entirely on the "know-hows", leaving the "know-whys" and "know-whereas" largely out.

> **Contextual analysis, relating to the utility or otherwise of a tool, is of far greater importance than just the content related matters.**

There is a growing trend towards intensification of such "tool orientation" with new schools trying to copy their older counterparts. In their zeal to do better than compatriots, newer ones try to expose students with some additional tools with a lot of fanfare. This tool orientation has also been receiving added boost from spectacular developments in computing and communication technologies. There is no denying that it is relatively easier to handle the technicalities of tools in a class room situation, in comparison to any detailed and in-depth context related analysis. However, a mere tool orientation robs the students of certain knowledge and skills which they would desperately require later in their career. Lack of recognition of this, both by the students as well as the teachers, has converted management education to a mere routine.

Job placement being the only concern in majority of the schools, the very purpose of learning is obliterated. Generally speaking, schools are not known to keep a close track of on-job performance of their graduates

and assess first-hand what the deficiencies may be in knowledge and skills provided. So long as sizeable number gets placed, institutions assume that they have done their job well.

Sadly, a false sense of elitism is being perpetuated in the corridors of many of our management schools. This practice, distances students from certain basic problems our business, industry and society face. It is common to find students using meaningless verbiage and promoting unnecessary technicalities in their attempt to create and live in an elitist world of their own. One does not see much concern in them to know what the actual needs of business are, much less those of the larger society. A climate of this kind is instrumental in promoting a desire in students to become a "corporate high flier" or a "jack of all trade" consultant from day one and creating a "that is not my job" kind of mentality towards the socio-economic problems the country faces. These aberrations have caused confusion in matters relating to the purpose and content management education and, in turn, created a distorted image of it.

### Existing Misconcepts

*Management education is multidisciplinary*

A perception is fast developing that management education is an education of certain functional areas of business plus a few general aspects pertaining to human behaviour, data analysis, accounting approaches etc. This perception is caused largely due to the absence of courses that produce integrative learning. Even the business policy course (including its latest incarnation, strategic management) appears overly routinized, falling short in playing its role as an effective integrator. With strategic management contemplating to become a discipline of its own in academia, there are lesser hopes that it would be able to play such a role in future. It may possibly be of interest to know that the business policy course, when originally introduced in the Harvard Business School, was intended to primarily discuss business problems allowing certain policies to emerge from these discussions (Arben, 1997). The original intention was two fold, to develop a holistic view of a problem situation and to integrate the learnings received from various courses, as one generates alternative action strategies. The need to have a holistic view and integrated understanding is probably much more today than what they were in the earlier years. However, with the schools perfecting the art of compartmentalizing knowledge, there is increasingly lesser recognition of such needs, leave alone attempts to cater to them. Thus management education has become a routine mixture of functional and discipline based courses as-

suming a multidisciplinary image, being moved away from its original interdisciplinary slant.

> **The need to have a holistic view and integrated understanding is probably much more today. However, with the schools perfecting the art of compartmentalizing knowledge, there is increasingly lesser recognition of such needs.**

*Fitting problems to known solution sets is the goal*

The existing plethora of textbook solutions have created a mentality of fitting a problem to some known solution set. Sometimes even basic appreciations are missing. For example, a similar thing observed in two or more situations may not necessarily have been caused by the same set of reasons. Too much reliance on standard textbook solutions also produce a "ready-made solution orientation". Subtle differences go unrecognized like, maximizing a profit function is not the same thing as maximizing profit. Likewise, numerical growth in product sale is treated as a definitive indicator of rising product popularity. One can cite many such examples. Suffice to say that this disturbing trend of letting students graduate with a straitjacketed view, treating tools as final answers to business problems, is something that perhaps hurts the most, as solution methods take precedence over problems in the minds of students.

*Latest must be the best*

In recent years, there is a growing tendency to glorify approaches which are new. Often, large scale propagation begins even before rigorous theoretical analysis and/or comprehensive field tests are complete. One must appreciate that developing environments cannot afford to be always trendy. One has to carefully assess the abilities needed to adopt something new. Take as an example, business process reengineering (BPR), one of the current fads which is being made out as the panacea of all ills, as if this is the first time one thought of doing something with processes. History will testify that examinations, as well as modifications of processes as needed, had always been important components of any managerial job. Little has been done in this country, by way of any systematic analysis, to take stock of our past performance on process related matters, particularly those concerning their change. It is doubtful whether we are sufficiently educated yet to make a clear distinction between processes and proce-

dures. Unfortunately, we get carried away when we come across something new and get busy implementing it without assessing whether any mindset level changes are required, and if yes, what these actually are, their nature and organisational implications. While a latest piece of technology is regarded superior because of factors like, speed, power, reach etc., managerial approaches being far more situation specific, there is little guarantee that a management model coming up in the nineties will necessarily deliver better results for everybody, everywhere in the world. It may indeed be the latest in a sequence of steps already taken elsewhere in the world. However, a country receiving such latest approaches must first identify its own position in that continuum of things already done, assess its earlier performance in handling similar things in the past, and only then proceed any further. An approach can at best deliver in full to the intent behind its adoption, nothing more than that. Hence, what comes and goes may be of little consequence till the time we are able to more clearly identify what our real needs are, both towards improving things within our work organisations as well as in handling such external factors that influence their performance from outside.

> **We get carried away when we come across something new and get busy implementing it without assessing whether any mindset level changes are required.**

*Management knowledge is only for large conglomerates*

With practically everyone in the management education focusing on big business, there is an implied message that it is only the big business that needs to be managed or, is worth managing. Like in many other national economies, in India too, small and medium size enterprises contribute most to our gross national product. Yet, their representation in both the content and context of our management education is abysmally low. Management education in India, drawing its contents largely from the western world, thus remains considerably out of tune with several of our requirements.

> **Management education in India, drawing its contents largely from the western world remains considerably out of tune with several of our requirements.**

*Social sector is too mundane to deserve our attention*

Since most readymade solutions do not often apply to problems we face in this country, especially in areas like rural development, health, education etc., there is an unspoken belief that the social sector is still to come to a level to become manageable. Working on social problems is seen as something not all that glamorous, and hence, a fall from the high pedestal of corporate management. Moreover, since the problems of the social sector take relatively much longer time to be solved, working on these does not also appear career enhancing. Interaction with the common masses and/or the local administrators does not bring the kind of excitement which a management graduate expects from his otherwise high-profile corporate job. Also, there is a view that the social sector is besieged with such intricate and unfathomable issues finding solutions is practically next to impossible, hence why waste the time and effort.

As Kamla Chowdhry (1988) observed, "Management education in India, along with other higher education has built an edifice of learning but has deprived it of its foundations which are rooted in the social, economic, political and cultural life of the people". Our management education at present suffers from two vital deficiencies—insufficient emphasis on the development of vision, and insufficient integration of functional knowledge and skills.

> **Our management education at present suffers from two vital deficiencies—insufficient emphasis on the development of vision, and insufficient integration of functional knowledge and skills.**

India has recently taken up the task of implementing the visions and strategies contained in her ninth five year plan paper. Education being a vital instrument that can meaningfully translate the visions and strategies towards their successful implementation, a focus change is needed in our management education. But, first some of the salient aspects of the plan:

### Ninth Five Year Plan—Some Salient Aspects

The Approach Paper to the Ninth Plan states, "The Planning Commission believes that the principal task of planning in a federal system is to evolve a shared vision of and a shared commitment to the national objectives and the development strategy not only in the Govern-

ment at all levels but also among all other economic agents. No development strategy can be successful unless each component of the economy works towards a common purpose with the full realization of the role that has to be played within an overall structure of responsibilities." (GOI, 1997).

The plan stresses the need to enhance the economic efficiency of our domestic production recognising domestic entrepreneurship to be the backbone of our development process. It therefore promises to encourage domestic entrepreneurship, facilitate their growth and efficiency and take measures to enhance their competitive strength.

The plan recognizes the essentiality of having adequate quantity, quality and reliability of infrastructure not only for our economic growth and development but also to make the country internationally competitive and attractive for investment. Towards this, the Government wishes to motivate the private sector to come up with investments so as to make up for the shortfall that will occur because of paucity of Government resources. This, among other things, is envisaged to promote healthy competition with the public sector as well as to develop a meaningful partnership between the private and the public sector in the development process.

Essentially, through a set of nine stated objectives (See Approach Paper GOI, 1997), the plan seeks to achieve "growth with equity" in all aspects and expects contributions from all stakeholders while being committed to equitable distribution of the benefits that get realized. In addition, the plan aspires to reduce regional imbalances that exist both at inter-state as well as intra-state levels with the understanding that growth and development and intimately related to the level of economic integration of the various parts of the country.

The thrust plan intends to provide to make India self-reliant. Particularly noteworthy is the observation made in relation to the Government's intention of continuing the process of gradual and phased opening up of the economy to take advantage of new opportunities in trade and investment. The key statements are: "it should be from a position of strength and not through either external compulsions or a lack of alternatives"; and "The ninth plan will address the issues of external vulnerability and develop suitable strategies for making India a strong and confident player in the international economy".

The plan promises to have carefully worked out perspective vision consisting of economic/demographic scenarios and long-term plans in demographic, human resource development, infrastructure, environment and

science and technology sectors, keeping in view the sustainability considerations. The approach paper emphasizes the need to increase the productivity of existing assets. The plan also promises to encourage the formation of small scale industries consortia for attaining the required volume and financial strength to compete effectively both at home and abroad.

## Implication for Management Education

The expectations and promises contained in the plan document present certain challenging issues before management education. Of particular significance is the expressed need to make India strong and self-reliant. Management education in India started with the goal of providing the much needed professional managers in the wake of planned industrial development. A perception, albeit mistaken, continuing to be held by many till date is, that a person becomes a professional manager simply on possession of a formal degree. It is time we remind ourselves that a professional manager is one who acquires certain knowledge and skills of managing, not just a mere possessor of a formal degree or diploma. Surely, the onus lies with the educational institutions to ensure that the required skills have been acquired by the candidate before a formal certificate is issued. However educational systems, being what they are, tend to compare a student's performance against the expectations the system sets. It is here the problem comes because many times these expectations are at variance with those that are needed to fulfil the societal needs. More careful planning and greater objectivity in setting expectations would be helpful in meeting societal obligations and having clear and comprehensive assessments of the knowledge and skills required.

Louis (1990) identified five distinctive areas in which knowledge and skills are necessary for people manning the management cadre. The distinctive areas are: technical competence, analytical skills, people skills, macro business perspective, and organisational realism. Technical competence refers to the acquisitions of knowledge in functional disciplines that should enable students to speak the language of business. Ability to translate data into useful information, and then use that information to solve organisational problems is what analytical skills should be concerned with. People skills include a number of things, more specifically, the abilities of building effective relationships, working in groups, influencing without formal authority and communicating with others precisely and meaningfully. Macro business perspective entails gaining of such skills and knowledge that help the integration of organisational function for the purpose of interfacing with the environment. Organisational realism refers to sensitivity towards and appreciation of the need to handle various organisational characteristics such as, ambiguity, change, networking, creativity etc. which are involved not only in decision making but also in the formation of culture.

> **Five distinctive areas in which skills are necessary for people manning the management cadre are: technical competence, analytical skills, people skills, macro business perspective, and organisational realism.**

However, despite its long existence, management education in our country is still to come of age. As of now, there is little effort to provide our students with any in-depth understandings especially in things like, macro business perspective and organisational realism. Of particular importance is the ability to understand organisational characteristics. It is these that make each organisation unique and therefore its problems of interfacing with environment different from those of others. Absence of such understanding is likely to produce artificiality in approach and a rigid outlook towards tools.

Over the years, our business environment has gone through many changes. We are in the process of learning to live and grow in a more dynamic environment with our economy becoming increasingly more open and aspirations growing to become a global player. Today, we are faced with the need to become competitive. This, among other things, would imply that our business processes ought to become more resilient and also increasingly more productive. Having been deeply soaked in a bureaucratic mindset for many years, giving up some of our self-serving practices and making our processes more user-need focussed, will be both painful as well as time-consuming. Abilities required to make things move faster are multifaceted, also to an extent unique, given our specific requirements. Building these needs constant support from indigenous research efforts. So far the research responses have been largely superficial, not taking us beyond the introduction of a course or two. Only through appropriate research agendas, we may be able to recast things and compose the tone and tune required in our management education to match our needs. A noteworthy aspect in the ninth plan is its emphasis on social sector, something we often neglected, but can ill afford to.

To build understandings necessary in the five crucial areas we require focused research supports, we have generally relied on research outputs coming from

various other places of the world. As a result, not only mismatches have been taking place but differences in perceptions also crop up. Take, for example, quality circles. The country of their origin, namely Japan, took to these interventions as a part of their companywide quality control (CWQC) efforts. We have largely gone for quality circles as a stand—alone exercise, thereby separating them from the overall objectives they were designed to serve (Chakraborty, 1988). Secondly, everything that comes out as research outputs may not necessarily be always useful, not even relevant. Perhaps it may be worthwhile to share some of the observations relating to research outputs of west, which we adore and try to emulate.

### Relevance of Research

Although different users of research may have different views, depending on how they see things, it may be eye-opening to note what some of the researchers themselves think. According to Montgomery and Clancy (1994), "Much of what is published in the primary management research journal either is not relevant to the most important issues of the day or has little potential for application". Rudolph (1995) observed that "bulk of the research done by marketing professors is useless to business because it is artificial, esoteric and arcane". Question of relevance has also been raised for research done in other associated fields like, accounting (Leisenring and Johnson, 1994), operations research (Corbett and Van Wassenhove, 1993), business communications (Limaye 1993; Smeltzer 1993), psychology and sociology (Adlag, 1997). Mowday (1993), reflecting on his years as the editor of the Academy of Management Journal, observed that management research seems to have become irrelevant not only to practitioners but also to its own scholars. Collectively these observations hold serious charge against management research, irrespective of the extent of academic respectability these may otherwise carry. There is, therefore, an urgent need to do something to make management research more relevant, much more so for us in India.

> **There is an urgent need to make management research more relevant.**

Certain suggestions have already been advanced by some scholars of the western world to make management research relevant. There have also been pertinent observations on what creates the gap between theory development and the needs of the work place. As per Moran and Ghoshal (1996), a major source of the growing gulf between theory and practice lies in the lack of realism and balance in most theories. No doubt the demand for parsimony would require a certain degree of abstraction from reality. But, for any theory to become useful, the theory's "use in practice" must be considered, which is rarely done. Moran and Ghoshal further add, "In their collective desire to enhance the rigor of their theorizing, management scholars have increasingly turned a blind eye to the extreme stylization and sweeping assumptions in the ideas they have imported from different disciplines to analyze organizational and managerial issues. While these abstractions, stylizations and restrictive assumptions have enhanced our understanding of certain isolated situations, they are not yet sufficiently general to apply to practice in any meaningful way". As far as we in India are concerned, we mostly make half-baked attempts to implement some of these to our own work situations with the hope of turning things around. Given our context and the current priorities, in management research we should desert continuing with our prime passion of theory-building and choosing research agendas from this perspective and start from some of the many problems we face in practice, generate alternative ways to handle them and theorize from the learnings we derive. In short, ask ourselves, dispassionately, what in our view should come first, the solution or the problem?

> **For any theory to become useful, the theory's "use in practice" must be considered.**

Recommendations put forth by Mowday (1997) towards making management research purposeful are worth considering in this regard. Mowday urges researchers to first identify important research questions. Researchers are to conduct surveys to know the most important challenges and problems practitioners face; go through student essays to locate the areas of gap and use new information technologies to establish a dialogue about research. A cursory look at these may raise anxieties of possible loss of rigor in research. A closer scrutiny of the suggestions should reveal that these are not about the research process to be followed, they only relate to the identification of more purposeful research agendas. Mowday (1997) and a few others, like Adlag (1997), assert that relevance should not come at the expense of rigor. Our management academicians should decide whether the issue of rigor versus relevance is something that should be left to be resolved using a trade-off type analysis. Putting it differently, researchers need to clarify their minds as to what their prime concerns should be. Is it greater relevance for use or mere promotion of esoterism? Sig-

nificantly, inspite of years of rigorous academic effort, India still ranks 45th out of 53 countries in global competitiveness according to the latest report of the world economic forum.

Judging dispassionately, the real issue is one of understanding and acceptance. Lack of relevance is not what management research actually suffers from, it is the lack of recognition of that relevance which is the major problem. Ninth plan document, with some of its forthright statements, makes it imperative that unlike in USA, we need not adopt a philosophy of the so called "publish or perish" type in our management academia. In our context even though these, not always readily actionable ideas, as opposed to generalized criteria, would be much more useful and find publication platforms which are considered academically respectable. Being faced with a "do or die" kind of situation our management research should aim to generate and transmit better understanding of things, rather than trying to develop criteria for action. If this requires breaking away from the western trends we may do that without any hesitation so as to be able to serve the pressing demands of our nation.

> **Actionable ideas, as opposed to generalized criteria, would be much more useful.**

## In Search of Purposeful Alignment

To channelize management research in a purposeful manner focused research work should examine and understand the implications of the current and emerging realities. Few such realities have been identified here (the list is neither exhaustive nor is there any rigidity about the order. Fellow researchers are welcome to modify the list, if required). The primary objective is to identify such aspects of reality which have a bearing on the performance of the various socio-economic tasks, laid down before us. An associated objective is to generate support material for teaching, so that, more wholesome context related discussions can be had in our management class rooms. To cater to this purpose the following are suggested for consideration:

*   Organisations are open to adaptive systems

*   Managing (not management) is the real need

*   Process (not the result) is what can be managed

*   Performance is not measured by numbers alone

If these realities are kept in view and their implications thoroughly studied and widely shared, the needed mindset level changes in our management research and education should hopefully come. Perhaps agencies like the All India Council of Technical Education (AICTE)) or the Association of Indian Management Schools (AIMS) could do their bit toward this end.

For long, organisations have been viewed as closed systems, held in an equilibrium state. Perhaps the very foundation, the industrial organisation (IO) theory, on which management thoughts grew has been responsible for creating such a view. The IO theory, which is concerned with industry structure and firm performance and provided the base for management thoughts in early years, is actually derived from certain microeconomic principles. These principles rest on a few major assumptions like, industry structure is known, diminishing returns apply, and firms are perfectly rational. As we see things today, firms lack complete information, world wide web sites make increasing returns not just possible but an opportunity to grab (see Arthur 1994, 1996), and firm behaviours are far from rational. Beinhocker's (1997) presentation of current realities cites the following as an illustration. When a telecom CEO faces regulation, profound technological change, industry convergence, globalization and increasing returns in sectors like internet and wireless, what the CEO needs is a model of a world where innovation, change and uncertainty, rather than equilibrium, are the natural state of things. However recognition of this is not easy to come by unless managerial minds are prepared to look at things from a different perspective. The present mould of management education does not quite help its students to analyze the synchronicity of an organisation with its environment. Sometimes, routinisation of solution methods acts as a stumbling block. Research must come out with more refined understanding of things and help everyone, including the student, to visualize that in reality, organisations are open systems operating in a dynamic environment. Hence the need to constantly interface with changing realities is paramount. More specifically, management research should strive towards the development of only such strategies which are robust, and yet sufficiently focussed in the short term, so as to be able to cater to the needs of open, adaptive and dynamically interactive systems of today.

The real need of work organisations is to manage their affairs well, not management tools and techniques. That certain management tools may be useful is an altogether different matter. Tools as means exist only to support the ends, they are not the ends in themselves.

Therefore managing, not the management tool, is what is important. The problem is, the present educational thrust on "how to" in preference over "what to" creates a mentality of doing what is "doable", instead of focussing on the "deliverables", where deliverables represent the results or outcomes of doing good. To deliver, managers of today need the abilities of connecting business strategies, goals, tactics and financial performance with competencies, skills, practices and people. Obviously there is no single best way of doing this, nor can we find something that can work for us for long, given the fast changing environment of today. Continuous research is necessary to come out with ideas and approaches that suit the changing needs of business and society.

> **Tools as means exist only to support the ends, they are not the ends in themselves.**

Excessive result focus during the seventies has left behind its mark on our minds. People often chase results in order to grow without pausing to understand that results, being the effects, are not something that can be directly controlled. There is also no guarantee that the same set of steps would produce identical results even a second time, let alone on a continuing basis. In recent times it is the process which makes the results happen. Also, processes are amenable to adjustments/readjustments, including monitoring and control. The basic activities that constitute any process can be combined that recombined differently (which also include their addition/deletion), to construct effective processes which help organisations to retain and/or gain customers, improve relationships with suppliers, inspire their own employees, and add to shareholders wealth. A lot can be achieved by having deeper insights into the numerous relationships that exist between the steps followed and outcomes realized. In this context, it is interesting to note the recent shift in emphasis, announced by Government of India, in our family welfare programme. The same has now been made target free, after fiercely chasing people to achieve targets for nearly half a century. Perhaps family welfare programme is one of the early candidates in the social sector to appreciate the important roles processes play. Management schools should make concerted efforts to examine the various interplays processes produce, and develop adequate insights relating to effective choice of processes as well as their meaningful conduct.

Excessive focus on end results, coming from the dominant manufacturing slants of earlier years, has created a bias towards measuring performance using only numbers, and that too, largely those that talk about the financial performance of an organisation. Added to this is the overwhelming desire to be accurate with measurement. The result has been devastating. Qualitative measures found practically no place in our performance indicator list. It is now known that the most frequently used indicators, namely the financial measures, have many shortcomings. They are backward-looking, slow to respond and often do not expose the factors which are driving the current business. In recent times there is a growing need for organisations to know how responsive they are to user needs, what ability they possess to assess and absorb changing needs early enough, act upon these without goofs or failures etc. Therefore, certain qualitative measures in conjunctions with the quantitative ones have become the needs of the day. In the limited few places where some qualitative measures have been introduced, these have been just added to an existing list without proper integration. Consequently the measures, as a whole, fail to provide a well rounded view of how the business is doing today and in which direction it is heading. There is an urgent need to design appropriate performance indicators that can meaningfully link an organisation's day to day activities with its operating strategy. Comprehensive research efforts are therefore necessary to address this whole question of performance measurement urgently.

> **The most frequently used indicators, namely the financial measures, have many shortcomings. They are backward-looking, slow to respond and often do not expose the factors which are driving the current business. Qualitative measures in conjunctions with the quantitative ones have become the needs of the day.**

## What to do with Education Now?

Can we do something at the moment with our education process while we wait for the research outputs to become available? The least we can do is to attack the present status-quoist mentality. We come to hear many talks about change these days, including its intensity and immenseness. In this backdrop it may be educative to take up a survey to see how many institutions have actually undertaken any major exercise in recent years to develop a fresh look at their MBA curriculum. One should not be greatly surprised if such a survey reveals that nothing much has really been done

except probably some cosmetic changes like adding a course or two. Catchy titles like, International Business, Competitive Strategies etc. are popular these days. But beyond their titles it may still be a simple rehash of the same old stuff.

Management education is not merely the learning of functional skills. The real capital of a management student is her/his mind. If management education is to meaningfully contribute towards the realization of some of our national aspirations, outlined in the ninth plan, the education must retune itself to reinforce this belief. Management education, should seriously gear itself to prepare the students mind, not merely as a depository of huge accumulation of facts, tools and teachings, but also as a sharp, flexible instrument that can model one's own responsibilities to the community.

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# The Impact of Liberalisation on HRD Practices in Power Sector – A Case Study

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*Human Resource Development (HRD) has a pivotal role in realising the aspirations of the New Industrial Policy (NIP). Complementarily, NIP is expected to induce the adoption and implementation of scientific HRD systems in the organisations. The present paper seeks to ascertain the impact of NIP on HRD practices in the state controlled power sector; and suggest the immediate priorities and ingredients of a HRD plan for the liberalised public power sector. The field survey supplemented with unstructured personal interviews reveals that the impact of liberalisation on HRD practices in the public power sector is largely insignificant. The study prescribes a pragmatic HRD plan with the objective of strengthening the efforts of the state power sector in becoming more efficient and competitive.*

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In the wake of acute macro-economic crisis, Government of India launched a series of Economic Reform measures in July 1991. Perhaps, the most radical change implemented in the reform package has been in the area of industrial policy: that of increasing the competition in areas hitherto dominated by monolithic public sector enterprises. As a consequence of New Economic Policy (NEP) and in the context of the paucity of resources with central/state public sector companies, to bridge the gap between the rapidly growing demand for electricity and the supply, a policy to encourage electric power generation by private enterprises including foreign investment was formulated in 1991. The legislation governing the electricity sector was amended in October 1991, allowing private investments to set-up generating companies which would supply power in bulk to the grid. The policy permitted 100 per cent foreign owned companies to set-up power projects of any capacity in India and repatriate profits without any export obligation. The labour market reforms of NEP, particularly National Renewal Fund (NRF) instituted in 1992 have significant relevance to the Public Power Sector in the backdrop of existing labour redundancies and envisaged restructuring plans.

Human Resource Development (HRD) has a pivotal role in realising the aspirations of the new economic policy. The new economic reforms have pushed the Indian industry to compete globally. In the light of this, improvement of managerial systems, decision making patterns and development of organisational culture have become mandatory. This need is more so in the public power sector which is backbone of economic development and in the background of privatised power generation. Hence a study was undertaken to ascertain the impact of liberalisation on HRD practices in Power Sector with special reference to Andhra Pradesh State Electricity Board (APSEB).

## A Case Study of APSEB

The following factors led to APSEB becoming the universe of the present study:

- APSEB came into existence in the year 1959, as a statutory body under the provisions of the Electricity Supply Act, 1948 and propelled the rapid development of the power sector.

- APSEB was one of the first few to respond quickly to the new economic policy/power development policy through various measures including the setting up of Investment Promotion Cell (IPC) to evolve and evaluate a long term strategy for private participation in the Power Sector.

- The Government of Andhra Pradesh constituted a high level committee known as "Hiten Bhaya Committee" in January, 1995 to provide guidelines and appropriate recommendations on the issues of private investment in power sector, restructuring of power sector and a tariff policy in the context of liberalised policy. The committee submitted its report in April, 1995.

## Methodology

A questionnaire containing forty eight statements covering the majority of the HRD sub-systems was prepared. A 5 point scale with numerical identity [Strongly Disagree (1) to Strongly Agree (5)] was developed to seek the respondent's level of agreement with the 48 statements twice i.e. first for pre-liberalisation (1986-91) and second in post-liberalisation period (1991-96).

The approach of assessing each statement twice was specifically adopted in the absence of such study on prevailing HRD practices in public power sector during pre-liberalisation period (1986-91) for the purpose of comparing with post-liberalisation practices in order to draw inferences about the impact of liberalisation on HRD practices in the power sector. The questionnaire was sent to three judges for selecting the items and to check the consistency. Accordingly a total of thirty four statements were finalised comprising 29 positive and 5 negative statements (table 10). A pilot study was carried out on a few selected respondents to further establish the reliability of the questionnaire. Based on the feedback a few terms were replaced with known terms in the organisation.

The questionnaire was administered in person and through mail during Oct.-Nov., 1996 on a random sample of executives (Non-workmen) covering all levels and disciplines of the organisation except Board level incumbents. Care was also taken to cover all the zones, head office and one generation station. The percentage of aggregate response to the survey was of the order of 78 per cent. The researcher also held unstructured personal interviews with a few senior level executives evoking response on various HRD sub-systems prevalent in pre and post liberalisation periods (This study includes use of secondary data collected by the researcher during his visits to APSEB establishments).

The 34 statements were analysed in 7 sub-groups and as a total group comprising all the sub-groups as shown in table 1 to 8. The scores of negative statements were reversed. Mean percentages were generated to the raw scores of each sub-group and total group representing a particular HRD sub-system and overall HRD system respectively.

## Analysis of Data & Results

The mean percentages as generated were taken as a base to analyse and illustrate the status of HRD practices in APSEB during pre and post liberalisation periods vis-à-vis impact of liberalisation on HRD practices in public power sector. A statistical significant test, namely $x^2$-test was also applied to validate the inferences.

### Analysis of HRD sub-systems

*Training:* A total of four comprising two negative (6, 10) and two positive (1, 4) statements of the questionnaire dealt with the training function. A small group representing 5.3 per cent as depicted in table 1 agree that consequent to liberalisation, the relevance of training programmes to training needs is more and training imparted to perform jobs in the organisation is adequate. The percentage of agreement that liberalisation has a positive impact on the training found to be very mild.

*Performance Appraisal:* Four positive (2, 11, 14, 17) and two negative (22, 27) statements given in the questionnaire are relevant to the implementation of performance appraisal system. As shown in table 2, the percentage of average respondents agreeing to the positive impact of liberalisation on performance appraisal stands at 2.2 per cent and strongly agree at 1.8 per cent. The percentage being insignificant, it is inferred that liberalisation has no significant effect on performance appraisal sub-system.

*Manpower & career planning:* A total of six statements (5, 7, 9, 13, 15) including one negative (21) of

questionnaire are relevant to the manpower and career planning sub-system of HRD. An average of 1.3 per cent respondents agree and another 1.8 per cent strongly agree that there is a positive change in the practice of manpower and career planning. Table 3 indicates the mean score pertaining to manpower and carrier planning sub-system practices. The percentage of respondents agreeing to 'impact of liberalisation on manpower and career planning' is found to be insignificant.

*Manpower adjustment:* The statement No. 3 and 18 are meant to measure the manpower adjustment practices. An average of 3.2 per cent of respondents strongly disagree and another 7.5 per cent disagree to the perception that there is no positive improvement in manpower adjustment practices in the post liberalisation period. Table 4 illustrates the status of manpower adjustment practice during pre and post liberalisation periods. The effect of liberalisation could be inferred as highly marginal.

*Communication:* The statement No. 12, 19, 23, 28 and 29 are relevant to the communication sub-system of HRD. An average of 2.56 per cent respondents strongly agree and another 3.39 per cent agree that the communication system has improved in the post liberalisation period. As table 5 clearly shows, the effect of liberalisation on communication is found to be insignificant.

### HRD department

A total of five statements (8, 16, 24, 30, 31) and table 6 are relevant to the HRD department. An average of 4.2 per cent respondents disagree with the statement that there is no impact of liberalisation on the performance of the HRD department in the organisation. The percentage being insignificant, it is inferred that liberalisation has no effect on the functioning of HRD department.

*Other HRD practices:* All positive statements numbering 20, 25, 26, 32, 33 and 34 of the questionnaire have dealt with other HRD practices such as restructuring effort, top management commitment, openness and trust etc. Table 7 constitutes the mean percentages of responses on the other HRD practices. An average of 3.1 per cent disagree with the statement that there is no impact of liberalisation on these practices.

### Overall HRD system

As shown in Fig. 1, a great number of respondent (96.4 per cent) perceive that liberalisation has had no effect on HRD practices, whereas a small number representing 1.2 per cent strongly disagree and another 2.4

per cent disagree with the perception of no-effect of liberalisation on HRD practices. The mean scores generated for the total HRD system is shown in table 8. The average disagreement of 3.6 per cent as indicated largely emerged from the training and manpower adjustment sub-systems. The reason could be the increased attention and budget allocation for the training function. In accordance with the financial budget reports of APSEB an amount of Rs. 67 lakhs was spent during 1992-93 and Rs. 81 lakhs in 1991-92. Secondly, the collective dialogue that took place on manpower adjustment strategy during 1995 might have led to the perception of improvement in manpower adjustment practices.
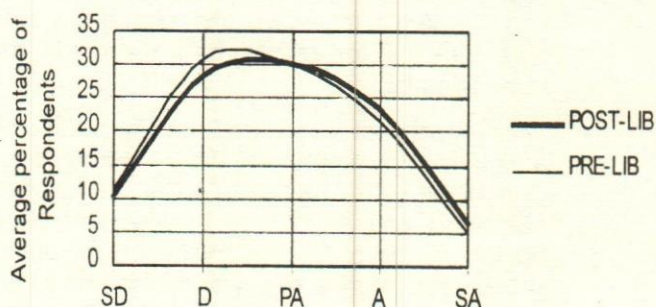


**Fig. 1.** Impact of liberalisation on HRD practices

*Statistical significant test*

The impact of liberalisation on HRD practices is estimated using a relationship obtained by Regression Analysis between the variables given in table 8. The relationship between two variables i.e. responses on HRD practices during pre- and post-liberalisation periods is as follows:

Impact of liberalisation on HRD practices = 5.44 (intercept) + 0.912 (status of HRD practices in pre liberalisation period)

**Table 1:** Impact of liberalisation on Training sub-system

| Period | Mean Scores | | | | |
|--------|------|------|-------|------|-----|
| | SD | D | PA | A | SA |
| Post-Lib. | 6.0 | 15.0 | 13.75 | 8.75 | 3.5 |
| Pre-Lib. | 5.5 | 17.0 | 14.75 | 6.25 | 3.5 |
| Impact | 0.5 | −2.0 | −1.0 | 2.5 | 0 |

SD: Strongly Disagree D: Disagree PA: Partially Agree A: Agree SA: Strongly Agree

The data used for the $x^2$ is tabulated in table 9. Since the calculated $x^2$ value (2.405) at 0.01 significance

level is less than the tabulated $x^2$ value, (13.277) (Gupta & Kapoor, 1986) the impact of liberalisation on HRD practices is largely insignificant.

**Table 2:** Impact of liberalisation on Performance Appraisal sub-system

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 3.83 | 14.67 | 13.5 | 11.17 | 3.33 |
| Pre-Lib. | 4.33 | 16.0 | 12.67 | 10.17 | 2.5 |
| Impact | −0.5 | −1.33 | 0.83 | 1.0 | 0.83 |

**Table 3:** Impact of liberalisation on Manpower & Career Planning sub-system

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 5.17 | 13.33 | 14.83 | 10.83 | 2.5 |
| Pre-Lib. | 5.12 | 14.5 | 15.0 | 10.17 | 1.67 |
| Impact | 0.05 | −1.17 | −0.17 | 0.66 | 0.83 |

**Table 4:** Impact of liberalisation on Manpower Adjustment practice

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 6.5 | 16.5 | 9.0 | 7.5 | 2.5 |
| Pre-Lib. | 8.0 | 20.0 | 8.0 | 7.0 | 2.5 |
| Impact | −1.5 | −3.5 | 1.0 | 0.5 | 0 |

**Table 5:** Impact of liberalisation on Communication sub-system

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 3.2 | 11.8 | 15.6 | 14.0 | 2.2 |
| Pre-Lib. | 4.6 | 12.0 | 16.6 | 12.4 | 1.0 |
| Impact | −1.4 | −0.2 | −1.0 | 1.6 | 1.2 |

**Table 6:** Impact of liberalisation on Functioning of HRD Department

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 4.6 | 12.2 | 15.2 | 10.6 | 3.8 |
| Pre-Lib. | 6.6 | 12.0 | 14.8 | 10.0 | 2.8 |
| Impact | −2.0 | 0.2 | 0.4 | 0.6 | 1.0 |

**Table 7:** Impact of liberalisation on other HRD Practices

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 5.17 | 11.5 | 14.33 | 11.5 | 4.17 |
| Pre-Lib. | 4.83 | 13.0 | 13.83 | 11.5 | 3.17 |
| Impact | 0.34 | −1.5 | 0.5 | 0 | 1.0 |

**Table 8:** Impact of liberalisation on Overall HRD system

| Period | Mean Scores | | | | |
|---|---|---|---|---|---|
| | SD | D | PA | A | SA |
| Post-Lib. | 34.47 | 95.00 | 96.21 | 74.35 | 22.00 |
| Pre-Lib. | 38.98 | 104.5 | 95.65 | 6.49 | 17.14 |
| Impact | −4.51 | −9.5 | 0.56 | 6.86 | 4.86 |

**Table 9:** Impact of liberalisation on HRD practices: A statistical significant $x^2$ test

| Scale | Actual post liberalisation responses (O) | Expected post liberalisation responses (E) | $(O-E)^2$ | $(O-E)^2/E$ |
|---|---|---|---|---|
| Strongly Disagree | 34.47 | 40.990 | 42.5072 | 1.03702 |
| Disagree | 95.00 | 100.744 | 32.9936 | 0.32750 |
| Partially Agree | 96.21 | 92.673 | 12.5117 | 0.13501 |
| Agree | 74.35 | 66.991 | 54.1567 | 0.80842 |
| Strongly Agree | 22.00 | 21.072 | 2.0401 | 0.09682 |

**Table 10:** List of Statements in the Questionnaire

1. Training programmes are designed and conducted based upon realistic training needs of the Organisation and the employees

2. Performance Appraisal System contributes for objective assessment of employee performance and contribution

3. To weed out redundant and un-trainable manpower exit practices/voluntary retirements are taking place

4. All employees are given adequate training to perform their job effectively

5. Overall manpower position is adequate in your organisation

6. Training programmes are conducted in a haphazard manner and being conducted for the name sake of training

7. In general right man is placed to right job

8. Personnel Department helps workforce in carrying out their functions effectively

9. Promotions are based on objective assessment of employees

10. Participation in training is a kind of leisure time and not a serious business in this organisation

11. Performance Appraisal System helps in understanding one's role responsibility and key performance areas

12. The information pertaining to company business is disseminated to all levels of the organisation

13. A systematic succession planning is adopted in this organisation

14. Performance Appraisal System works as a developmental tool; helps in identifying employee's strengths and weaknesses

15. Manpower planning is matched with business plans of this organisation

16. Personnel Department make efforts in cultivating positive work environment

17. Performance Appraisal System is used as an effective feedback system from seniors

18. To gainfully utilise the manpower a systematic retraining job rotation and re-deployment are undertaken to bridge the gap between skill availability and demand

19. Communication among colleagues is effective

20. Top management is committed to evolve good Personnel Policies and procedures in this organisation

21. There is a mismatch between skill availability and skill demand in your organisation

22. Performance Appraisal System is used to control the subordinates

23. Communication between superior-subordinate is adequate

24. Personnel Department is adequately strengthened in terms of manpower and infra-structure facilities

25. Openness and trust are existent in this organisation

26. Effort of the Management in restructuring the organisation is adequate

27. Performance Appraisal System is used only for the purpose of promotions

28. Communication infrastructure facilities are adequate

29. All employees get the opportunity to present views on company related issues

30. Personnel Department facilitates for open communication dissemination of company news policies etc.

31. There is a greater impact of Personnel Department working in your organisation

32. The working environment is conducive for good performance

33. Employees identify with organisational goals

34. Employees' participation in management of your organisation is being encouraged

## Discussion

Despite the lapse of five years, neither the message of the New Industrial Policy nor the Power Development Policy (PDP) seems to have reached the State Control-led Power Sector, at least in the sphere of Human Resource Environment. The progress of participative management, intensive training, skill development and up-gradation programme as envisaged in the Industrial Policy is tardy and organisation of training for the personnel engaged at various levels in the Energy Sector as embodied in Energy Policy is inconspicuous in action. National Renewal Fund (NRF) instituted in January, 1992 is still unheard of, leave aside any attempt to exploit the benefit. The idea of Human Resource Development (HRD) which has been pioneered in the sixties by Leonard Nadler is still an alien concept here. The mammoth efforts of Udai Pareek and T.V. Rao in popularising the practice and efficacy of HRD, year after year in the last two decades with their path breaking research in the country has not meant much in this gigantic sector of Electricity.

> **Despite the lapse of five years, neither the message of the New Industrial Policy nor the Power Development Policy (PDP) seems to have reached the State Controlled Power Sector. The progress of participative management, intensive training, skill development and up-gradation programme is tardy.**

The field survey supplemented with unstructured interviews in the state power sector reveals that the impact of liberalisation on HRD practices, which is most susceptible among all disciplines for any change/ liberalisation if implemented, is insignificant and lackadaisical. There is not even gradual or evolutionary impact as underlined in the reform package. The sector is gripped with redundant manpower on the one side and on the other side retention of competent managerial and technical manpower poses a formidable challenge as the number of these people opting for a lucrative career in private power sector is progressively mounting. The reluctance of the management to deal with redundancies with the added state of current labour legislation makes it almost impossible to expect even an incremental improvement in the situation. The dwindling allocation of financial resources for the development of human resources is another evidence to prove that the concern for HRD continues to be the last priority of the power sector corporate agenda. For example, as per the financial budget reports of APSEB, the allocated financial budget for training function in APSEB stands at Rs. 47 lakhs in 1993-94, 33 lakhs in 1994-95 and 20 lakhs in 1995-96 financial year for a manpower strength of 72,000. This works out to be Rs. 2.80 per

head towards training during 1995-96 which is shockingly low. The centralised management style, traditional functional structure, rigid organisational hierarchy, lopsided human resource planning, large number of grades and innumerable designations in each grade, eroding discrimination between jobs and role clarity, absence of job evaluation, poor performance management, emphasis on seniority at the expense of flexibility and organisational effectiveness, non-responsive attitude, disintegrated human resource function and dry deal to learning are a few of the maladies existent in the organisation due to lack of adequate attention and appreciation of scientific HRD systems.

> **The sector is gripped with redundant manpower on the one side and on the other side retention of competent managerial and technical manpower poses a formidable challenge as the number of these people opting for a lucrative career in private power sector is progressively mounting.**

As Manmohan Singh, former Finance Minister observed "the role of Public Sector cannot be wished away in the Power Sector even though the private sector has a definite contribution to make in infrastructure development (The Hindu, 4th Dec. '96)." Further, the participation and success of private sector in power generation is dependent upon the performance of the state power sector due to the latter's continuing monopoly of the transmission and distribution sector coupled with the licensing system for the construction and operation of power generation plants. Therefore, it is high time for the state electricity sector in India, which is one of the largest in the world, to gear up and adopt scientific HRD systems not only for its own survival and stability, but also for strengthening the tempo and pace of the economic development.

> **The participation and success of private sector in power generation is dependent upon the performance of the state power sector due to the latter's continuing monopoly of the transmission and distribution sector coupled with the licensing system for the construction and operation of power generation plants.**

## Developing HRD for Liberalised Power Sector

Given the dynamic nature the power sector ought to adapt to change. But there are serious stumbling blocks in labour legislation, external usurping, absence of sustainable organisational climate, resistance to change and slow perception of changes in the environment etc., to bring about rapid changes in the skills, systems, strategies and structure of organisation in power sector. On the other hand, the absence of effort toward adaptation can cause further inefficiency, de-motivation, abysmal financial health, chaos in work environment, loss of jobs etc. Therefore, seeking change in the present scenario is not an option but a compulsion on the part of the power sector, particularly in an open economy and the emerging consequential challenges.

In a rational process, any endeavour to renew the organisation development and effectiveness, must begin with human resources. The following measures are proposed for transforming the human resource as a vibrant, competitive force capable of carrying out the mandate given to the state power sector.

## Creation of an Integrated Human Resource Function

It is highly desirable to introduce an integrated human resource function bringing all sub-systems of HRD such as human resource planning, performance appraisal, training, career planning, re-deployment etc., under one umbrella as these functions are linked to one another and the absence of some of them may create problems for the others. For instance, employee records were maintained at inconsistent levels of details in APSEB. There is little evidence of integration of information, which creates difficulties in taking decisions concerning HRD. Top management commitment and involvement is imperative in the effort. The function is to be manned by people who have a basic aptitude for and considerable training in the field of HRD, OD and OB. The self-renewal or HRD audit exercises must be carried out at regular intervals in order to keep up the calibre of HR function as a means of achievement and growth.

## Development of a HRD Philosophy

A HRD philosophy which is integrated with the corporate plan makes effective use of the human resource potential of the organisations. The fundamental necessity of the power sector today is the development of a HRD philosophy to deal with skill development, retraining and re-deployment, climate building, preparing the human resource for organisational restructure and the consequential new roles and of course for articulation

and dissemination of the organisational philosophy. Lack of perspective or philosophy for the development of human resources is one of the biggest problems that organisations face.

## Human Resource Planning

Human Resource planning plays a crucial role particularly in view of the privatisation of power generation and the impending restructure of the state controlled power sector. The norms for determining the quality and quantity of human resources being followed at present are required to be replaced to match the emerging new technologies and business plans. The power industry must take immediate steps to initiate and strengthen the process of a scientific work study for the optimal distribution of manpower in the sector to avert the widely prevalent malady of over and under-manning of functions. HR planning shall also take care of succession planning based on potential appraisals, and career planning to build core competencies and career paths. However, these should not be hurriedly introduced. Irrational aspirations among employees may be discouraged as the very term career and succession planning raises excessive hopes which would be counterproductive.

## Performance Management

An effective performance management framework is essential to achieve HRD goals. The power sector must immediately adopt a structural framework for performance management within which an individual and his superior, or manager can set performance and development goals in line with the organisational goals. This exercise will provide the impetus for the effective alignment of human resources with organisational goals. The performance appraisal tool must include identifying and setting key performance areas, developmental objectives, self-appraisal and performance review discussions.

> **The power sector must immediately adopt a structural frame work for performance management within which an individual and his superior can set performance and development goals in line with the organisational goals.**

## Training, Retraining & Redeployment

This is one function that is going to demand substantial attention and time of the power sector manage-

ment in the coming days. The restructuring and modernisation process will not necessarily result in retrenchments but certainly calls for training, retraining and redeployment due to changing roles, requirement of new skills, necessity to strengthen core competencies etc. The power sector has to immediately carry out an exercise of Training Needs Analysis (TNA), skill inventory in their organisations in order to chalk out the right strategy for training and retraining of all levels of human resources for gainful utilisation. Re-deployment is to be preceded by skill inventory exercises coupled with retraining of workforce. In a few cases, where retrenchment can not be avoided in the larger interest, a safety net and rehiring criteria must be evolved. Organisations are also required to take up measures for setting up a cell to explore alternative employment including self-employment for the retrenched workforce.

## Restructuring

If the objectives of liberalised measures are to be achieved, the present form of organisation certainly needs to be altered to become more vibrant and responsive. Perhaps, the job loss could have been less with modernisation and restructuring than without. Job loss can be higher in a rigid labour market because the consequential inefficiencies not only reduce the opportunities for productive deployment of limited resources, but also make entrepreneurial activity less rewarding (Venkataratnam, 1992). Restructuring is needed to replace the existing centralised functional structure with devolved functional structure in the first phase followed by developed process structure. The number of grades and designations are to be brought down to a minimum extent possible in order to establish role clarity and job enrichment. A devolved process will enable the establishment of clear reporting lines and relationships and help to reinforce processes that meet customer requirements.

## Co-determination

Unless and until the workforce is made an equal partner in the process of change and assigned a role, the efforts of restructuring, envisaged plans and envisioned corporate mission will fall flat. As the first step, the management must come out with openness and trust to share the prime information related to the functioning of the organisation which is till now inaccessible. The restructuring plans or any turn-around strategies are to be designed in consultation with employees. Such an exercise not only strengthens the aspired organisational transformation but is also conducive for building salutary organisational climate. Co-determination is the essence of corporate turn around success.

## Culture Development

The successful transformation of public power sector to be capable of fulfilling its mission demands significant changes in the organisational culture. Formidable effort is required to build and reinforce the change among the employees as there is only a slow perception of the need for change. Managing culture involves assessing the current culture phenomenon and instilling the requisite culture to support the change efforts. A wide range of processes may need to be applied to increase the organisation's capacity to innovate and inculcate culture successfully.

## Retention Strategy

The public power sector also needs to focus on the challenge of retention of competent managerial and technical people in view of the piracy being practised by the private sector. The sector will remain a training ground and an easy source to private industry if proper attention is not paid in handling this problem. A pragmatic restructuring process, improved performance management, culture development for organisational commitment and job enrichment programmes will certainly discourage them from shifting. The focal point of retention strategy must be organisational commitment and belongingness.

## Human Resource Information System (HRIS)

HRIS is the kingpin of HRD plan. A comprehensive and integrated information system alone can lead to a rational decision making pattern. An immediate need exists for creating computer based cross purposive data that would cater to present and future requisitions. Unfortunately, today most of the decisions that come from the power industry are based on largely approximate data and sometimes even on hearsay. This practice needs to be immediately arrested to avert the 'bounded rationality' syndrome.

## Conclusion

Management consultants and high level committees appointed from time to time to review the functioning of state electricity boards and central generating companies like NTPC, POWERGRID have exhorted for organisational restructuring, adoption of better management system, development of vision etc. Orissa State Electricity Board (OSEB) went ahead with restructuring for better performance. But their experience as on date is disheartening. The study and analysis of restructuring reveals two significant aspects:

An inappropriate emphasis on the integration of the management of human resource with the restructuring, which creates an adverse climate. The weakened system corrupts organisational viability. People set to immediately throw the prevailing systems and work practices without adopting new ones are resulting in laissez-faire and chaos.

Therefore, a pragmatic, purposive and clear HRD plan is mandatory for survival, stability and growth of power industry, particularly in the fast changing environment; HRD plan cannot be static but must be dynamic and needs to be redrafted through self-renewal exercises at regular intervals.

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# Public Enterprises Through Reforms — A Financial Ratio Analysis

## P. Rameshan

*The policy reforms introduced in India since 1991 aimed, among other things, at directly or indirectly enabling the public sector enterprises (PSEs) to improve their efficiency, productivity and profitability. However, a look at the first four years' operational data of the PSEs reveals that the performance of the PSEs in these four years was characterised more by their failure on several counts than by their achievement of any significant turnaround especially in respect of the weaker ones. A new thinking based on pure business considerations is necessary for realising our policy goals about the PSEs concludes the author.*

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An important objective of the economic reforms announced in July 1991 in India was to improve the efficiency and performance of the public sector enterprises (PSEs). The strategy was to enhance the allocative and technical efficiencies of the enterprises by providing for an effective internal organisational process, by enabling the management to take and execute efficient decisions through building up around them an environment of intensive competitive pressure and by according greater managerial freedom of decision making and implementation. The various policy measures directly designed to serve the above purpose include the following:

> **The strategy was to enhance the allocative and technical efficiencies of the enterprises by providing for an effective internal organisational process, by enabling the management to take and execute efficient decisions by according greater managerial freedom.**

### Policy Measures for Public Sector Reform

*Macro-level privatisation* of such sectors as telecom, power, air-transport, oil etc. by taking these sectors out of the list of areas reserved exclusively or largely for the public sector. The de-reservation was expected to bring more players from the domestic and foreign private sector to those areas thereby posing serious competition to the existing PSEs.

*Disinvestment of government ownership*: This was expected to provide the private investors, who are driven by the profitability of their investment, an opportunity to participate in the management of the PSEs to the extent of their investment. Unlike the non-persuasive

owner, viz., the government, which itself is subject to severe agency problems, the private directors in the governing board would be more responsive to the needs of the investors which would necessitate the management to be more sensitive to the investor expectations and to formulate and implement more prudent decisions and projects. So disinvestment is supposed to create an internal pressure for performance improvement. As a matter of fact, uptil 31 December, 1995, the government disposed of part of its ownership in 40 PSEs including IDBI and in 15 of them the level of disinvestment was between 20 and 50 per cent [Economic Survey, 1995-96, p. 121].

*Setting up of the National Renewal Fund (NRF) and the introduction of the Voluntary Retirement Scheme (VRS)*: These steps follow the application of the Sick Industrial Companies Act (SICA) to the PSEs since 1991 whereby the sick PSEs could be registered with BIFR for deciding fast upon their closure if non-viable or for working out quick and feasible revival packages (involving even private parties) if they could be turned around. The NRF would be applied to the workforce affected in the SICA proceedings. The workers of the wound up PSEs and the excess workforce of the revivable sick PSEs and other PSEs would be offered the benefits under VRS. A number of PSEs especially in the textile sector reeling under the problems of excess workforce, huge wagebill and low labour productivity would be its greatest beneficiaries. Incidentally, upto 31 March, 1995, 81,036 workers, coming to about 4 per cent of the employment level of PSEs in 1994-95, accepted the VRS many of them from the textile sector. The total amount spent under the NRF, including on VRS, in 1992-93 and 1993-94 approximates to Rs. 830 and Rs. 1020 crores respectively. The allocation for 1994-95 comes to about Rs. 700 crores. The total number of PSEs registered with the BIFR upto 31 March, 1995, comes to 53 out of which 9 are already identified for winding up [Public Enterprises Survey, 1994-95].

*Signing of Memorandum of Understanding (MOU) with the management of the non-sick and larger PSEs*: In MOUs, the rights and responsibilities of the management and the expectations and obligations of the government are spelt out and, within the terms and conditions of the MOU, the management has organisational freedom, i.e., to act in accordance with the MOU goals [For details about the MOU framework in India and abroad, see UN, 1995, pp. 113-67]. While orienting the PSEs toward improving their performance, the MOU system was also to help the PSEs to keep away unnecessary government interference in its routine matters and, hence, to avoid some of their operational problems. As records reveal, in 1993-94, MOU was signed with 101 PSEs. 94 out of these PSEs had sub-

sequently produced 'good' to 'excellent' results in that year [Public Enterprises Survey, 1993-94]. Similarly, for 1994-95, 99 PSEs signed MOUs and 87 of them performed 'fairly' better [Public Enterprises Survey 1994-95]. The results of the performance appraisal for 1995-96 for which 105 PSEs signed MOUs are yet to be published.

## Complementary Measures

A number of other reforms introduced side by side with the above policy inputs have also been considered to indirectly lend strong support to the rejuvenation efforts of the PSEs. The major components of such complementary measures are as follows:

*Successive reduction of import duties* on various foreign products and simplification and liberalisation of the import procedures and facilities. The growing imports at cheaper rates would make the domestic products more vulnerable to market pressures forcing the enterprises to rationalise their operations so as to bring down cost and prices.

*Simplification of the FERA and MRTP provisions* whereby even 100 per cent foreign owned subsidiaries could be set up. The entry of big multinational corporations and domestic industrial houses into the previously restricted or regulated area now becomes easier. This has raised the number of competitors in many of the sectors that were earlier the privileged domain of the PSEs. This measure appears significantly sharper on the PSEs particularly in view of the macro-level privatisation of several sectors.

*Capital market reforms* and the new found willingness of government in according permission to the PSEs for exploiting the capital market. The former ensured the growth of capital markets and the easy accessibility to funds in general while the latter enabled the confident and stronger PSEs to utilise a new source of funds. Before 1991, the PSEs were hardly permitted to tap the GDR or domestic bond markets. The new source of funds could reduce the difficulties of PSEs in raising working capital and resources for expansion. This might, in turn, eliminate their liquidity problems and facilitate faster growth and modernisation despite the dwindling budgetary support (PSEs like the SAIL are already on the capital market in a big way).

*The new thrust on export orientation of the economy.* Those PSEs having or developing their inherent and new strength activated by the reforms could successfully compete with the foreign producers. As their cost efficiency, productivity and product quality im-

**Table 1:** Sectoral Distribution of Investment and Gross Profit in PSES (%)

| Sector | Investment | | | | Gross Profit | | | |
|---|---|---|---|---|---|---|---|---|
| | 1985-86 | 1988-89 | 1990-91 | 1994-95 | 1985-86 | 1988-89 | 1990-91 | 1994-95 |
| Steel | 13.43 | 8.69 | 14.24 | 12.83 | 6.13 | 6.22 | 2.04 | 8.36 |
| Minerals and Metals | 7.22 | 7.28 | 5.44 | 3.75 | 0.19 | 2.96 | 4.97 | 4.18 |
| Coal and Lignite | 11.04 | 11.76 | 11.73 | 9.55 | (–)3.01 | 6.03 | 4.82 | 4.26 |
| Power | 10.85 | 16.47 | 17.56 | 18.53 | 5.21 | 8.57 | 11.64 | 8.46 |
| Petroleum | 10.22 | 9.80 | 9.77 | 11.77 | 52.73 | 43.35 | 38.95 | 32.22 |
| Fertilisers | 9.35 | 5.81 | 4.77 | 3.35 | 1.89 | 0.94 | 0.18 | 2.29 |
| Chemicals and Pham. | – | 2.75 | 1.88 | 1.85 | – | 1.59 | 1.43 | 3.51 |
| Heavy Engg. | 3.43 | 2.16 | 1.65 | 1.52 | 4.03 | 3.57 | 2.17 | 0.92 |
| Medium and Light Engg. | 2.05 | 2.26 | 1.99 | 1.42 | 3.74 | 3.54 | 3.74 | 1.38 |
| Trans port Equipments | 3.66 | 2.80 | 2.40 | 1.55 | 2.72 | 2.60 | 2.77 | 1.78 |
| Consumer Goods | 2.32 | 2.05 | 2.38 | 1.87 | (–)0.78 | (–)1.01 | (–)0.01 | (–)2.08 |
| Agril. Products | 0.09 | 0.07 | 0.06 | 0.04 | 0.15 | 0.03 | 0.00 | 0.05 |
| Textiles | 2.45 | 2.31 | 2.15 | 2.28 | (–)1.05 | (–)2.20 | (–),0.71 | (–)1.29 |
| Trading and Marketing | 2.13 | 3.22 | 2.21 | 1.49 | 17.37 | 6.13 | 10.34 | 8.73 |
| Transport Services | 5.34 | 4.53 | 4.91 | 5.83 | 4.97 | 4.47 | 3.63 | 4.26 |
| Contract and Construction | 0.80 | 0.53 | 0.68 | 1.54 | 1.11 | (–)0.17 | 0.01 | 0.20 |
| Indl. Devp. and Tech. Consul. | 0.40 | 0.45 | 0.41 | 3.86 | 0.99 | 0.59 | 0.41 | 2.66 |
| Tourist Services | 0.28 | 0.18 | 0.16 | 0.09 | 0.14 | 0.16 | 0.20 | 0.28 |
| Fin. Services | 4.91 | 8.36 | 11.44 | 11.43 | 3.55 | 6.22 | 10.15 | 10.82 |
| Telecommunications | – | 2.49 | 2.91 | 4.19 | – | 0.03 | 5.67 | 7.89 |
| Infrastructural goods and Service[1] | 56.99 | 63.08 | 73.65 | 79.53 | 71.68 | 75.31 | 77.32 | 79.13 |
| Steel Minerals and Metals | 20.65 | 15.97 | 19.68 | 16.58 | 6.32 | 9.18 | 7.01 | 12.54 |
| Steel Coal and Lignite | 24.47 | 20.45 | 25.97 | 22.38 | 3.12 | 12.25 | 6.86 | 12.62 |
| Infrastructural Goods[2] | 45.54 | 46.72 | 53.30 | 52.68 | 61.06 | 64.17 | 57.45 | 53.30 |
| Fertilisers Chemicals and Pharmaceuticals | 9.35 | 8.56 | 6.65 | 5.20 | 1.89 | 2.53 | 1.61 | 5.80 |
| Engineering and Transports[3] | 9.14 | 7.22 | 6.04 | 4.49 | 10.49 | 9.71 | 8.68 | 6.08 |
| Consumable Goods[4] | 4.86 | 4.43 | 4.59 | 4.19 | (–)1.68 | (–)3.18 | (–)0.72 | (–)2.32 |
| Trading and Marketing and Tourism Services | 2.41 | 3.40 | 2.37 | 1.58 | 17.51 | 6.29 | 10.54 | 9.01 |
| Infrastructural Services[5] | 11.45 | 16.36 | 20.35 | 26.85 | 10.62 | 11.14 | 19.87 | 25.83 |
| All services | 13.86 | 19.76 | 22.72 | 28.43 | 28.13 | 17.43 | 30.41 | 34.84 |

Notes:
1. Obtained as (1+3+4+5+15+16+17+19+20)
2. (1+3+4+5)
3. (8+9+10)
4. (11+12+13)
5. (15+16+17+19+20)

Source: Calculated from "Public Enterprises Survey", various years.

prove, their disadvantages in tapping the foreign markets would also diminish. Many of the PSEs could increase their output for export purpose even without creating any additional capacity—simply by exploiting their unutilised installed capacity. So export promotion opens avenues for better capacity utilisation and entails a plunge into the tide of global competition that may further consolidate the PSEs strengths.

## Purpose of the Study

Five years have already passed since the commencement of the reforms. The government continues to reiterate that the reform measures already. undertaken are inadequate in terms of both our needs and the expectations of the world community and, hence, the reform process is to continue. This implicitly accepts that the past reforms since 1991 have led to atleast some positive results and, therefore, more reforms would be further beneficial. In other words, the performance of the PSEs in these five years has been thought to be in accordance with the aspirations embodied in the reforms. As such, the future response of the PSEs to additional reform inputs could be expected to be more productive. Hence a study was attempted to analyse the first of the above premises, viz., that relating to the nature of performance of the PSEs under the reforms since 1991, so as to get some insights possibly useful for further reforms.

We have four years' detailed data available to us on the PSE operations since 1991-92. It may be worthwhile to examine them and see if the first four years into liberalisation generated a satisfactory profile of the central PSEs in contrast to their so-called dismal performance in the earlier years.

Some preliminary observation on a previous occasion had revealed only some mixed results [Rameshan, 1996a]. The experience of some of the profit and loss leaders in the first three years has also not been found to be very promising [Rameshan, 1996b]. But, if we examine the inter-sectoral distribution of important variables like the investment and gross profit of PSEs (table 1), we notice some sudden significant gains, under the reforms, in the shares of PSEs operating in petroleum, transport services and contract & construction services in the case of investment; steel, fertilisers and chemicals & pharmaceuticals in the case of profits; and industrial development & technical consultancy and telecommunication services in the case of both investment and gross profits. Table 1 clearly suggests a growing importance of PSEs rendering services.

Further, as exhibited in tables 2(a) and 2(b), there are eight PSEs which moved from a loss position since 1985-86 to profits in any year under reforms while as many PSEs have also moved backwards with losses in some years under reforms while earlier, since 1985-86 they had always reported positive pre-tax profits.

**Table 2(a):** PSEs Having Positive Pre-tax Profits First Time Since 1985-86 Under Reforms

| PSE | Beginning Year of Positive Profits |
|---|---|
| Bengal Immunity Limited* | 1994-95 |
| Hotel Corporation of India Ltd. | 1994-95 |
| Vignyan Industries Limited | 1993-94 |
| Biecco Lawrie Limited* | 1993-93 |
| Hoogly Printing Company Limited* | 1992-93 |
| Maharashtra Antibiotics and Pharmaceuticals Limited | 1991-92 |
| Southern Pesticides Corporation Limited | 1991-92 |
| Western Coalfields Limited | 1991-92 |

**Note:** * Sick companies taken over from private sector.

**Table 2(b):** PSEs Having Net Losses First Time Since 1985-86 Under Reforms

| PSE | Beginning Year of Net Losses |
|---|---|
| Andrew Yule and Company Limited* | 1994-95 |
| Indian Telephone Industries Limited | 1993-94 |
| Hindustan Machine Tools Limited | 1993-94 |
| National Handlooms Development Corporation Limited | 1993-94# |
| National Textiles Corporation Limited* | 1993-94 |
| Nuclear Power Corporation of India Limited | 1993-94 |
| Hindustan Photofilms Manufacturing Company Limited | 1992-93 |
| Hindustan Vegetable Oils Corporation Limited* | 1991-92 |

**Notes:** * Sick companies taken over from private sector
# Again positive pre-tax profits in 1994-95

Against this background, we shall attempt to analyse in more detail the various operational and financial ratios of the PSEs during 1984-85 – 1994-95 on an overall basis so as to evaluate any discernible differences emerging between their pre and post reform performance. It may be presumed that the PSEs in general may not be able to produce a spectacular change in their performance; but what we may expect at best could be only some initial symptoms of a future recovery facilitated atleast by the currently and potentially healthy enterprises.

## Data & Technique

The relevant data for this study are obtained from the Public Enterprises Survey for various years between 1984-85 and 1994-95. All data are expressed in current prices. This is sufficient because the study is based almost on ratios which cancel out the inflationary elements present if a single variable is considered in absolute terms. However, while looking at the annual growth rate of some selected variables, the annual inflation rates in terms of the Wholesale Price Index (1981-82 = 100) shall also be listed so that the growth rates can be contrasted against the inflation rates. The main techniques used comprise simple ratios and percentages. Some of the financial ratios whose definition appears less explicit in the tables are explained as follows:

- *Total assets turnover ratio:* Net sales to total assets (which include net fixed assets and current assets).

- *Interest coverage ratio:* Profit before interest and tax to interest charges.

- *Inventories turnover ratio:* Net sales to inventories.

- *Working capital turnover ratio:* Net sales to current assets.

- *Current ratio:* Current assets to current liabilities.

- *Return on investment:* Pre-tax profits to total investment (which covers loans as well as equity capital).

- *Return on total assets:* Pre-tax profits to total assets.

- *Dividend payout ratio:* Dividends to post-tax profits.

- *Erosion of networth:* Deficit to networth (equity capital plus free reserves and surplus).

## Performance of the PSEs

Table 3 presents the year-wise growth rates of some selected variables since 1984-85. As evident from the table, the PSE investment has been showing a real growth at significant rates since 1985-86, but only upto 1991-92. As apparent, even when there occurred a positive real growth in the 1990s, it was much lower than in the 1980s, thus, revealing an investment slowdown in PSEs during liberalisation. Further, in the first three years under liberalisation, the 'net sales' of the central PSEs registered a zero or negative real growth, suggesting a fall in their market strength as well. This situation is likely to have arisen from the emerging competitive atmosphere which forced many PSEs like Air India, Indian Airlines, ONGC etc. to lose considerable potential and existing business volumes and revenues. However, it is soothening to observe a turnaround at the aggregate level in this respect in 1994-95.

> The 'net sales' of the central PSEs registered a zero or negative real growth, suggesting a fall in their market strength.

The foreign exchange earnings continued to grow at impressive but declining rates under the reforms in-

Table 3: Annual Growth of Various Operational Parameters of Central PSEs — 1984-85 to 1994-95

| Item | Annual Growth Rate (%) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1984-85[1] | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 |
| Total Investment | – | 18.00 | 22.30 | 15.50 | 20.30 | 15.50 | 20.30 | 16.10 | 14.70 | 18.90 | 9.00 |
| Net Sales | – | 13.90 | 10.40 | 17.30 | 14.50 | −14.00 | 47.00 | 13.80 | 8.80 | 7.80 | 17.50 |
| Foreign Exchange Earnings | – | −34.50 | 3.10 | 6.00 | 17.10 | 30.10 | 11.30 | 26.70 | 15.10 | 15.50 | 12.40 |
| Value Added | – | 4.90 | 21.80 | 24.50 | 25.60 | 8.60 | 13.20 | 10.30 | 9.40 | 7.70 | 13.30 |
| R & D Expenditure | – | 12.50 | 19.60 | 17.10 | 44.00 | 0.40 | −4.20 | 39.10 | 121.60 | −71.80 | 25.70 |
| Pre-tax Profit | – | 3.50 | 42.70 | 8.10 | 31.40 | 20.20 | −33.90 | 14.30 | 26.80 | 28.90 | 47.30 |
| Employment (Regular) | – | 2.23 | 2.65 | 0.14 | −0.23 | 1.22 | −0.76 | −1.80 | −1.24 | −3.86 | −1.40 |
| Number of PSEs (Nos.) | 215 | 225 | 226 | 225 | 238 | 244 | 246 | 246 | 245 | 246 | 245 |
| WPI (1981-82 = 100) All Commodities | 6.47 | 4.41 | 5.82 | 8.21 | 7.45 | 7.39 | 10.26 | 13.79 | 10.06 | 8.35 | 10.40 |

**Note:** 1. Growth rates for 1984-85 not calculated.

*Source:* Public Enterprises Survey, various years, except for WPI. WPI taken from RBI Bulletin, various years.

dicating partly the increased exposure of the PSEs to foreign competition and partly, particularly in the initial years, the gains from the massive rupee devaluation of 1991. In the case of value added, the growth rate since 1991-92 has been declining upto 1993-94 in absolute terms, the rates in all these years being well below the inflation rates, meaning a real decline. However, 1994-95 witnessed a positive real growth of value added, as during the 1980s, implying that the high real growth of net sales noticed in that year would not result in a significant decline in the proportion of value added in net sales. But whether this positive trend will be sustained in coming years is to be seen.

In R&D expenditure, there was hardly a consistent growth during the 1990s. The large figure in this respect for 1992-93 originates from a huge R&D investment made in a single PSE, viz., Hindustan Aeronautics (close to Rs. 650 crores) except for which 1992-93 would have registered a decline in R&D spending by half. This shows the persistently myopic technology vision of the PSEs in spite of their earlier technological problems and their new situation of having to suddenly face domestic and foreign competition in large doses.

The growth rate of the pre-tax profit of the PSEs is successively higher since 1991-92. It reached a magnificent level in 1994-95. This is perhaps among a few silver linings in respect of the PSEs. But even this can be found an uninspiring one as we see that during the 1980s there were years when the profit of PSEs grew equally rapidly. Besides, it appears that the 'other incomes' of PSEs expressed as a proportion of their

pre-tax profit is still quite large (78.5 per cent in 1993-94) which makes us wonder how pitiable would be the level of return on investment of the PSEs if 'other income' sources totally dry up.

Another grey area emerging under the PSE reforms is the sharp decline in employment. The undisturbed decline started in 1990-91 on a small scale, got intensified to an almost 4 per cent fall by 1993-94 before the rate of decline came down to nearly 1.4 per cent in 1994-95. This may be attributed mostly to the VRS and partly to an undeclared partial moratorium on the creation of new posts and on new recruitment.

> Another grey area emerging under the PSE reforms is the sharp decline in employment.

Some of the profit and cost features of the PSEs can be gauged from table 4. The proportion of PSEs earning positive pre-tax profits declined, after reaching a peak in 1991-92, till 1993-94; but the proportion again improved in an almost offsetting way by the succeeding year. In 1991-92, some of the PSEs might have registered some windfall gains because of the sudden opening up of the market and the subsequent price adjustments. But, subsequently, when the windfall gains disappeared and the pressures of competition started rising, the marginal firms might have relapsed into loss-making. However, the stronger ones possibly learned to withstand the changes and to recover as years passed.

**Table 4**: Profit, Loss and Cost Aspects of Central PSEs: 1984-85 to 1994-95

| Ratio | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (Percentage values) | | | | | | |
| Profit-making PSEs (Proportion) | 52.60 | 52.90 | 47.80 | 50.70 | 49.20 | 53.70 | 50.00 | 54.10 | 53.50 | 48.80 | 53.10 |
| Pre-tax Profit to All-PSE Investment | 7.50 | 7.70 | 7.80 | 7.20 | 7.40 | 7.30 | 5.80 | 5.70 | 6.20 | 7.20 | 7.00 |
| Loss-making PSEs (Proportion) | 42.80 | 40.00 | 44.20 | 45.80 | 44.50 | 40.20 | 45.10 | 41.50 | 43.30 | 47.60 | 44.50 |
| Net loss to All-PSE Investment | 2.60 | 3.30 | 2.80 | 2.50 | 2.20 | 2.00 | 2.70 | 2.70 | 2.80 | 3.20 | 2.80 |
| Total Cost$ to Net Sales | 97.20 | 100.10 | 99.20 | 96.20 | 98.20 | 130.90 | 103.30 | 101.10 | 103.70 | 102.00 | 107.70 |
| Labour Cost to Total Cost | 10.40 | 9.60 | 10.00 | 10.00 | 10.30 | 10.10 | 9.70 | 9.80 | 10.00 | 10.10 | 8.70 |
| Socio-Eco. Welfare Cost to Total Cost | 1.26 | 1.35 | 1.40 | 1.32 | 1.33 | 1.40 | 1.36 | 1.45 | 1.33 | 1.46 | 1.27 |
| Interest to Net Sales | 4.97 | 5.37 | 5.34 | 4.78 | 4.85 | 7.21 | 6.99 | 7.82 | 8.09 | 8.20 | 7.47 |

**Note:** $ Cost of production/services
*Source*: Public Enterprises Survey, various years.

This is also evident in their higher pre-tax profit — all-PSE investment ratio which had touched a low 5.7 per cent in 1991-92.

On the other hand, while the proportion of loss-makers slightly declined in 1994-95 after climbing significantly in the previous year, the ratio of net loss to total investment scaled to new heights after the reforms, notwithstanding a positive change during 1994-95. On the whole, it is not unambiguously evident if the reforms brought any immediate tangible relief to the less fortunate ones among the PSEs.

Any way, at the end, the profits of some and losses of others resulted in a rise in the overall profitability (difference between the two corresponding ratios of profit and loss to investment) from 3 per cent in 1991-92 to 4.2 per cent by 1994-95. But, if we look back to the 1980s for comparison, we can find that, despite the policy changes, the achievement during the 1990s is not the best, in particular vis-a-vis the results of 1986-87. Moreover, the table also shows the ratio of total cost to net sales as exceeding unity and, therefore, as quite unfavourable to greater profit realisation in all the years under liberalisation. This means, the roots of profitability should be traced to the inventories of finished goods and work-in-progress or to the other incomes resulting from the sale of assets and securities transactions that hardly form part of the declared activities of the PSEs. Still, we should not immediately interpret this to be the general failure of the reform process since the reform measures like disinvestment and MOU have been applied just to either a few selected PSEs or to the profitable ones.

The increasingly unfavourable cost position of the PSEs does not seem to emanate from labour-related costs. Such costs in proportion to total costs remained almost stagnant since 198e4-85 and did not rise even under the liberalised conditions of the 1990s. Rather, it declined noticeably in 1994-95. As a matter of fact, the raw-material and power and fuel charges were also proportionately stable during this period. At the same time, the interest charges have been moving up since the close of the 1980s and started a systematically upward swing by 1991-92. The economic liberalisation and the PSE reforms might have played a role in this. On the one hand, the government continued to lower its budgetary support to the PSEs, thereby, forcing them to

> The increasingly unfavourable cost position of the PSEs does not seem to emanate from labour-related costs.

seek alternative sources of finance, including possibly debt. On the other hand, the liberal capital market conditions prompted a growing number of PSEs to tap the debt market, thereby, driving up the interest obligations. Thus, the high interest charges would have been thought to be the main culprit in the rising costs of the PSEs. However, this point is disproved by the decline in interest charge proportion in 1994-95 when the total cost-net sales ratio substantially rose to our great concern. It also reflects the continued inability of the PSEs to rationalise production costs whereby an eventual expansion of expenses on some components could hardly be offset by cost controls on the other components. This also overshadows the gains in value added in this year mentioned earlier.

> The government continued to lower its budgetary support to the PSEs, thereby, forcing them to seek alternative sources of finance, including possibly debt.

Another set of selected performance ratios are listed in table 5. The ratio of value added to net sales can be found to be almost stagnant since 1991-92 despite the positive real growth of value added in 1994-95. Though the values are better compared to the early and mid 1980s, the period of 1988-89 to 1990-91 had produced a better picture in this respect. This indicates that the PSEs could not achieve adequate economy on the intermediate input front whereby more or less the same proportion of sales proceeds have been required even during the reform years, which are characterised by the creation of competitive forces and a relative decisional freedom, to meet the intermediate costs.

Table 5 also reveals the ratio of foreign exchange earnings to its utilisation as assuming one of its lowest values under the reforms. This is obviously because of a slow rise of export earnings in comparison with the rise in the utilisation of foreign technologies and facilities. At the same time, the earnings vis-a-vis net sales appeared better after 1990-91 as compared to the mid-1980s. This underscores the renewed effort of the PSEs in looking beyond the boundaries in finding markets for their products, though he main contributors in this regard might be the stronger and more successful PSEs. As a matter of caution, the above evidence should be qualified by referring to the big devaluation of rupee of 1991 which might have partly inflated the export turnover of the PSEs vis-a-vis their sales at least in the initial years.

The low R&D expenses-to-net sales ratio reveals that the R&D outlook of the PSEs still remains ob-

solete. In the past, there was a technological stagnation in Indian firms in general on account of regulations and poor R&D vision. In the changed scenario, to take on the competitors, it is necessary for every PSE to pay sufficient attention to R&D and in-house technological innovations. But this is yet to be realised by the PSEs. The R&D—net sales ratio would have been extremely low after 1991-92 except for the randomly high value of 0.66 for 1992-93 originating mostly from a big investment by Hindustan Aeronautics in its modernisation. The Indian PSEs seem to continue to evince interest more in foreign technology acquisitions than in developing its own strength through internal innovations.

> **In the changed scenario, to take on the competitors, it is necessary for every PSE to pay sufficient attention to R&D and in-house technological innovations.**

As regards the role of internal resources in investment, after 1991 reforms, it is only in 1994-95 that any marked improvement occurred. This positive change is indeed commendable. However, unless this trend persists during the coming years, one of the important objectives of reforms, of raising more investment resources through internal effort, may not bear fruit.

The dependence of the PSEs on budgetary support of the government for investment resources has been steadily declining since the 1980s as proved by the rising ratio of internal resources to budgetary support. Encouragingly, a reversal in this trend noticed in 1993-94 did not hang on as clear from the higher value of the ratio reported in 1994-95.

The contribution of PSEs to the exchequer in terms of taxes, dividends etc. has been smaller, in proportion to the total investment in all PSEs, since 1991-92 as compared to the mid-1980s. But the proportion during the last year of our analysis reached the highest figure since the reforms. The inclusion of interest charges on government loans into the above contribution does not alter the above trend. Noting that the dividends have always been moving forward, the unstable relative contribution to exchequer could be connected to the variations in the tax rates and surcharges effected under different budgets since 1991 and to the various tax exemptions and rebates apart from the performance differentials of the PSEs over the years. Significantly, PSEs like SAIL whose profits amount to more than a thousand crores of rupees pay virtually no corporate income tax by claiming such exemptions and rebates.

Another important failure under the reform measures is embodied in the poor capacity utilisation of the PSEs. Increased capacity utilisation was expected to follow the targeted improvement in the allocational,

**Table 5**: Selected Performance Ratios of Central PSEs: 1984-85 to 1994-95

| Ratio | Yearwise Values (%) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1984-85[1] | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 |
| Value Added to Net Sales | 24.60 | 22.60 | 25.00 | 26.50 | 29.10 | 38.20 | 29.40 | 28.50 | 28.60 | 28.60 | 28.10 |
| Foreign Exchange Earnings to Utilisation | 98.50 | 59.80 | 72.90 | 61.10 | 65.70 | 46.90 | 49.00 | 47.90 | 41.20 | 53.00 | 45.70 |
| Foreign Exchange Earnings to Net Sales | 11.50 | 6.60 | 6.20 | 5.60 | 5.70 | 8.60 | 6.50 | 7.30 | 7.70 | 8.20 | 7.80 |
| R & D Expenditure to Net Sales | 0.26 | 0.26 | 0.28 | 0.28 | 0.35 | 0.41 | 0.27 | 0.33 | 0.66 | 0.17 | 0.19 |
| Internal Resources to Total Investment | 10.00 | 10.10 | 9.80 | 9.70 | 10.40 | 10.80 | 9.90 | 9.60 | 10.00 | 10.10 | 11.60 |
| Internal Resources to Budgetary Support[$] | N.A. | 1.01 | 1.14 | 1.45 | 1.76 | 1.98 | 2.52 | 3.58 | 4.30 | 4.09 | 4.57 |
| Contribution to Exchequer to Total Investment | 17.80 | 18.00 | 19.60 | 21.30 | 19.10 | 18.40 | 17.10 | 14.70 | 15.20 | 14.00 | 15.90 |
| Contribution to Exchequer & Int. to Total Investment | 23.80 | 24.20 | 25.20 | 26.30 | 24.00 | 23.80 | 23.80 | 21.90 | 22.60 | 21.20 | 23.30 |
| PSEs with Capacity Utilisation > 75% | 40.50 | 42.70 | 39.80 | 44.90 | 52.90 | 55.70 | 50.00 | 48.00 | 50.20 | 46.70 | 49.40 |

**Note:** $ Simple ratio and not expressed in percentage. N.A.: Budgetary support figure not available.
*Source*: Public Enterprises Survey, various years.

**Table 6**: Financial Ratios of Central PSEs: 1984-85 to 1994-95

| Ratio | Year-wise Values | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 | 1994-95 |
| Leverage: Loans to Networth | 0.87 | 0.82 | 0.84 | 0.92 | 0.96 | 0.96 | 0.99 | 1.14 | 1.04 | 1.04 | 1.32 |
| Net Sales to Total Investment | 1.19 | 1.15 | 1.04 | 1.06 | 1.00 | 0.74 | 0.95 | 0.91 | 0.91 | 0.88 | 0.99 |
| Total Assets Turnover | 0.73 | 0.72 | 0.66 | 0.65 | 0.63 | 0.44 | 0.55 | 0.55 | 0.52 | 0.51 | 0.55 |
| Interest coverage | 1.83 | 1.70 | 1.91 | 1.93 | 2.06 | 1.99 | 1.46 | 1.41 | 1.47 | 1.55 | 1.77 |
| Inventories Turnover | 4.02 | 3.94 | 3.90 | 4.21 | 4.38 | 3.38 | 4.36 | 4.52 | 4.13 | 4.43 | 3.59 |
| Inventories to Current Assets$ | 34.10 | 35.10 | 33.70 | 35.20 | 33.20 | 29.80 | 28.80 | 25.70 | 25.60 | 24.10 | 33.30 |
| Working Capital Turnover | 1.37 | 1.38 | 1.31 | 1.48 | 1.45 | 1.01 | 1.25 | 1.60 | 1.06 | 1.07 | 1.20 |
| Current Ratio | 1.73 | 1.76 | 1.80 | 1.67 | 1.72 | 1.77 | 1.71 | 1.73 | 1.88 | 1.93 | 1.78 |
| Working capital to Total Assets$ | 53.20 | 52.30 | 50.10 | 43.70 | 43.00 | 43.60 | 43.70 | 47.00 | 49.20 | 47.70 | 46.00 |
| Pre-tax Profit to Net Sales$ | 4.13 | 3.75 | 4.85 | 4.47 | 5.12 | 7.16 | 3.22 | 3.24 | 3.77 | 4.51 | 5.76 |
| Return on Investment$ | 4.92 | 4.31 | 5.03 | 4.71 | 5.15 | 5.33 | 3.07 | 2.92 | 3.44 | 3.98 | 5.68 |
| Return on Total Assets$ | 3.01 | 2.71 | 3.19 | 2.89 | 3.20 | 3.14 | 1.76 | 1.77 | 1.96 | 2.30 | 3.16 |
| Dividend to Equity$ | 0.89 | 0.80 | 1.05 | 1.05 | 1.02 | 0.82 | 0.95 | 1.50 | 1.52 | 1.82 | 2.46 |
| Dividend payment$ | 19.40 | 16.30 | 16.80 | 15.80 | 11.80 | 8.50 | 18.20 | 29.20 | 24.20 | 22.90 | 19.90 |
| Erosion of Net Worth$ | 27.00 | 26.50 | 24.80 | 23.60 | 23.00 | 20.60 | 21.70 | 23.50 | 24.10 | 25.30 | 33.30 |
| Deficit to Net Sales$ | 14.00 | 14.80 | 15.30 | 14.00 | 14.20 | 17.40 | 14.20 | 15.00 | 16.40 | 18.10 | 18.00 |
| Deficit to Total Investment$ | 16.60 | 17.00 | 15.90 | 14.80 | 14.20 | 13.00 | 13.60 | 13.60 | 15.00 | 16.00 | 17.80 |

**Note:** $ in percentage terms.

*Source*: Public Enterprises Survey, various years.

technical and organisational efficiency of the PSEs originating from the increased competition, operational freedom and other policy inputs. As can be found from table 5, the percentage of PSEs with their capacity utilisation exceeding 75 per cent was the lowest under the reforms after 1987-88. Menacingly, the proportion has been less than 50 per cent in three of the four reform years focussed here. It reinforces our suspicion that the reform inputs were less successful than thought of at the outset in inducing the PSEs to improve their operational efficiency.

> **Another important failure under the reform measures is embodied in the poor capacity utilisation of the PSEs.**

Table 6 provides a financial profile of the PSEs during the study period with reference to some important and commonly used financial ratios. To begin with, the rise in the leverage or gearing ratio of the PSEs since 1986-87 reached a peak level after the reforms

implying a greater resort to debt financing. The ratio was, however, lower during the two intermediate years of focus which would sound like a tapering off of the enthusiasm of the PSEs in tapping debt or the slow down in the lending habits of the lenders of PSEs, but which, in actuality, was assisted by a tendency of several PSEs to retire part of their debt obligations.

The ratio of net sales to investment, which may be roughly called the investment turnover ratio, continued during the first three years of reforms with the general declining trend of the 1980s. 1994-95, however, marked a turnaround in this respect which pushed the turnover ratio almost to the 1988-89 level. The total assets turnover ratio also behaved similarly, but the rate of recovery was relatively small. Interpreting these ratios, the productivity of the invested capital and assets of the PSEs came down year after year even during the 1990s and some symptoms of a recovery appeared only by the fourth year of reforms.

As regards the interest coverage ratio, it declined by 1991-92 to a considerably low level, but started recouping since the next year and continued to expand. How-

ever, this was made possible, as seen elsewhere, not by cost economisation measures of all PSEs but by a few profit-markers and with aid from the non-production transactions. A relatively higher inventories turnover ratio together with a declining share of inventories in current assets had indicated in the first three years of reforms a slightly better inventory management among the PSEs in general. But a worsening of the two ratios by 1994-95 suggests that the advantage gained in this respect in the earlier years has been lost. As noticed, the higher inventory build up of PSEs in 1994-95 has been on account of the service enterprises rather than due to the goods-producing PSEs.

Unfortunately, the achievement of PSEs in the utilisation of working capital as a whole is more dismal. Because, the working capital turnover ratios descended to the lowest levels (after 1989-90, which was not a normal year owing to internal and external political and economic crises) under the reforms notwithstanding a slight recovery during the last year of our analysis. That is, the problem of declining effectiveness in the management of the quick assets (working capital minus inventories) turned serious especially at the initial years of reforms. The main contributor of this situation is possibly the cash and bank balance components which grew perhaps due to the increasing cash flow from profits and the improving credit accessibility.

At the same time, if we look from the other angle, the working capital component of the total assets shows a relatively comfortable position since 1991-92 eventhough the ratios registered persistent declines after 1992-93. Also, the current ratio exhibited a good improvement between 1991-92 and 1993-94 mainly due to the growth of liquid assets as noted above though even this situation turns out to be unsatisfactory when compared to the mid-1980s. To our concern, a faster growth in the current liabilities and provisions during 1994-95 forced the current ratio to decline almost to the 1991-92 level. On a positive note, however, since 1991-92, there emerged, in comparison with most years of 1980s, a greater technical solvency to PSEs in total, notwithstanding the fact that this does not ensure the solvency of each individual PSE.

There is unambiguous evidence of the rising aggregate profitability of the PSEs after the reforms. The rising values of the three ratios of pre-tax profits to net sales, return on investment and the return on assets testify to this. Interestingly, these ratios have shown remarkable growth in the last of the reform years focussed here and such growth resulted, for the first time since 1991, in some of these ratios assuming values higher than during the 1980s. Thus, the reform measures seem to have prevented a further downslide

(as noticed in the 1980s) in the profitability ratios and initiated the process of a movement toward a gradual recovery.

When we look from the government side, as an equity contributor, the return is very meagre as the dividend paid to the equity owners is just about 2.5 per cent of equity by 1994-95 despite the impressive growth in this ratio after 1990-91 with the onslaught of reforms. It is true that the dividend payout ratio has climbed to impressive heights with the reforms. But reminding the declining trend of the 1980s, the dividend payout ratio is gradually retreating after 1991-92. Looking from the PSE angle, this, however, is a healthy sign since the retained earnings provide a good source of internal resources for the PSEs for new investment and expansion especially in the light of the declining budgetary and plan support given by the government.

The problem of deficit is again becoming serious. The deficits as a proportion of net sales have been growing since 1991-92 and reached such an extreme level in 1993-94 which was never experienced before since 1984-85. Deficits lately form more than one-sixth of the total PSE investment. It has already eroded (by 1994-95) about a third of the net worth of the PSEs. This erosion has, in fact, turned faster after the reforms which has to be contrasted against a continued decline in the erosion during the 1980s. The deficit is a problem created by the loss-making PSEs. An aggravation of deficits since 1991-92 is tantamount to an adverse impact of reforms on the sick and potentially sick enterprises.

## Concluding Remarks

During 1991-92 – 1994-95, the PSEs, as a whole, have indeed exhibited some encouraging operational characteristics. These include: a high growth in the foreign exchange earnings though this was arising atleast in the initial years of reforms from the rupee devaluation, a declining dependence on budgetary resources for investment notwithstanding the fact that it is rather a fait accompli in the face of the government's growing financial problems, a better overall solvency position although this from the other angle is an evidence of reduced efficiency in managing the liquid assets, the rising retained earnings of the profit-makers and a perceptibly growing overall profitability though contributed by a fewer profit-makers. However, unfavourable features of their post-reform operations are quite a few. They comprise, among other things: a slow-down in real investment, poor R&D attention, a sharp decline in employment without any obvious corresponding productivity gains, a near stagnation in the ranks of loss-makers, inefficient cost management, greater inter-

est obligations, significantly poor capacity utilisation, poor asset turnover, deteriorating efficiency in working capital management, lower contribution to exchequer and growing deficit burden leading to progressive erosion of the networth. On the whole, the performance of the PSEs in the four reform years is overshadowed by their failures and by what they could not achieve, in spite of the fairly fertile atmosphere created for their expected success.

In essence, the reforms seem to have helped in the first four years possibly in a little way the less successful PSEs in making a turnaround in their operations or profitability. The stronger ones which make profits after the reforms were already profitable and successful in their earlier period. So their continued better performance cannot be hailed as a legacy of reforms. It is the recovery of weaker ones that can be considered a mark of success and of the achievement of the goals of the PSE reforms. In the light of the continued dismal profit-performance of a larger proportion of PSEs coupled with the turning of some of the previously profit-making PSEs [as shown in table 2(b)] into loss-makers and the continued losses of some important once-profitable PSEs (Mineral Exploration Corporation, Indian Airlines etc.), the reforms since 1991 cannot be viewed as successful as expected in their objectives atleast in the first four years.

However, four years might not be long enough, as suggested at the beginning, to provide conclusive evidences on the impact of a landmark reform measure. As such, one may have to wait for the results of a few more years before making any drastic comments about the failures of PSEs under the reforms. Nonetheless, it appears to be an euphoric optimism to expect the sick and potentially sick PSEs to turnaround on their own without any enterprise-specific support and financial assistance simply because of the macro reforms and, thereby, to metamorphosise the entire public sector into a bunch of merry profit-seekers just as in a typical free market society. For ensuring expected results, there is a need to make the future reforms more objective and realistic.

In determining what is objective and realistic while forming public sector policy options, the government may consider the issues that still lie unresolved for the PSEs and those that limit their operational flexibility and impinge on their financial efficiency and managerial performance. The government should also accept with due weightage the views and suggestions of the experts and scholars, who spend their precious efforts in analysing the PSEs problems, on issues like disinvestment (e.g., Goswami [1996]), MOU (for instance, the recommendations of the "Round Table on MOU System in Public Enterprises in India" organised in 1993 by the Centre for Industrial and Economic Research and the SCOPE [UN, 1995]) etc.

The managerial problems are foremost in the profitability front of the PSEs. One step in tackling this, as suggested by many, is to fix the level of disinvestment of PSEs at 50 per cent or more so that it enables the private participants to control the management effectively. Whether a PSE is privatised or not, there should be adequate provisions for a change in top management if the existing management is incapable of checking a fall in profitability in successive years, in preventing sickness or in effecting a turnaround in the financial performance of a loss making enterprise over the years. In other words, the management should be held responsible for failures and, therefore, punished.

> Whether a PSE is privatised or not, there should be adequate provisions for a change in top management if the existing management is incapable of checking a fall in profitability in preventing sickness or in effecting a turnaround.

There should not be any government control on the enterprise in shedding the workforce assessed to be in excess of its requirement. If the current VRS is not conducive for achieving an optimum level of labour force, it may be necessary to introduce a 'Compulsory Retirement Scheme' whereby the redundant employees could be identified and sent off with adequate compensation. The government should also take measures to fill the top executive vacancies as quickly as possible. Many PSEs operate without a head which cause a lot of decisional and operational problems. The retirement of top executives should be foreseen sufficiently early. Either the successors of corporate heads should be identified before the present incumbent retires or there should evolve a mechanism whereby the new incumbent is automatically identified from within the enterprise or outside.

There should also be a clearly defined purpose (or purposes) for which the disinvestment proceeds shall be used. Instead of using the resources for financing the revenue expenditures, the government should provide a larger portion of the disinvestment proceeds in quickly reviving the revivable sick PSEs. Longer the delay in initiating the revival process, more difficult will be the process of revival-sometimes such delay may jeopardise even the chance of revival, thus, rendering the as-

sets involved totally worthless. The government may also earmark part of the resources raised through disinvestment as R&D funds to be deployed for industry specific adaptive and innovative R&D activities meant in particular for the small and loss-making PSEs. This would ensure better technical adaptability of such PSEs to the emerging competition and to the increasing foreign technology inflow. In addition, the profitable PSEs could be told to allocate enterprise-specific R&D funds proportionate to their sales and/or profits. This, alongwith the industry-specific R&D efforts proposed out of the disinvestment proceeds, may bolster the technical efficiency and productivity of the respective PSEs.

Furthermore, when both the public and private sector enterprises are competing or involved in any project falling especially in those areas which were earlier reserved for the former, the government should desist from providing, undue favours to the private sector. Thus, if ONGC spends a lot of resources in discovering an oilfield, it should not be forced to forego recovery of its exploration cost when the oil wells are leased out to the private firms. Such external factors result in the PSEs losing huge resources incurred as cost. While the private sector may gain out of it thus balancing the net gains in the social sense, the PSE may be blamed for its subsequent low or non profitability. Finally, the PSEs should be effectively insulated against non-business, political interferences. In spite of all the liberalisation and reforms, the political factor has still a strong influence on the PSE operations. There are political considerations in the appointments of chairmen and managing directors. The persons so appointed indulge in corrupt practices and thereby expose the PSEs to unnecessary risks through untenable actions (as in the case of National Fertilisers Limited). The PSE management would be safe only with such personnel who are endowed with

entrepreneurial and managerial skills and not with those whose chief merits lie in political or personal affiliations.

> **The PSEs should be effectively insulated against non-business, political interferences.**

### Acknowledgement

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# Narmada Multipurpose Project: A Critical Appraisal

R.K. Agarwal

*Based on Western models, India has opted for mega projects without considering the impact of the disruption to the original habitants as well as the subsequent degradation to the environment. The author presents a cost benefit analysis and urges the government to re-evaluate the Narmada project to preserve the socio-economic-ecological system.*

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The Indian Government, since independence, has adopted the Western model of economic development with the Gross National Product as the criterion of national development with emphasis on sophisticated technology, energy and heavy capital investment. The harnessing of the resources of land, water, minerals and forests for this purpose has resulted in structural changes in the economy and affected the modes and relations of production and distribution (Dogra, 1991). Millions of people mostly tribals, rural folk and backward sections have been displaced through submergence of their land, acquisition of their properties or through change of usership of lands (Dogra, 1992). Much of the fruits of such projects are denied to the original habitants of those areas.

> The Indian Government has adopted the Western model of economic development, with emphasis on sophisticated technology, energy and heavy capital investment. This has resulted in structural changes in the economy.

The alternative model of development has the objectives of meeting the needs of the people, strengthening self-reliance and achieving sustainable development in harmony with the environment. Hence, a study was attempted to present a socio-economic cost benefit analysis of the Narmada Multipurpose Project with emphasis on the adverse socio-ecological effects in the submergence zone and other zones as well as an assessment of the real benefits of promised irrigation, flood-control and electric generation.

## Salient Features

The Narmada river originates in Madhya Pradesh and terminates into the Arabian sea after flowing for

1312 km through Madhya Pradesh, Maharashtra and Gujarat. The Narmada Valley Project is for irrigation, electric generation and domestic water consumption. It consists of 30 major, 135 medium and 3000 minor dam projects to be built in the next 50 years. The Sardar Sarovar Projects (SSP) and the Narmada Sagar Projects (NSP) are inter-connected components of this project.

The SSP consist of a Sardar Sarovar Dam, irrigation canals, power house and transmission lines. The dam is being constructed in Bharuch district of Gujarat. It will have a height of 139 m and a 200 km long reservoir, submerging 37,000 ha. Thirty seven villages would be fully submerged and 209 partially submerged. Its network of Canals will require 85000 ha of land and irrigate 18 lakh ha. About 300 MW of electricity will be generated at the dam site which would later drop to 150 MW.

The NSP will submerge 90000 ha and irrigate 23000 ha. About 223 MW of electricity will be generated which will later drop to 118 MW. Its associated dams will submerge 14000 ha, irrigate 129000 ha, provide 223 MW of electricity dropping to 100 MW later.

Because of this project about 400,000 people will be displaced, out of which 47 per cent belong to scheduled castes and tribes. About 47,000 ha of forests and 56,000 ha of agricultural land will be submerged.

The resettlement and rehabilitation of displaced persons have been uncoordinated, insensitive to the socio-economic needs of the people and discriminatory for different categories of oustees. Studies indicate that the socio-economic standard of the displaced people has been lowered. The number of displaced persons was underestimated. The environment assessment and clearance of SSP and NSP have been severely criticised. The availability of water for SSP and NSP is overestimated. The delayed construction and enhanced construction cost have affected the real cost benefit ratio of these projects. The effect of water logging and salinisation will reduce the irrigation benefits. The effects of sedimentation in the reservoir have been underestimated. Malaria control measures in the irrigation command area have not been adequately undertaken. The upstream afforestation measures have not been properly conceived to compensate the submerged forests.

## Cost Benefit Analysis

The cost benefit analysis (CBA) of big projects is a controversial topic because the theory requires that the project be a relatively small one which does not de-

stablise the overall economic structure. The various benefits and costs from the Narmada Valley Projects (Ruitenbeek, 1995) are listed in table 1.

**Table 1:** Selection of asserted benefits and cost from the Narmada Valley Projects

| Benefit | Description/Nature of Benefits |
|---|---|
| Irrigation | Irrigated area of 1-2 million ha. Area served by SS depends on upstream control at NS. |
| Power | SS has installed capacity of 1450 MW: additional capacity of 1590 MW from NS projects. |
| Domestic water | From 25-40 million people will have improved access to domestic water supply. |
| Livestock water | In the northern part of Gujarat, pastoral families will have improved access to water. |
| Industrial water | Narmada Water Disputes Tribunal Award allocated 0.207 maf to industrial uses. |
| Pisciculture | Estimated improvements of the order of 70 crore for NS project area. |
| Flood control | Flood control exists from Narmada Sagar projects as upstream control structures. |
| Reduction imports | Increased foodgrain and oilseed production reduces need for imports. |

| Cost | Description/Nature of Costs |
|---|---|
| Dam construction | Dam works at each of the NS project (4,200 crore) and SS project (11,000-18,000 crore) areas will be constructed. |
| Catchment area | Demarcation of degraded areas nursery development, and action treatment programme for treatment of catchment area at cost of approximately 1,100 crore. |
| Command area development | Provision of surface and sub-surface drainage and pollution control measures to mitigate waterlogging maintain water quality and optimise water use (2,500 crore). |
| Compensatory afforestation | An area of 90,000-97,000 ha of degraded forest will be afforested at the cost of approximately 1,700 crore. |
| Canal construction | Canal network will involve about 75,000 km of canals (including main, branch, distribution and minor canals) over 85,000 ha. |
| Domestic water provision | Supplementary costs of water supply were excluded from earlier estimates of project costs. Cost estimates range from 1,500-5,000 crore for SS project area. |
| Power consumption | Supplementary power requirements for lifting groundwater and operating domestic water distribution. Costs estimated in the range of 2,700-3,400 crore for SS project area. |
| Resettlement and rehabilitation | Total direct resettlement and displaced persons estimated to be as high as 1.5 million individuals. Many are indigenous people. Total direct costs are 2,200 crore. |

| | | | |
|---|---|---|---|
| Forestry loss and environmental losses | Submergence will cause loss of 43,000 ha of forest in NS project area and upto 16,000 ha in SS project area. Total direct costs of forest loss are about 600 crore. Total indirect environmental costs (excluding loss of genetic resources) associated with forest loss are 73,500 crore, using norms established by the Forest Research Institute. | | |
| Agriculture land | Submergence will cause loss of 44,400 ha of agricultural land loss in NS project area and 113,000 ha SS project area. | | |
| Wildlife impact | Loss of corridors will reduce habitat and threaten ecosystem biodiversity. | | |
| Sedimentation and siltation | Sediments reduce useful life of dam reduce power generation capacity, and create backwater effects which inundate upstream areas above submergence zone. | | |
| Waterlogging | Soil degradation and fertility loss from waterlogging anticipated in 1,00,000 ha in Narmada Sagar project area. | | |
| Salinisation | Salt water intrusion of surface and ground water anticipated in downstream urban and rural areas. Mitigation requires supplemental pumping. | | |
| Health impact | Increased incidence of malaria, filaria, cholera, gastroenteritis, viral encephalitis, goitre and some other water borne diseases in the vicinity of reservoirs and canals. | | |
| Pollution | Increase in suspended sediments and retention of pollutants from decreased circulation. | | |
| Cultural heritage | Loss of important religious sites and tourism potential. | | |
| Earthquake risk | Recent events have tragically underscored the seismicity of the region. Fears exist that dam construction will increase seismicity. | | |
| Fishery loss | Hilsa mullet and prawn species threatened. Losses will exceed 385 crore in Gujarat, much of which will be foreign exchange. | | |

The simplistic (Agarwal, 1996) CBA of four dams (Narmada Sagar Omkareshwar, Maheshwar and the Sardar Sarovar Dam) has been attempted. The results are listed in tables 2 to 5 — the benefit-cost (B/C) ratio of these projects are 0.75, 1.47, 1.30 and 0.67 respectively. The combined B/C ratio of the four projects detailed in table 6 is only 0.76.

**Table 3:** Omkareshwar Project — Costs and Benefit

| Costs | Rs. in Crore | Benefits | Rs. in Core |
|---|---|---|---|
| Dam | 1,300 | Revenue from Power | 2,000 |
| Land Acquisition and Rehabilitation | 40 | Irrigation: Increased Produce | 625 |
| Catchment Area Treatment | 120 | | |
| Command Area Development | 300 | Non-Agricultural use of water | 25 |
| Compensatory Afforestation | 40 | | |
| Total | 1,800 | Total | 2,650 |
| | B/C Ratio = 1.47 | | |

**Table 4:** Maheshwar Project — Costs and Benefits

| Costs | Rs. in Crore | Benefits | Rs. in Crore |
|---|---|---|---|
| Dam | 980 | Revenue from Power | 1,340 |
| Land Acquisition and Rehabilitation | 40 | | |
| Catchment Area Treatment | 10 | | |
| Total | 1,030 | Total | 1,340 |
| | B/C Ratio = 1.30 | | |

**Table 5:** Sardar Sarovar — Costs and Benefits

| Costs | Rs. in Crore | Benefits | Rs. in Crore |
|---|---|---|---|
| Dam | 18,000 | Revenue from Power | 4,500 |
| Land Acquisition and Rehabilitation | 400 | Irrigation: Increased Produce | 9,000 |
| Catchment Area Treatment | 350 | | |
| Command Area Development | 1,300 | Non-Agricultural use of water | 200 |
| Compensatory Afforestation | 350 | | |
| Total | 20,400 | Total | 13,740 |
| | B/C Ratio = 0.67 | | |

**Table 2:** Narmada Sagar — Costs and Benefits

| Costs | Rs. in Crore | Benefits | Rs. in Crore |
|---|---|---|---|
| Dam | 3,000 | Revenue from Power | 3,400 |
| Land Acquisition and Rehabilitation | 620 | Irrigation: Increased Produce | 625 |
| Catchment Area Treatment | 600 | Non-Agricultural use of water | 50 |
| Command Area Development | 500 | | |
| Compensatory Afforestation | 700 | | |
| Total | 5,420 | Total | 4,075 |
| | B/C Ratio = 0.75 | | |

**Table 6:** Benefit-costs Ratio for Four Dams (Combined)

| Project | Cost | Benefit | B/C Ratio |
|---|---|---|---|
| Narmada Sagar | 5,420 | 4,075 | 0.75 |
| Omkareshwar | 1,800 | 2,650 | 1.47 |
| Maheshwar | 1,030 | 1,340 | 1.30 |
| Sardar Sarovar | 20,400 | 13,700 | 0.67 |
| Total | 28,650 | 21,675 | 0.76 |

## Conclusions

A comparative study of the comprehensive short term and long range CB aspects of the Narmada Valley projects given in table 1, with the simplistic traditional BCA given in tables 2 to 6 reveal that many of the uncertainties, distribution impacts, risk to ecosystem and human health are not addressed in the simplistic analysis. In order to ensure the stability of socio-economic-environment aspects, the people directly affected should be involved in the planning, execution and management of major projects. This would ensure that the real benefits accrue to them rather than to those unaffected by the execution of such projects. The presumed levels of benefits from the

> **To ensure the stability of socio-economic-environment aspects, the people directly affected should be involved in the planning, execution and management of major projects.**

projects must account for the cumulative socio-economic-environmental impacts. Moreover, funds should be generated by levies on the project beneficiaries in order to cope adequately with unforeseen cost related to resettlement or environmental problems.

There should be continuous and cumulative assessment and planning with an explicitly built-in reversibility of decisions in the light of new available data. Historically large scale projects may have been favoured here or elsewhere, however there have been successful small scale water management strategies implemented in India itself such as water tank systems in South India and *baoli* system in the desert area of Rajasthan. There is a need, therefore, to prefer small scale projects. In case a large scale project is envisaged, a comprehensive general economic assessment should be mandatory for the stability of the socio- economic-ecological system.

> **There should be continuous and cumulative assessment and planning with an explicitly built-in reversibility of decisions in the light of new available data.**

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# Productivity of Public Sector Enterprises: An Eco-systemic Modelling Approach

## S.S. Pal

*A Taxonomy of the tetra-triadic control environment of the public sector enterprises is provided for efficient appraisal of their significant productivity parameters. An eco-systemic three-dimensional graphic model of a seven-factor representation of each of the Affective, Accessive, and Adaptive thrust dimensions has been drawn towards capturing the parameters for a meaningful and directed productivity pursuit in the now changed national socio-economic environment. Recognising management of public sector as a class in itself, as a relatively newer and important business practice, which did not wholly fit into any existing model, the proposed action programme outlines the direction for re-focussing on its theory of business and purpose based on a careful study of the underlying eco-systemic model and its tetra-triadic control phenomenon.*

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The emergence of the Public Sector Enterprises in post-independent India was primarily with the definitive purpose of ushering in an era of rapid socio-economic development all around, commensurate with the Directive Principles of State Policy enshrined in the Constitution. There were hardly any basic or capital goods industry to form the economic infrastructure on which further development could have rested when India earned freedom from the colonial past. Simultaneous to consolidating the benefits of economic development and reconciling with distributive justice, the need to catch up 'with the industrial revolution that occurred long ago in Western countries' was also overwhelming (Nehru, 1952).

### Public Sector: Genesis & Goals

Nevertheless, left to itself, the various constraints and compulsions of a free market in a new-born developing economy could cause such a slanted development pattern that may not necessarily have coincided with maximum social advantage. As a matter of fact, both these ideological and pragmatic considerations had given the initial thrust for the development of Public Sector in India. Because of the requirement of large capital outlays, long gestation periods and low return on investment, it was considered very much unlikely for this core area to attract any major private initiative. Even though a spiralling growth of re-investible surplus was assiduously sought, there was a conscious endeavour to avoid concentration of wealth and economic power in few private hands. Interference by the State became only imperative for a quick bridging of the gap, the kind of which exists even today with varying degrees in several spheres. And, the Public Sector was born as 'an article of our public faith'.

Since inception, many experts have studied several aspects of its functional parameters and come out with

newer insights. Since the announcement of the New Economic Policy in 1991, this area has aroused the renewed interests of business economists and other management specialists alike. Whether from within or from outside, concerns are continuously expressed regarding its productivity parameters, because the sound health of this sector still has a great bearing on the national economy, for at least the large outlays it involves, if not for anything else. Public Sector Enterprises (PSE) in their present form were born in a protected mixed-economy. At present, demand on these is once again on to undergo the evolutionary cycles in the process, to encounter the pressures of liberalisation and globalisation, and become successful; for, the successfuls only can productively survive at the end, given the myriad transitional pangs in and around their business eco-system of present times. In this context, Fig. 1 depicts the tetra-triadic control environment for appraisal by the controllers of their significant productivity parameters for efficient management of PSE.

Every business survives within its own eco-systemic niche. To examine the full-factor functioning of an organisation, it would be therefore extremely essential to understand its specific eco-system.

All business organisations have to constantly work, in view of and with, their individual eco-system. Any abrupt change or invasion ought to be faced via the generation of a coping mechanism. Drawing upon natural concepts, this has included inducing changes in the system, creating niche, transgressing, sub-dividing and the like, opening several strategic fronts until extinguished or renewed. This dynamics has been prevailing alongwith any growth process, coordinates of which call for careful apriori identification at any given point of time to chart out the desired pathway for progress therefrom. The present paper attempts to contribute a new taxonomic approach in that direction.

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## Management Practice

As the literature review reveals, Management of Public Sector came to be recognised over the years on



**Fig. 1.** Tetra-triadic Control Environment for Management of Public Sector Enterprises

many counts as a class in itself. For several reasons, it has assumed quite a distinct style of functioning, matching its exclusive parameters of inception and existence. This relatively new and important part of administrative practice has, however, a very chequered history of evolution, as the prime influencer of productivity of these enterprises.

> **Management of Public Sector has assumed a distinct style of functioning, matching its exclusive parameters of inception and existence.**

Even though these were launched primarily following the old existing private sector, since it was under the auspices of the State and funded from the public purse, the responsibility naturally dawned first on the government executives to manage their affairs. Alongwith came the borrowed codes of secretariat management for handling gainful economic activities, which were perhaps at the outset no match to each other in any way. As a result, it could acquire the virtues of neither in full but took on the peculiarities of both the 'private sector' and the 'secretariat' culture. Seldom could the principles and experiences, as those were of managing law and order, suit those of managing a business venture. This was the humble beginning. Following the natural process of growth and evolution as many combinations of it have settled down ultimately and got stabilised in as many enterprises there are. Each enterprise has developed its individual management pattern, or 'regiment culture' depending upon the respective intensity of each of these factors which prevails there. This now rules the waves of productivity there as the engine of a mammoth cart that pulls it along. Obviously, the more it could add to this, in terms of thorough professionalism, dedication to the objectives of economic growth and social justice, and the development of a corporate spirit, the more became its influence on the organisational productivity. Of course, no prescription is available readymade anywhere; the management practice must grow, change with the times, and evolve its own individual ethos over a period as it goes on.

Boes et al. (1984) dealt with the international economic behaviour of bureaucratic public enterprises in this regard. Bureaucracy has in fact indulged in economic business to some extent or the other all the time across the globe since the dawn of governments. Recall the Indian experience, cited in Lobo (1986), of bureaucratic strategies as found coded in Kautilya's Arthashastra. A great deal of world's business is still done by bureaucrats, observes Venkitaramanan (1996), in the review of a recent World Bank publication entitled, "Bureaucrats in Business". In developing countries, the public enterprises still accounts for 11 per cent of GDP, almost as much as they did nearly twenty years ago. Interestingly, even in developed countries public sector enterprises, account for about 9 per cent of GDP. The important consideration is that these bureaucratic enterprises ought to be generating wealth for the State, for public sharing of their contribution to GDP.

## Accountability, Autonomy & Entrepreneurship Crisis

Public enterprises have been setup primarily as an instrument of the State Policy for bringing about the desired socio-economic transformation with investment from the public purse. It is but natural therefore, that the State would have a decisive say in the matters of its functioning and performance. As Mrs. Gandhi stated, "The very fact that they (public enterprises) are publicly owned, ensured that (their) performance will be under constant public scrutiny and that there will be constant pressures for their improvement" (Nigam, 1984). They belong to the 'Nation'.

The concept of accountability is in no way an assertion of the sovereign right of the State, which of course needs no such demonstration. It is rather just the means to an end, that the public enterprises are managed so efficiently as to fulfil the socio-economic objectives of the State for which these were created (Dutt, 1980). It is accepted that accountability is more closely related to the financial performance of an enterprise, whereas autonomy is related to the working results of an enterprise, in terms of financial, strategic, and operational-level autonomy (Kaul, 1990).

The need for functional autonomy was appreciated thus by Pandit Jawahar Lal Nehru (Dutt, 1980). "When one deals with a plant and enterprise where quick decisions are necessary, which may make a difference between success and failure, the way the Government functions is not sometimes suitable. The normal government procedure applied to a public enterprise of this kind will lead to the failure of that public enterprise. We have to evolve a system for working public enterprises, where on the one hand, there are adequate checks and protections, and on the other hand, enough freedom for that enterprise to work quickly and without delay". The rule applies to both administrative and financial control. Many argue that may be the Government therefore considers itself more as an 'umpire' in the game, leaving the 'captaincy' to the management of public enterprises for all tactical matters under Company Law parameters.

> **We have to evolve a system for working public enterprises, where on one hand, there are adequate checks and protections, and on the other hand, enough freedom to work quickly and without delay.**

As a matter of fact, the public enterprises are actually neither fully autonomous, nor fully accountable, and some suffer the worst crises of entrepreneurship. This situation warrants the adoption of systemic remedial measures by striking a dynamically optimum balance on a continuous scale. A decision in the public domain should not only be right, but should also appear to be right, as goes the maxim. Management experts contend that if management becomes always over-fearful, the result is bound to be a highly conservative, excessively prudent and technically backward undertaking with questionable adequacy of professional decision-making. Only a carefully drawn governmental initiative might remedy this situation of crisis. The accountability of enterprise management ought to be equally matched by the obligation of the government for achieving the desired objective through adequate and genuine professionalisation, insulation from the pressures of political, local or parochial myopic interests. All these logically call for a weighted freedom for business actions, as any other universal business enterprise would opt for.

In this regard again, Boes (1986) has argued the case for privatisation. Venkitaramanan (1996) analysed the current Indian approaches on the diverstiture policy. India is categorised as a slow reformer in this direction mainly for the reason that privatisation was not India's preferred prescription. International experience found it intriguing, of course, for Korea which is ranked as one among the successful reformers, had never undertaken divestment as a remedy; nor did China, where public enterprise contribution from industrial output is more than 43 per cent from the state-owned sector and 38 per cent from the local government-owned sector. Internationally, successful PSE reformer nations were those which induced more competition, lowered the entry barriers to their business eco-systems and unbundled large enterprises. Constricted budgetary support encouraged self-supporting measures. Some reforming countries which first opted for partial privatisation, later allowed more private enterprises to come up in the same sector so as to reduce the relative size of the PSE. This is the path which India in the recent past found expedient to follow, but perhaps not so successfully.

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## Management Software

The sense of competition should develop from within to better the 'best' all the time, in serving the large cause of managing the country's economy well. Higher the productivity, the more will be the Gross National Product available for public consumption against a given level of expenditure of resources, providing for a raised level of economic well being for the people at large. This is, of course, a measure for the denominator input control for productivity.

However, the numerator output control measures for productivity are no less significant. To realise this goal of higher quality of performance, the first thing that is necessary, is an all out expansion of its current knowledge-base. Routine know-how may be quite adequate for performing in some way or the other, but it will fall far short of the mark, if the need is to excel. This knowledge-base must be continuously updated, fresh knowledge must either be created (by research), or be acquired (by direct import) and adopted to suit the local conditions (by development).

A 'technical' R&D can indeed help an organisation fight obsolescence and create or maintain its edge in the market, and the 'managerial' R&D ought to be installed to provide for newer softwares of support systems for achieving excellence in decision-making. Use of modern-day optimisation techniques which remain mostly relegated to the realms of business schools, can open up many virgin vistas towards efficient project monitoring to cut short the gestation delays, towards better capacity utilisation, and the like. R&D setups of Public Sector, the few that exist, remain mostly occupied with 'Product Research', whereas, every need can be found to include the 'theory-industry interface' for soft researches in these establishments for translating advanced managerial techniques into the language of the individual practical problem, by way of better methods or improved processes. Needless to add, any saving thus accruing would be equivalent to a matching fresh investment.

The same applies to capacity utilisation. Ensuring an optimum utilisation is as important as the adding of newer capacities. An unplanned utilisation of idle capacity may again give rise to the problem of carrying

unplanned inventory. Hidden capacities must first be stretched and taken out for proper planning of inventory holding needs, before augmentation of capacity is thought about.

Problems of inventory are quite acute in many public enterprises. Pursuant to the policy of equitable regional development, many of these enterprises were setup in hitherto backward and far-flung areas of the country, where not much industrial infrastructures were available beforehand. Such handicaps in location, coupled with a general state of shortage in everything at the time when it would be required, and the predominant sellers' market, all contributed to build up idle investment on inventory in sheer anxiety to maintain continuity of operations. Though the managements try hard to strike an optimum balance between the policy guidelines and the crisis situations, these unique eco-systemic conditions prove to be insurmountable con-straints.

The analysis of the failure costs in operations, and opportunity cost for the lost effort due to rejections, points to the urgent need for a widespread quality con-sciousness. This concept of total quality control is, how-ever yet to find a strong root in the general public sector scenario. Doubtless, the volume of production must meet the target. But the priorities should not get lop-sided or befogged between production and productivity. In the urgency of achieving the target quality ought not to become the causalty. Or else, withstanding the onslaught from global competitors could become a mirage.

> **Priorities need not get lopsided or befogged between production and productivity. In the urgency of achieving the target quality ought not to become the causality.**

*Partners in progress*

It is actually the involvement of men that achieves result. Workers, managers, the government, and the people at large, are all 'partners in progress' in a PSE. Participative management involves a manager consult-ing his employees and letting them actively participate in the decision-making process leading to greater in-dividual satisfaction on the part of the employees and greater goal achievement for the manager and the or-ganisation. Only a committed management can under-take this task efficiently.

The thinking however, has not yet crystallised along with the boundary relationship of management and workers in the matters of participative management, for the advocates and opponents of this concept are to be found both among management personnel and the workers' representatives' (Chouksey, 1978). The call for workers' participation is viewed sometimes by Unions as a veiled threat to their authority as most have in-herited the British philosophy of perpetual conflict in trade unionism, where the management and union are always in opposition. The aim should be to make this conflict productive, 'as the music of violin that also one gets by friction' (Sapre, 1983). There is as such doubt in many about what exactly this participative management stands for, democratisation of decision making, losing the management control over the workers, or asking the workers to voluntarily exert more.

## Productivity Perspective

Productivity does not necessarily mean working har-der. If productivity were measured by the total human energy expended during the work-day, then the construc-tion of ancient Egyptian Pyramids would represent the peak period of productivity (Oswald, 1981). The term productivity in its simplest form is the ratio of output to input. But this apparently simple ratio is not so unassum-ing as it appears at the first glance. It conveys much more meaning to the initiated than what ordinarily meets the eye; the complete state of the health of an organisation gets summarily depicted in this quantification.

In the true sense of the term, the idea of productivity is rather a value concept than a mere physical one. The European Productivity Agency notes that: Productivity is (rather) an attitude of mind. It is a mentality of progress and constant improvement. It is certainty of being able to do better today, than yesterday and continuously. It is the constant adaptation of economic and social life to changing conditions; it is the continual effort to apply new techniques and new methods; it is the faith in human progress.

The objective of the derivative Quality of Work Life (QWL) seeks to develop among all members of an or-ganisation an awareness and understanding of the con-cerns, and needs of others, and a willingness to be more responsive to them. Finally, it is improving the way things get done to assure the long term effectiveness and success of an organisation. The cause of produc-tivity in public enterprises can thus be best served through a continuous influence of the pursuit for moder-nisation and innovation, participation and awareness, technology and an effective management of change, all put together.
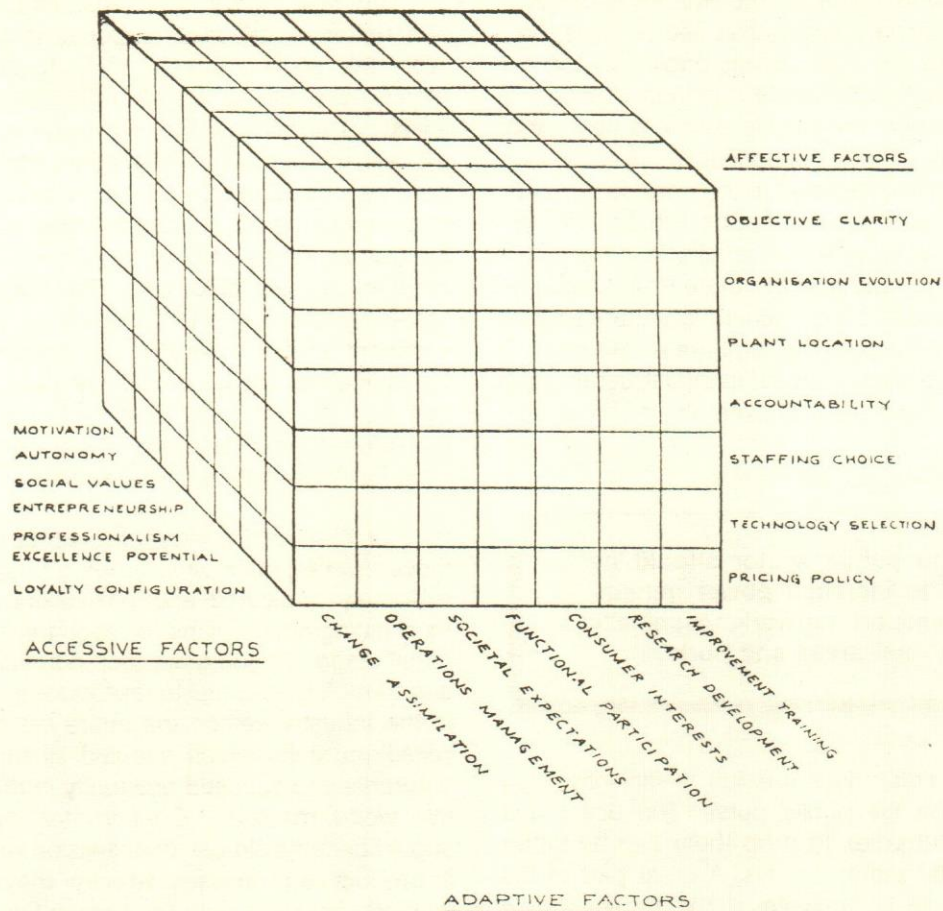
**Fig. 2.** Productivity Eco-system of Public Sector Enterprises

Productivity eco-system of public sector enterprises has been taken to be a modal envelope on three dimensions of affective, accessive and adaptive factors as in Fig. 2. Each dimension has been sub-divided into seven slots in the cubic matrix. Thus, each building block enables appraising the inter-play of other significant factors with the selected one, as the analyser prioritises the set. Affective factors are those which appear on the system as given, accessives are acquired by the system over time, and adaptive factors are interactive reciprocative factors, acting between the organisation and the system, to which the organisation has to adapt itself. In a live business situation, all these factors are inherently dynamic and are qualified by the fourth dimension of time.

Through such a systemic view, an apparently soft and shapeless phenomenon can be quadratically captured and related in terms of organisational modal elements, but varying the weights on each of which, the whole system-thrust can be steered in a desired direction by the manager of the situation. Indeed, such a study of the eco-system permits the appraisal of the whole productivity scenario, or a part thereof, at any sequence, at will, and at any direction in the three dimensions, at of course a specified time domain.

**Challenges Ahead**

A decade back, World Bank Annual Reports (The Times of India, 1985), observed that growth in India remained constrained by shortages in the infra-structure sector and an urgent need existed for capacity expansion and better utilisation of existing capacity in power generation, coal mining, rail transport and irrigation. This need exists even now, with equal intensity if not more. In essence, the time is yet not ripe that the role of the public sector enterprises can be slighted to the advantage of the general economy and growth targets.

The Planning Commission has estimated a total outlay of Rs. 20 billion for the Ninth plan, out of which the public sector will account for a staggering sum of Rs. 8 billion at 1996-97 prices (Economic Times, 8 Nov. 1996). The Commission has assumed a 7 per cent annual rate of growth in GDP; increase in public sector saving from 1.6 per cent to 2.5 per cent during the Ninth plan; and state plans to account for 45 per cent of the projected

outlay of Rs. 8 billion. It further projects an increase in the ratio between private and public sector investment to 60:40. Outlining the role of the public sector, the Commission states that it should continue to invest in the social sector where the private sector is hesitant to come forward. It is squarely sceptical of private investment coming up in any big way in the core sector even during the Ninth plan. Going by the Eighth Plan experience, the Commission holds that efforts in the public sector both at the Central and the State level should be stepped up to increase power generation and transport network, especially roads in the rural areas and ports. It suggests a massive step-up again in infrastructure both in the Central and State plans as were the priorities also a decade back.

> **Efforts in the public sector should be stepped up to increase power generation and transport network, especially roads in the rural areas and ports.**

Where public enterprises are run inefficiently, they become a drain on the public purse. The direct and indirect mark-up subsidies to prop them can be better routed to the social sector outlays. A great part of the fiscal deficit in India is because of the perennial low returns by assigning notional return values to social benefits, to locational disadvantages, and to the like, or otherwise. However, the debates notwithstanding, in the Ninth Plan, the States have been suggested to mobilise resources from their revenue earning operations. The Central Sector has been asked to operate on commercial lines and generate maximum internal resources.

At this point, we ought to recall the relevant aspects in the launching of the new economic policy in July 1991, with the initiation of the policies of economic liberalisation, marked by increased global competition and privatisation. Exclusive areas for operation of Public Sector were reduced from seventeen to eight. Many, which had a protected status so long, were destined to meet the new challenges and competition. In essence, although the expectations from the Public Sector remained on similar lines, they became more stringent. The inefficient and the sick would warrant referral to BIFR, the non-viables may face closure. However, by virtue of their large scale and investments made therein, the Public Sector would continue to occupy a major role in the economy. It underscores the efforts towards generating a fair and reasonable return on investments (RoI) in these organisations all the more important.

The new policy, inter alia, emphasised efficiency and better utilisation of capacity in the Public Sector. With the scaling down of budgetary support, emphasis was placed on self-reliance and generation of investible surpluses. Plainly speaking, the Public Sector was compelled to transform itself thence to conduct its sustenance and survival on a purely commercial basis. As against this, a later study, (The Economic Times, 1994) on some 212 public sector companies estimated that the combined net profit made by them during 1992-93 on an aggregate investment of Rs. 1,45,867 Cr. amounted to Rs. 3396 Cr. indicating an RoI of 2.3 per cent. This despite the fact that the marginal cost of funds to PSUs during the referred year had been 8 per cent vis-a-vis 17 per cent for the private sector industry.

For the newly industrialised countries, including those on the pacific rim, it took a couple of decades of extremely dedicated and painstaking work, based on hard hitting action-plans to reach their present development stage. To integrate our country with the global economy, it is essential to reproduce in our economy and in the industry sector, the entire set of conditions and paradigm shifts which enabled all top-notch industrial enterprises to succeed eminently in the highly competitive world markets. "Concern for higher productivity should become almost an obsession with those engaged in productive processes, whether they are managers or workers, because only by augmenting productivity can we enlarge the surplus available for investment. This is an obligation which the employed owe to those who are yet to be employed. The employed should not become an instrument for exploitation of the unemployed" (Indira Gandhi, 1971, cited in Nigam, 1984).

Technology is undergoing a sea change. The existing gaps with the competitors ought not be allowed to widen. Successfuls should surpass and strive for earning the competitive edge. There remains no short-cut to excellence and no substitute for hard work.

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Feature

# Organisational Adaptability & Firm Typology

Thiruvenkatam Ravichandran & K.B. Akhilesh

*This paper identifies 'adaptability' as the ability of an organisation to understand, interpret and accommodate changes, demanded both by the external environment and the internal dynamics. A new perspective identifying sensitivity and learning as the constituents of adaptability, is analyzed at the levels of the organisational subsystems — technology, structure, process and people. The study is supported through an empirical investigation of 27 manufacturing organisations. The study demonstrates the need for Indian firms to learn and be sensitive to the environmental changes and design management practices based on native culture.*

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Organisational studies on adaptation thus far focused much on organisational strategies (e.g., Miles & Snow, 1978; Mintzberg, 1979) and behavioural attributes (Miller & Friesen, 1980) that aid in adapting. A number of investigations were also carried out about the environment's influence and its nature, related to the organisation (Hrebiniak & Joyce, 1985; Astley & Van De Ven, 1983). Hrebiniak and Joyce's study (1985), revealed the importance of an organisation's strategic choice and its environment's determinism for adaptation and concluded by defining organisational adaptation as the interdependence and interaction between strategic choice and environmental determinism. Earlier organisational theories also provided prescriptions for an organisation to adapt in different environmental conditions {contingency theorists (e.g., Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Thompson, 1967); Zucker, 1983) 'mimetic isomorphism' (Dimaggio & Powell, 1983) etc.

Adaptation theorists also rely on rational calculation and the capability of the organisational actors; most suggest that relatively pliable organisations commonly respond to the threats and opportunities created by environmental changes by altering the organisational strategies and structures in ways that enhance performance and prosperity for survival (Thompson, 1967; Chandler, 1962; Pfeffer & Salancik, 1978). Though a lot of research has proliferated on this phenomenon, the ability of the organisation to adapt has been totally neglected by researchers in India. Further, the researchers have not worked with care on the indicators of adaptability. Therefore, the attempt here is towards conceptualizing and measuring organisational adaptability. However, this study does not attempt to investigate the influence of the external environment on organisational adaptability. This lacuna is suggested for further research.

## Organisational Adaptability

Organisational adaptability is the ability of an or-

ganisation to cope with unforeseen changes in the environment in which the organisation operates. Implied is the capacity to foresee/predict changes in the environment much essential for an organisation's survival, sustained performance and growth. This ability, at the process level, is reflected through the means in which an organisation renews, alters or introduce changes at different organisational forms. Thus, adaptability is an underlying ability, a potential, whose evocation or realization occurs in the form of 'an innovation/adoption' and/or 'a change' to meet the environmental needs and demands. Thus, adaptability is more a cognizant phenomenon. Its oresence can be felt through its outputs, viz., innovations, adoptions and 'significant' changes. By 'significant' changes we refer to those changes that are relevant and leave an impact on the functioning of the system. Adaptation leads to change, but not all changes are successful adaptations. Innovations are most often, if not always, the indicators of adaptive changes. Innovation as an indicator of change is a concrete manifestation of adaptability. However, change can disrupt the existing routines and lower the existing performance and alter the organisational mission. Thus, although change may be beneficial in the long run, it will be hazardcus in the short run and as a result organisations may fail precisely as a result of their attempts to survive (Hannan & Freeman, 1984).

> **Adaptability is an underlying ability, a potential, whose evocation or realization occurs in the form of 'an innovation/adoption' and/or 'a change' to meet the environmental needs and demands.**

An adaptive organisation is receptive and possesses the ability to analyze, understand and accommodate the changes. It also possesses the flexibility and capacity to organize itself to accommodate the changes. According to Cohen and Levinthal (1990), absorptive capacity is the ability of the firm to recognize the value of new, external information, assimilate it and apply it to commercial ends. Adaptability not only refers to the ability to sense or acquire information but the ability to exploit the strategic value of the information. As pointed out by Knight (1967), the organisation's recognition of the problem is determined partly by its ability (or inability) to obtain the goals it has set.

The environment often compels an organisation to change itself in ways that suit new developments (Miller & Friesen, 1980). Anticipation followed by accommodation testifies to the adoptive capacity of the organisation. Organisations adapt either in ways arrived at through decisions taken internally, or through ways determined by environmental imperatives (Hrebiniak & Joyce, 1985). But capacity to understand and interpret the environment and bring about changes in one's own cognitive and social structures in such a way as to accommodate the new understanding and interpretation. The organisation tries to improve its chances of survival through adaptive changes, just as its biological analog—an organism—survives through adapting itself to changes in the environment.

Thus, adaptability could be seen from two perspectives. One, through the organisation's ability, that is, through its indicators or constituents. And two, through the outputs—the outputs being innovations and/or adoptions and/or changes.

## Constituents of Adaptability

Adaptability is essentially an amalgam of "sensitivity" and "learning"

### Sensitivity

Aguilar, (1967) states "innovative ideas often stem from a sensitivity to the environment". Organisational studies identify it as 'scanning', i.e., a search for opportunities or information (Miller & Friesen, 1980; Aguilar, 1967). But more scanning will not help the organisation to adapt to a volatile environment. Organisations should search, anticipate problems (Mirvis & Berg, 1977) and formulate strategic responses to adapt to environmental change (Singh, et al., 1986). To be adaptive, members in the organisation have to be "sensitive", that is alert and receptive to even the subtlest changes in the environment.

Not to be confused with any kind of mystic ability to foresee or predict, sensitivity does however have to do with 'educated intuition or trained hunch' that enables one to interpret the signs of the times, the "tendencies" of the present, and the possible pattern of future developments in the environment.

### Learning

Learning capabilities involves the development of the capacity to assimilate existing knowledge (Cohen & Levinthal, 1990). In studying organisational learning some organisational theorists (Cyert & March, 1963; Carter, 1971; March & Olsen, 1975; Argyris & Schon, 1978; March, 1981) provided an adaptive view of organisational change. Shrivastava (1983) provided a typology of learning from a behavioural view, Malerba (1992) an economic perspective. Learning takes place

when organisations interact with their environments and increase their understanding of reality by observing the results of their acts (Hedberg, 1981). Hence, organisations learn while change occurs and learning causes further changes. March (1981), sees action as an extension of past learning. Adaptability is both facilitated by and leads to learning. According to Mirvis and Berg (1977) the organisation is a learning system where the constituents and the constitute both acquire knowledge and information, and experiment with new forms of behaviour and structure. Thus an adaptive organisation is one which adapts through continuous learning and improves its learning capabilities consistently to respond to the environment by unlearning the old routines and by inventing or adopting new alternatives.

Learning, therefore is one of the primary aspects of the organisation's adaptive nature. Thus learning could be defined as the faculty that enables an organisation to derive significant knowledge from its environment, experience and history to facilitate change.

> **Learning is one of the primary aspects of the organisation's adaptive nature. The faculty to derive significant knowledge from environment, experience and history to facilitate change.**

### Measuring adaptability

Organisational adaptability can be measured both qualitatively and quantitatively. The qualitative measure includes a questionnaire, based on the constituents, which would evoke attitudinal/perceptual responses from the organisational members.

Damanpour and Evan (1984) considered innovations as responses to enviromental changes or the means of bringing about change in an organisation. Innovations are adopted to improve performance or eliminate performance gaps caused by external environmental changes. The quantitative measure hence, should include the history/records of innovations and adoptions introduced/created as a means of adaptive behaviour. Further, if a change has been effected then the time lag between sensing the need for change and introducing the change will be a relevant indicator of the organisation's adaptability. However, a longitudinal approach is suitable, with a history of information and interviews digressing back with different functional heads. This kind of a study appeared difficult, if not impossible, due to the lack of authenticity and the sloppy maintenance of the records in the organisation and the reluctance of the executives. Therefore, the present study was conducted using a questionnaire evoking attitudinal/perceptual responses and discussions.

## Methodology

The questionnaire for studying the perceptual responses of organisational adaptability consisted of four sections viz., technology, structure, process and people — the four subsystems of an organisation (Leavitt, 1964). Adaptability is measured through its second order constituents viz., sensitivity and learning, under each of the subsystems, resulting in eight variables which are technological sensitivity, technological learning, structural sensitivity, structural learning, process sensitivity, process learning, people sensitivity and people learning. These eight variables provide the basis for measuring Organisational adaptability. The questionnaire consisted of 16 item measuring the 8 variables framed on a five-point scale.

The questionnaire was developed, based on interviews with a group of executives and researchers. It was reviewed and pilot tested in about ten companies for contextual clarity, relevance and coverage of items. The face validated questionnaire was then used for further test.

The sample for the present study was selected from the Center for Monitoring Indian Economy reports (CMIE, May & Nov., 1991). CMIE reports cover 1,593 industrial and 256 non-industrial companies of which 1,595 are in the private/co-operative sector. Five industries, out of the listed 33 types of industries, were chosen based on their operating environment. The list included machine building, pharmaceuticals, computers, electronics and accessories, auto components and ancillaries. While the machine building, pharmaceuticals and auto components were assumed to operate in a relatively benign environment, the computers and electronics industries were assumed to operate in a dynamic environment.

Firms from each industry were selected on the basis of their corporate/financial data availability during the period 1981–1990-91 (data for the year 1990-91 were collected from the firms' annual reports). The time period was chosen based on the consideration that a 10 year period would be sufficient to evaluate a firm's adaptability and to reduce the effects of exceptional performance if any, during a particular period. The sample thus contained the variability in terms of size, technology, product mix, etc.

Fifty firms were contacted through letters for securing the permission to conduct the study. Twenty seven firms belonging to some of these five types of industries located in the major metropolis of South India responded positively. The data for the study was obtained, through questionnaires, interviews/discussions from key executives, such as Vice President(s) or Senior managers who could give a holistic view about their firms. To check data reliability, 'multi-source' (more than one contact person) was sought. That is, the number of persons involved for the study from a firm varied between 4 and 6. To counter individual differences in perceptions the responses were averaged to produce the organisation's score (Khandwalla, 1985).

## Results

Table 1 shows the results of cluster analysis using Ward's (1963) sub-optimization algorithm. As seen from the table, three groups of firms were extracted and the extractions were found to be similar when single-linkage and unweighed algorithm were used. Cluster I consists of 12 firms, cluster II nine and cluster III six firms. Each group exhibited unique characteristics – Cluster I was found to possess defensive managerial strategies, while cluster II exhibited continuance strategies and cluster III, proactive managerial capabilities.

Based upon the cluster mean scores, the clusters were classified as high, moderate and low adaptive groups. Cluster I, with a mean score of 37 was less adaptive, cluster II (mean score 44) was moderately adaptive and cluster III (mean score of 59) highly adaptive. Each group was given a distinctive name evoking principle characteristics. Thus the less adaptive group was named 'Survivors', the moderately adaptive group as 'Reactors' and the highly adaptive group as 'Creators'.

Table 1 shows the mean and standard deviation of adaptability for the three types of firms.

**Table 1:** The Mean Scores and S.D's of the Clusters

| Construct | Clusters | | | | | |
|---|---|---|---|---|---|---|
| | Survivors | | Reactors | | Creators | |
| | (N = 12) | | (N = 9) | | (N = 6) | |
| | M | S.D | M | S.D | M | S.D |
| Adaptability | 37 | 5 | 44 | 4 | 59 | 3 |

One-way analysis of variance was conducted on these groups to establish whether the groups of firms are significantly different from one another in adaptability. The results indicate that the three types of firms differ significantly (F: 40.35; $p < 0.001$).

## Discussion

One of the characteristics of the adaptive firms is being receptive and possessing the ability to analyse, understand and accommodate changes as a response to the environmental demands. The differential number of firm as appearing in the category indicates that the Survivors or the less adaptive firms (N = 12) are twice the number of highly adaptive firms or Creators (N = 6) and the moderately adaptive firms or Reactors (N = 9) are one and a half times the number of the Creators. Though, limitations exist in generalizing the findings, the available evidence is suggestive of the predominance of less adaptive firms in the environment. The Creators exhibit high adaptability in all the four organisational subsystems followed by Reactors and the Survivors.

### Technology

The Creators are highly adaptive in the technological subsystem of the organisation. All the six Creators have collaborations with MNC's which are world leaders in their market such as Reiter and Zellweger Uster of Switzerland, Bosch of Germany, Nippon of Japan. Thus, the Creators are truly adaptive and not innovative, they are the pioneers however, in introducing the products in the country. In a perspective of innovation theory, the Creators are innovative because they introduced products which are new to their operating environment, if not to the World. The Creators place a strong emphasis on the production and marketing of established true products which suggests that they are not risk-ready, if not risk-aversive. However, firms of such pioneering types require marketing innovations to create an environment for themselves.

Organisational sensitivity and learning of the Creators is evident their adoption of new technologies, products and processes. They possess a sound technological system utilizing advanced and sophisticated controls. However, the due to their collaborations they did not engage in R&D activities resulting in the creation of new products and processes. The average R&D intensity of these firms was only 1.47 per cent. Their major concern was to enhance competitiveness, sharpen customer focus and accelerate profit operations. Technology absorption and identification of areas for improvement of products and processes that suit Indian conditions were the other concerns.

The Reactors exhibited less sensitivity and learning relative to the Creators. Most of the Reactors did not monitor the environment for changes and developments in product, process, technology. The Reactors were less risk-ready or probably risk-aversive, because they just imitated the success of the Creators. The Reactors,

though not innovative, were quite successful in gaining a niche in the market by focusing on the immediate environment, that is, identifying a few geographical locations, concentrating around them, and employing cost leadership strategy.

The Survivors are insensitive to the external technological developments. Eventually, they operate with obsolete technological system without acquiring sufficient knowledge concerning developments in the products, processes and technology. However, they sustain their growth through the systematic pattern of delivering goods to their clients. They have an unstandardized pattern of production to cater to the variegated needs of their clients. Thus, the technological subsystem of the Survivors is flexible. Now the underlying question is, are the clients of the Survivors also less adaptive as they do not demand new patterns of output.

### Structure and process

Organisational adaptability essentially involves the enhancement of the long term strategic capabilities of organisations. The objective is to foster creativity, entrepreneurship and autonomy, which are the essential building elements supporting proactive and flexible competitive strategies. The objective is also to move beyond knowledge accumulation towards knowledge creation (Pucik, 1993).

The Creators exhibit the attributes of learning, creativity, entrepreneurship and autonomy. These qualities are reflected through organisational processes such as quality circles, product development committee, suggestion system and implementation of the generated ideas. However, they are less effective due to formal authority where power is concentrated in the hands of a few functional heads. Since it is the managerial responsibility to create a climate (of course, a perceptual phenomenon and therefore, responses vary within the organisation) conducive for creativity, taking responsibilities and personal risks in initiating change, the organisational members were skeptical of being spared for their failures.

Most of the Reactors and almost all the Survivors had no policies to nurture a climate fostering learning, creativity and innovation. Interviews revealed that the owners/managers of the Survivors did not recognize the need for a formal system that nurtures learning and generation of new ideas. Two reasons underlie this attitude—one, most of the Survivors, and some of the Reactors, predominantly operate in low-tech areas and two, they are engaged mostly in customized business. Further, these firms are smaller in size (manpower) and as a consequence, did not experiment with new management concepts and theories. The Creators, predominantly large size firms, requiring managerial/administrative innovations to cope with growing uncertainties, operating with large structure, did not go beyond quality circles, suggestion system, rewards and incentives. They were aware of the changes/developments concerning organisational structure and process and acquired knowledge about them. However, they did not experiment with new working methods, concepts and theories to effect changes in the system. Majority of the Reactors and Survivors were unaware of these new developments and changes.

Organisations to be adaptive should focus on the quality of interactions among the organisational members and subunits. However, this quality was not apparent in the firms of Survivors and most of the Reactors. Though lateral communication/cross-functional interaction is prevalent among Creators, the interactions were too programmed, formal and routine, which does not nurture innovations. Creators did not have a formal task force constituting cross-functional members for identifying/solving problems, but had a product development committee which constituted managers from different functions. The committee met only when a need was identified/emerged.

Adaptation (sensitivity and learning) and innovation require loose organic properties, while efficiency and profitability require tight mechanistic qualities. However, the firms investigated here have the structure and properties exhibiting rigidity, that is to say, exhibiting mechanistic properties throughout, from conceptualization through development to commercialization.

### People

The human factor is a vital resource of any organisation due to its contribution in different forms such as work, skills, creativity. The Creators were found to be nurturing learning through vocational training, continuing education and other OD intervention programs. This equipped the members to perform a given job more effectively (Nelson & Phelps, 1966). The Creators were also found to be investing a sizable capital in training and development programs than the Reactors and Survivors. Five out of the nine Reactors and six out of the 12 Survivors were not involved in training and development. No clear data was available to identify the training intensity. (Training intensity is defined as the percentage of money invested in manpower training over the total sales of the organisation).

The members of the Creators were well informed about new developments in their work and related areas. In contrast, the Survivors were indifferent to new

developments concerning technology, product, process and management practices. Probably, the need was not recognized by them as they operate in low-tech areas and engage in customized business which does not demand creative solutions.

The Creators were learning through environmental scanning/industry spillovers. They were adaptive through continuous search, exploitation and creation of opportunities. This characteristic is augmented through tridimensional scanning, that is, depth, breadth and width wise scanning. Depth wise, the Creators investigated many more variables concerned not only with technological developments, products, processes but also new concepts, principles and theories concerning organisational structure and process. Breadthwise, they utilized multiple channels such as R&D/engineering personnel, sales and marketing personnel, MR agencies, trade journals, customers, reports etc., to scan the market. In width wise scanning, they scanned local/domestic markets as well as markets at both the national and global level. This indicates a firm's learning behaviour. The firms which are more sensitive to the environment learn more. A causal effect relationship can be observed between sensitivity and learning. Higher the sensitivity more the learning (Kotler et al. 1985). The amount of learning is a consequence of the firm's ability to anticipate, search, exploit opportunities and accommodate changes. Increases in learning imply improvements in the accuracy of predictions. That is, sensitivity causes learning and learning further nurtures the ability to being sensitive.

In Survivor firms, which were predominantly of small size where growth was limited and productivity was rewarded, the motivation and commitment were more materialistic and individualistic. Hence, the potentials of the firm members were left untapped. Recognition is a powerful incentive which was ignored by most of the firms. The reward system existent in the Creator was quite perfunctory, as employees were not motivated intrinsically to offer suggestions/creative solutions. Once an incentive is given, it conditions the mind of the worker to constantly think in money terms (Dutta, 1995). To illustrate, Maruti Udyog Limited faced a problem when it introduced Zen into the production line. Earlier, the company was giving incentive based upon the production of the old line. With the introduction of the new line, the workers wanted to get a combined incentive based on the output of both the lines.

The Western culture does not place a high priority on the values and idiosyncrasies of the individuals. It advocates and places premium on monetary incentives. Contrastingly, the Eastern culture esteems the core values of the individuals, thus focusing on the in-trinsic motivating principles. However, both the cultures, are not exclusive of the influence of monetary incentives as well as individual values. In the Indian setting, mostly the Western methods and concepts, and to an extent the Eastern management theories, are best understood by our management personnel thus overlooking the native cultural aspects. Indian firms should subscribe to geocentric management instead of polycentric management to design effective, efficient management practices. The task for the practitioners, researchers and theorists is to recognize and incorporate our own ethos, individual values, beliefs, shared opinions and philosophies in the management processes and practices.

> **The task is to recognize and incorporate our own ethos, individual values, beliefs, shared opinions and philosophies in the management processes and practices.**

## Conclusion

Innovation, both technological and managerial, appears to be one best solution to meet the demands of the environment. However, the short term prescription for Creators is to create marketing innovations. Organizations could also experiment with the organic type of structure during learning and creation and practise mechanistic structural properties during the implementation phase, recognizing the fact that learning and innovation should be a continuing activity. The dominant coalitions of the industry should attempt to design effective intrinsic reward systems based on Indian values and ethos. While it is important for all the three types of firms to experiment with geocentric managerial practices, the Reactors and Survivors should engage in tridimensional scanning too.

The study thus, concludes that the constituents sensitivity and learning are the necessary ingredients of adaptability, firms lacking or possessing a low degree of these constituents are critical.

In-depth investigations are required to identify the adaptive strategies and management practices of the firms collaborating with MNC's. The similarities and differences between the firms collaborating with MNC's of East and West would provide better insights. Investigations can also be conducted into the practices of fully owned subsidiaries of foreign companies. Further studies should also analyze how different environments such as technological, legal, economic, political and

demographic, affect organisational performance and survival and more finely the effect of various environments on the different subsystems of the organisation.

## Acknowledgement

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# Redesigning Organisations for Flexible Technology

## Anshuman Khare

*When thinking of the factories of the future, one is compelled to think about Computer Integrated Manufacturing (CIM) systems. Will they be essential parts of the future factory? Perhaps not, as the assumptions underlying computer-integrated manufacturing are seriously flawed. Flexible technology does not address the causes of manufacturing problems and may ultimately land up institutionalizing bad practices. The author opines that it is better to address organisational issues first, and then apply flexible technology as a last resort.*

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In response to international competitive pressures, manufacturing organisations have started focusing on new techniques and technologies for improving manufacturing activities (Duimering et al., 1992). Two dominant manufacturing technologies have emerged in this scenario—one being the Just-In-Time (JIT) manufacturing system, originally developed by Toyota, which includes a range of techniques aimed at simplification and waste reduction within the manufacturing system. The other is the Computer Integrated Manufacturing (CIM) approach, which uses computer based information systems to link islands of automation, islands of information, and advanced flexible production technologies throughout the manufacturing organisational system.

### JIT & CIM: Applicability

Although these two strategies have been developed and adopted their compatibility is not well understood, managers generally assume that both approaches are advantageous for improving the productivity and competitiveness of manufacturing operations. For example, both systems are supposed to increase productivity by improving organisational integration, product quality, and manufacturing flexibility and responsiveness. As such, future factories can be expected to combine some of the characteristics of both the JIT and CIM approaches.

> **Future factories can be expected to combine some of the characteristics of both the JIT and CIM approaches.**

Empirically, however, what is known about the success of the two manufacturing approaches within industry is rather limited. JIT has been shown by Toyota and other Japanese firms to be an effective strategy for

improving productivity when implemented appropriately (Monden, 1983). CIM is largely unproven; few well documented case studies of the system are available. Most of the literature describing CIM considers the system from a purely hypothetical perspective and tends to consist mainly of predictions about its success based on the theoretical potential of CIM technology (Doll & Vonderembse, 1987; Goldhar & Jelinek, 1985). Despite the limited amount of empirical evidence, there are some indications that the JIT approach is more likely to increase productivity than the CIM system. Two separate international surveys that attempted to examine the determinants of manufacturing productivity drew similar conclusions about the relative contribution the two strategies would make toward a firm's productivity (Krafcik, 1988; Schmenner; 1988; Schmenner & Rho, 1990). Both found, for instance, that JIT type approaches aimed at reducing manufacturing throughput time and simplifying production system were systematically related to higher productivity levels, whereas investments in advanced technologies showed no such direct relationship. Another study which examined Italian manufacturing firms, found that JIT implementation was strongly correlated with an overall factory performance indicator as well as a wide range of individual manufacturing performance indicators. The implementation of a technology-driven approach, however, was found to have no systematic relationship with overall factory performance and contributed to fewer individual performance indicators (Perona et al, 1991).

Regardless of the theoretical contributions the two systems might make, it is worth noting that western manufacturers have had limited success in implementing either strategy. Often this is because managers make assumptions about the organisational context in which the systems are implemented. For example, managers often assume they can implement JIT without modifying their organisational structure (Duimering & Safayeni 1991; Safayeni et al, 1991). Similarly, with respect to CIM, incorrect assumptions about human resources have been shown to result in sub-optimal performance of advanced technological systems (Ragotte, 1990).

## Conceptual Framework

*A Common Goal—Throughput Time Reduction:* Before considering the differences between JIT and CIM, we must note one point of similarity. Both systems share the idea that reduced system throughput time is a key factor leading to improved manufacturing productivity. A major focus of JIT is on reducing production throughput time, primarily by reducing or eliminating inventory buffers throughout the manufacturing system and supply chain.

Such techniques as Kanban, leveled schedules, and quick die change allow manufacturers to operate with low inventory levels. The CIM system addresses the concept more broadly to include not only production throughput time but also administrative throughput time, such as order processing time by using computer based information technologies, which allow for instantaneous information transmission and data sharing, and flexible manufacturing technologies capable of producing in very small batches (Goldhar & Jelinek, 1985).

The theoretical relationship between throughput time and manufacturing productivity has been identified in the literature (Krafcik 1988; Schmenner 1988; Schmenner & Rho, 1990 & Wacker 1987). Wacker (1987) has shown, for instance, that when the organisation makes reduced production throughput time the over-riding goal for its manufacturing system, other goals that have often been viewed as contradictory, such as low costs, demand responsiveness, and high quality, become quite compatible (Wacker, 1987). Consequently, underlying both the JIT and CIM systems is a common and apparently valid assumption that reducing throughput times can lead to improved overall factory productivity.

> **Underlying both the JIT and CIM systems is a common and apparently valid assumption that reducing throughput times can lead to improved overall factory productivity.**

## Throughput Time Reduction in JIT System

Theoretically, inventory within a manufacturing system is a buffer that absorbs variability between interrelated manufacturing processes (Thompson, 1967; Galbraith, 1973). The inventory buffer decouples interrlated processes from one another, thereby preventing the variability of one process from having an immediate impact on another. Suppliers shipping an incorrect part, machines breaking down in production, and unexpectedly absent workers are disruptions that can be absorbed by high levels of inventory so that production operations continue. There maybe enough stock on hand to give the supplier time to send another shipment, to allow time to to repair a malfunctioning machine, or for other workers to continue production even if one worker does not show up for work.

Other sources of manufacturing variability include organisational functions, such as design engineering or

marketing. For example, product designs that incorporate a large number of non-standard components, or a marketing department that generates frequent changes in the production schedule, both constitute sources of variability that have traditionally been absorbed by high inventory levels.

Significant inventory reduction under the JIT approach decreases the time it takes for variability in one process or organisational function to have an impact on another and thereby increases the degree of interdependence between related activities. Small amounts of inventory mean that the wrong part, machine breakdowns, absent workers, non-standard design components, and sudden schedule changes will rapidly disrupt the manufacturing system.

If the organisation cannot use inventory to handle variability, it must take other courses of action to avoid these kind of disruptions. Essentially, there are two available options: The first is to reduce variability at the source; the second is to increase variability handling mechanisms at the point of impact within production. Variability reduction might include such activities as presurizing suppliers to ensure consistently correct shipments, performing preventive maintenance to reduce the likelihood of machine breakdowns, modifying the employee reward structure to discourage absenteeism, ensuring the use of standardized components in design, and leveling production schedules to filter out market fluctuations. Strategies aimed at increasing variability handling within the system include developing emergency shipping procedures to handle late supplier shipments, having backup equipment available in case of absenteeism, and increasing the flexibility of manufacturing processes to cope with high levels of component variety or unstable production schedules.

*Organisational Design and Manufacturing System Integration:* There is a direct relationship between the preceding concepts and the idea of an integrated manufacturing system. An integrated manufacturing system would be one in which interrelated organisational tasks and activities are effectively coordinated with each other. Therefore, a measure of the system's overall integration would be its manufacturing and administrative throughput times. A well integrated system would have short throughput times, and a poorly integrated system would have long throughput times.

Short throughput times depend on a coordinated effort of variability reduction and handling. Managers making this effort should not everlook the connections between manufacturing and other functional units. Functions like marketing generate a tremendous amount of variability for manufacturing, simply because

functionally designed organisations typically lead to poor communication and coordination (Mintzberg, 1979). Manufacturing thinks the variability coming from marketing is unavoidable and stocks up on inventory.

To improve coordination, activities that create high levels of variability, such as marketing, purchasing, and design engineering, must be brought into closer contact with the activities, such as manufacturing, that must cope with the impact of this variability. One approach is to change the organisational structure to group individuals according to the products they work on. Under conditions of reduced inventory or throughput time, interdependence increase among individuals working on the same products. It has been suggested by Thompson (1967) that activities with the highest degree of interdependence ought to be grouped together within the same units since they require a high degree of communication and coordination (1973). Similarly, Galbraith suggests that when there is a high degree of uncertainty among interrelated tasks, organisations should try to reduce uncertainty as well as associated information processing and coordination costs by grouping these tasks together. Klein (1991) examined the impact of increased interdependence under JIT on individual worker autonomy; and Wilkinson & Oliver (1989) examined the impact of increased interdependence under JIT on power and control within organisations.

The principle of grouping highly interdependent activities applies at various organisational levels. Manufacturing work cells represent such coordination within a product grouping at the level of individual manufacturing processes. In this case, product could mean an individual component or sub-assembly produced within a single work cell. At higher levels, the meaning of product becomes more generalized. For instance, at the factory level, it may be appropriate to group units and departments according to more broadly defined product families.

Although many companies acknowledge the work cell as an appropriate way of organising manufacturing tasks, they often have difficulty applying the same principle to other functional units. However, in the works of Duimering & Safayeni, (1991), the researchers have found that lower throughput times correlated with companies that have structured along product lines at three different levels of analysis—the shop floor level, at which functions such as production, quality control, maintenance, and material handling were grouped by product; the plant or factory level, at which functions like production control, manufacturing engineering, purchasing, and information systems were grouped by product families; and the corporate level, where each plant might operate as a focused factory with respon-

sibility for a narrow range of products. Hence, system integration is achieved in successful JIT organisations not only by redesigning interrelated processes and functional activities to reduce or handle variability, but also through the basic redesign of the organisational structure.

> **System integration is achieved in successful JIT organisations not only by redesigning interrelated processes and functional activities to reduce or handle variability, but also through the basic redesign of the organisational structure.**

The main issue in designing low throughput time manufacturing systems, therefore, is addressing the way in which variability is reduced or handled within the organisational system. Whether it is accomplished using technology, people, or any other method is not the crucial issue. Let us examine how CIM achieves organisational integration and handle system variability.

## CIM as an Integrated Manufacturing Strategy

The CIM approach to maufacturing system integration is quite different from the JIT approach. Proponents argue that CIM integrates the organisation by automating the flow of information among interrelated processes and organisational functions (islands of automation) using advanced information technologies. In addition, flexible manufacturing technologies — such as robotics, automated guided vehicles, and automated storage and retrieval systems — reduce production throughput times by quickly processing a broad range of products in small batches (Doll & Vonderembse, 1987; Goldhar & Jelinek, 1985). Thus the main approach used in the CIM system for dealing with organisation variability is to increase the level of flexibility in order to handle variability at the point of impact (within manufacturing). Both integration and variability handling within the CIM system are essentially assumed to be purely technological issues rather than organisational issues. Let us examine these assumptions in detail.

### Assumptions about Integration

Underlying the concept of technological integration are several assumptions about the nature of organisations and manufacturing information that seem to be at odds with actual practice:

*Manufacturing Information can be handled by Computer Systems:* CIM assumes that most relevant organisa-

tional information can be effectively coded into a form that computers can handle. This may not be the case. Computer systems are adept at handling large amounts of simple numerical data, but little of the information used within manufacturing organisations can be coded into such a format. Manufacturing organisations rely to a large extent on soft data about such issues as future customer demand, human performance, and the expected output of a particular machine. For example, in one study, researchers compared the existing operations research and artificial intelligence (AI) approaches to modeling production scheduling with the actual approaches used by schedulers in manufacturing settings. They found that the models captured only a fraction of the reality of the scheduling task. They were too simplistic and based on unreasonable assumptions about the nature of the manufacturing environment (McKay et al, 1988).

> **Manufacturing organisations rely to a large extent on soft data about such issues as future customer demand, human performance, and the expected output of a particular machine.**

Furthermore, even when manufacturing data generated in one unit of the organisation can be coded into forms that computers can handle, often they cannot be appropriately translated into forms that are relevant to another unit's needs. Many of the difficulties traditionally encountered in the design of management information systems are related to an ability to appropriately transform information from a common database to meet the specific needs of different decision makers. Manufacturing managers commonly complain, for example that their performance is judged on the basis of irrelevant accounting data. Thus, simply putting financial or production data on-line does not necessarily make that data relevant to all decision making situations within the organisation.

*Reduced Information Transmission Time implies reduced Throughput Times:* As information technologies are supposed to reduce throughput times by increasing the speed of data transmission, it is worth considering the degree to which transmission time contributes to the throughput times. In information terminology, the throughput time between any two processes X and Y consists of both the information transmission time and the information processing time at X and Y. When one considers that information processing for such activities as design engineering, marketing, and accounting can take weeks, months, or even years (in the case of new product development), it becomes apparent that

focusing on high-speed information transmission misses the critical bottleneck entirely. To reduce administrative throughput times, the focus of improvement must be placed on the information processing portion of the equation. To reduce processing times, the activities performed by various functions must be coordinated.

*Organisations Lack Appropriate Information Transmission Technology:* CIM implies that organisations are not integrated because they lack appropriate information transmission technology. This is clearly not the case. One need only examine manufacturing organisations to recognize the wide range of technological options for transmitting information, including fax machines, electronic mail systems, even telephones. A design engineer who wishes to obtain information about the manufacturability of a potential design has many avenues available, the most direct of which is face-to-face communication with manufacturing engineers and production people. Lack of integration is not, therefore, the result of a lack of information technology or even a lack of available information. It is rather a lack of motivation on the part of individuals to use the available options.

*Information Transmission Equals Integration:* The CIM literature assumes that information transmission equals integration, as if organisations have a basic desire to be integrated and will become integrated when the necessary information is available. That is, it assumes that functional units share a higher goal that could be achieved with the availability of the correct information.

The reality is that most large organisations behave as loosely coupled systems in which functional units often have little desire to integrated their activities with one another (Weick, 1969). Each component has its own goals, and the extent to which they overlap or correspond to overall organisational goals is at best questionable. There are four reasons for differing functional goals:

*Differing Functional Perspectives:* Members of each functional unit may have unique perspectives on their contribution to the organisation's outputs. Design engineers may feel that their main objective is the elegance of performance of a product design. But this goal could conflict with the manufacturability of the product, thus creating difficulties for the production unit.

*Survival Techniques:* Functional units are often interested above all in the well-being and survival of their units; they may pursue their own goals at the expense of organisational goals. For example, one unit may be most interested in departmental growth and may draw resources away from units with more pressing needs.

*Performance Measurement Systems:* Units attend to those aspects of their activities that are measured as performance indicators. If a purchasing department is evaluated on the basis of how inexpensively it can purchase material or how low it can keep its raw material inventory levels, it will pursue those goals even if they cause problems for production.

*Means and Ends Inversion* (Cyert & MacCrimmon, 1968): The means for achieving an organisational goal can eventually take on the characteristics of a goal in its own right to the detriment of the overall organisation. For example, in one organisation, design engineers were provided with computer aided design (CAD) systems to improve design effectiveness. The designers used the systems to incorporate complex design features that had been impossible to draw before. These features added elegance to the designs but also added significant costs to the manufacturing process. The designers had replaced the goal of creating effective designs with the new goal of using the CAD systems to their limit.

Given such goal differences, it is difficult to argue that the mere availability of information will increase organisational integration. In fact, the opposite may be more likely. An increase in information may lead to an increase in its misuse or abuse. For example, freely available information about the difficulties of maintaining product quality on a particular production line could be used against manufacturing by another department to its own political advantage. Given such possibilities, units may begin to withhold or even fabricate information.

In short, one is forced to question whether CIM can be implemented without a consideration of organisational implications. Differences in functional goals produce myriad incongruent activities, which are a major source of variability for the production system. Production and administrative throughput times can be reduced only if functional goals are aligned. The most effective means of aligning them is redesigning the organisation structure such that members of different functional groups work together more closely.

> **Production and administrative throughput times can be reduced only if functional goals are aligned.**

True organisational integration amounts to correcting the problems that have created poorly integrated, loosely coupled organisational systems in the first place. If these problems—which are organisational rather than tech-

nological – are ignored, CIM implementers run the risk of institutionalizing ineffective organisational procedures and communications linkages by automating them rather than correcting them.

### Assumptions about flexibility

The use of flexible manufacturing technology is the main CIM strategy for handling organisational variability. The following are some of the assumptions underlying the idea of CIM flexibility:

*Infinite Flexibility:* Lately, the term flexibility has been used too broadly. Much of the recent manufacturing literature would lead one to believe that new flexible technologies are capable of doing almost anything. However, compared to the average human worker, even the most flexible piece of equipment falls short in its ability to learn and adapt to new situations, perform tasks requiring a high degree of coordinated motion (including some simple tasks such as picking parts out of bins), or process complex information (such as complicated pattern recognition). Thus, one should not assume that flexible technologies are infinitely flexible. Instead, they are flexible only within a pre-defined range of possibilities, which may be somewhat wider than that of traditional hard automation but which is still very narrow.

*Flexible Technology equals Organisational Flexibility:* A flexible manufacturing system is only as flexible as its least flexible subsystem, in the same way that a chain is only as strong as its weakest link. Consequently, even though a particular robot is capable of a tremendous range of activities, most of the activities may be completely inaccessible within the constraints of the overall system because of far less flexible material handling equipment or hard tooling.

Furthermore, manufacturing process flexibility represents only part of the chain, which also includes non-manufacturing activities such as purchasing and other organisational functions. An electronics plant, for example, uses automated machines to assemble a wide variety of circuit boards. However, the assembly process is constrained by an inflexible and unresponsive purchasing bureaucracy that is incapable of keeping the equipment supplied with components. The situation forces production to make large batches whenever components are available, thus eliminating any throughput time reductions that the flexible equipment might have been able to provide.

*Flexibility handles Unpredictable Circumstances:* Most flexible manufacturing systems are being justified on the basis that they will be able to adapt to unknown future requirements. However, this assumes that future requirements remain within the range of change envisioned by the systems' designers. When demands change beyond this range, the system becomes obsolete. For example, when the personal computer industry switched from 5.25-inch diskettes to 3.5-inch diskettes, even the most flexible of systems for producing the large format diskettes and disk drives were rendered obsolete at factories around the world.

In addition, the investment required to establish flexible technologies can actually reduce the firm's long-term flexibility and innovation. For example, a manufacturing plant may have installed large-scale multi-million-dollar automated storage and retrieval system in early 1980s as at that time such systems were generally considered highly productive investments. A few years later the management may realize the importance of a JIT strategy, emphasizing on the elimination of inventory and centralized warehousing. The organisation, in such a case, would be left with several years worth of outstanding debt and a host of inventory management procedures that would conflict with the ideals that the company plans to pursue. Short-term flexibility has been brought at the cost of long-term financial and procedural rigidity.

*Flexibility is Free:* The literature available has tended to create an optimistic impression that flexibility is free and has generally ignored any possibilities of additional organisational costs associated with flexible manufacturing technologies. Instead, CIM proponents have suggested that manufacturing flexibility allows organisations to broaden their marketing horizons by competing on the basis of economies of scope rather than economies of scale and by being able to compete effectively against any manufacturing sector, including unit, mass production, or continuous process industries (Goldhar & Jelinek, 1985; Nemetz & Fry, 1988). Does CIM really offer something for nothing? What are the potential costs?

One obvious cost is the greater financial investment required to purchase flexible equipment as compared to more traditional, less flexible equipment. There is no evidence that the flexible manufacturing technologies can be installed for the price same as inflexible technologies. There is plenty of evidence to the contrary. All else being equal, a process that is optimized for a narrow range of flexibility will always require less capital investment than one that must be optimized for a broader range. The same holds true for unit production costs. Dedicated equipment that is optimized for a narrow range of process will always have a lower per unit cost than flexible equipment that is optimized for a broad range of tasks.

A less obvious but potentially enormous cost is that associated with the increased level of complexity within the organisation. Advanced production technologies require advanced technical management and support staff, just as traditional data processing and information systems have required management and support staff to operate and maintain them. The researches have generally ignored this additional overhead burden, which represents a sizable cost and organisational risk.

*Flexibility is the only Option:* Perhaps the most problematic assumption, given the conceptual framework, is that production system flexibility is the most appropriate and cost-effective strategy for dealing with variability within the organisation. The CIM approach, as defined in the researches, assumes that organisational variability is best handled at the point of impact within production through the use of flexible technology. The researches virtually make no mention of strategies aimed at reducing variability at the source. Yet variability reduction strategies could eliminate the need for costly flexibility through CIM. For example, by reducing the variety of components used in its designs, an organisation can continue to use inexpensive, simple, dedicated machine tools instead of more costly flexible ones. In an automotive parts manufacturing plant, managers dramatically simplified the plant layout, replacing an entire automated guided vehicle line with a manual handcart system. The new system was far simpler to operate and required virtually no maintenance.

Is flexible technology ever the right choice? Certainly. In many situations, the source of variability is beyond the organisation's control. For example, customers will continue to demand a certain amount to product variety. But where the organisation does have some control over source variability, managers need to decide which strategy is likely to be more cost effective. In some cases, it is indeed more cost effective, at least in the short term, to cope with variability after the fact, rather than attempting to reduce it at source. It is important to recognize, however, that both options exist. In the long term, strategies that avoid costs by addressing and eliminating problems at their source are superior to strategies that require capital investment yet succeed only in coping with ongoing problems of organisational variability.

> In the long term, strategies that avoid costs by eliminating problems at their source are superior to strategies that require capital investment yet succeed only in coping with ongoing problems of organisational variability.

This line of reasoning applies regardless of the type of variability a manufacturing organisation experiences. That is, although organisations invest in flexibility for a variety of reasons — for volume flexibility to cope with variable demand volume, for product flexibility to quickly bring new products to the market, or for process flexibility to produce different products on the same machines with minimal setup time — the logic holds true. Wherever possible, it is wise to reduce the need for investments in flexibility by reducing the source of variability, rather than simply trying to cope with variability that may be avoidable and unnecessary.

For example, a common way of reducing the need for volume flexibility is schedule leveling, whereby volatile demands are met gradually over time rather than all at once. Similarly, in cases where demand is highly seasonal, companies attempt to manage demand by offering customers reduced off-season pricing. Naturally there are limits to such strategies, and investments in volume flexibility may be appropriate for coping with market variability that cannot be reduced.

Some Japanese automakers have reduced product variability by treating many traditional options as standard features and then grouping the remaining ones into a small number of option packages. By cleverly designing these packages to address actual customer demand patterns, these automakers are able to meet the demands of all but a very proportion of customers. Such a strategy filters out variability, dramatically reduces the need for process flexibility, simplifies material planning and control activities, and eliminates costs associated with information processing and coordination.

## Designing for Integration

To reduce production and administrative throughput times, organisations must create an integrated manufacturing system, which is essentially an issue of organisational system design rather than technological system design. The following are the issues that must be addressed as organisations attempt to design truly integrated manufacturing systems, regardless of the techniques or technologies they use.

*Reducing the impact of environmental variability*

All manufacturing organisations must cope with a certain amount of variability, which is caused by the market, suppliers, competition, government regulations, and so forth. The choices an organisation makes for handling variability within these domains implications for how the organisation functions internally. Consider the

marketing environment. No single organisation can meet all possible market demands; every organisation must decide how much market variability it can handle. For example, no car manufacturer can meet all possible customer desires. The Japanese automakers mentioned earlier have reduced variability by limiting the number of choices offered to consumers.

As organisations attempt to handle more market variability, organisation integration becomes increasingly difficult. As the range of options offered to customers increases, so does the difficulty of integrating the activities of materials handling, purchasing, scheduling, design engineering, suppliers, and so on. Therefore, decisions about how much market variability to handle should be made collaboratively, with input from each of these groups, rather than unilaterally by the marketing department, as is too often the case.

The trick is effectively coping with market variability is cleverly balancing the need to satisfy the greatest number of customers while generating the least amount of internal variability for the rest of the organisation. This requires a more detailed understanding of real market variability than has often been acquired by marketing departments in the past. In the automotive example, marketing may need to know if it would lose customers by grouping automatic door locks and automatic windows in an option package, rather than offering them separately. Do most customers care about these choices? Does the benefit of offering increased choice outweighs the cost of handling the extra variability that will be generated for manufacturing, purchasing, and suppliers? These are fundamental questions that have been ignored too often in the past.

### Reducing & handling variability internally

The same logic applies internally. At every organisational level, each unit's activities may generate undesirable variability for other units. Design engineering generates variability in the form of engineering changes, the number of components used in a design, and the manufacturability of design features — all of which must be handled downstream. Similarly, machines and work units within production can create variability for other work units, in the form of breakdown delays, changes in production rate, or inconsistent product quality. Organisations must make sure that the amount of variability generated by one unit is matched by the capability of other units to handle that variability (Beer, 1981).

Although such a match can be obtained either by reducing variability at the source or by increasing variability handling at the point of impact, variability

reduction is often the preferred solution. This is because every variability handling mechanism comes at a cost and tends to generate additional undesirable variability. It is widely accepted that reducing quality variability at the source using statistical process control or similar methods is a more effective strategy than after-the-fact inspection and rework. However, with respect to variability generated elsewhere in the organisation, most manufacturers have not applied the same logic.

Thus, one basic principle in designing an integrated manufacturing system is to keep the overall level of variability within the organisation to a manageable level. The variability generated by each functional and work unit must be kept under control. The lesson of statistical process control needs to be applied throughout the manufacturing organisation, so that all forms of variability are controlled at their source.

Each unit must balance its needs with the variability it generates by meeting those needs. Manufacturing must weigh the need for more sophisticated production processes against the potential for increased breakdowns and maintenance associated with increased process complexity. Design must balance the need for enhanced product design features against the impact design changes will have on production and other functions. Organisations have to limit the frequency of changes per year (or so) in order to reduce logistical confusion, as done by the Japanese car manufacturers.

### Appropriate organisational structure

Effective variability management requires a strong degree of communication and coordination among interdependent units. Such coordination is quite difficult when interdependent units are separated organisationally. The impact of their variability on one another is not obvious, and they receive little feedback from one another. Such isolated units tend to work toward their own goals with no regard for their impact on other units. To close the feedback loop, units that have the greatest impact on one another should be grouped as close together as possible. In the context of JIT, product-based organisational structures provide better coordination than functional structures.

At the extreme, this line of reasoning suggests that it is desirable to group interdependent tasks not only within the same units but also within the same jobs. Many organisations tend to underutilize the potential of human beings for handling variability. They invest in flexible technologies and then restrict human operators to simple, narrowly defined tasks. However, as individuals typically possess the most accurate information about the variability that affects their activities, it

makes sense that they also be given the responsibility to find appropriate ways of dealing with it. This is quite apart from any intrinsic benefits that may be gained from traditional sorts of job enrichment.

*Implications for Future Factories*

In order to take best advantage of CIM and JIT techniques and technologies, it is necessary to examine these systems within the organisational context. Such an examination not only can improve the design of such systems, it may also increase the likelihood of successful implementation. CIM implies many assumptions about the capabilities of information and flexible manufacturing technology as well as the outcomes of its usage. Most of these assumptions have been unquestioned in the researches, although many of them are difficult to defend. Thus, there is enough reason to rethink the use of advanced technologies.

It is important to recognize that major changes in manufacturing systems, such as those represented by CIM and JIT, have direct implications for the overall organisational design. Thus, it may be more productive to redesign the organisational structure before implementing available technology than to hope the technology will bring about manufacturing effectiveness. In summary, JIT emphasizes variability reduction; it creates an environment in which the level of variability is inherently more manageable. On the other hand, CIM emphasizes variability handling, suggesting that manufacturers can use flexible technolgy to handle an unmanageable situation.

What is needed is an approach that begins by examining the interdependencies that exist among functional units within the overall manufacturing organisation. The sources of production system variability generated by different functions need to be identified and corrected before variability handling is addressed. Investments in flexible technologies should then be considered as a last resort and used to handle variability that cannot be reduced through more efficient means.

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# Fuzzy Reasoning in Managerial Decision Making — An Overview

Kampan Mukherjee & Chinmaya Kar

*The conceptualization of fuzzy reasoning and fuzzy logic is meant for incorporation of the vague/imprecise perception and the judgement of decision makers. This paper is a brief account of possible fuzzy modelling and its application particularly in the field of management. It elaborates on the appropriate use of fuzzy reasoning in handling imprecise decision situations with the help of few models.*

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Decision-making is the most important and complex function in management, where the human factor enters with all its vagueness of perception, of subjectivity, of attitudes, of goals and conceptions. The subjective and personal viewpoint plays a vital role in solving management problems. It has been experienced that the models, used by a decision-maker while solving a problem do not often fit the real environment. As Einstein, stated, "so far as the laws of mathematics refer to reality, they are not certain. And so far as they are certain, they do not refer to reality" (Kosko, 1994).

The solution to any problem is often based on certain assumptions. Any change in the assumptions changes the solutions completely, which is why no problem can be assumed as perfectly deterministic or certain. As Schwartz, opines, "an argument which is only convincing if it is precise loses all its force if the assumptions on which it is based are slightly changed, while an argument, which is convincing but imprecise may well be stable under small perturbations of its underlying axioms" (Zimmerman, 1984). Hence a problem with its all reality represents a vague and uncertain situation. Fuzziness is characterized by this imprecision or in other words the imprecise knowledge about the situation.

> **The solution to any problem is often based on certain assumptions. Any change in the assumptions changes the solutions completely, which is why no problem can be assumed as perfectly deterministic or certain.**

## Fuzzy Reasoning

Precise reasoning is based on binary logic i.e., the membership function is 1 for a true statement and 0 for

a false statement. There is a sharp boundary between membership and nonmembership. But according to Zadeh, the father of the theory of Fuzzy Subsets, "it is a truism that human reasoning is approximate rather than precise in nature" (Kosko, 1994). And the fuzzy reasoning totally represents this imprecise human reasoning.
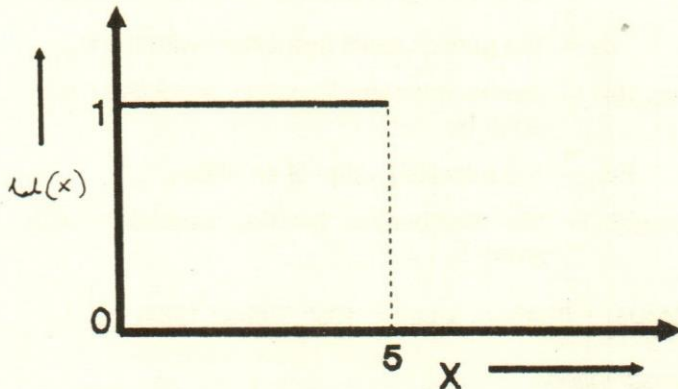


**Fig. 1.** Membership Function

For example, for the statement, 'X < 5', the membership function is 1 if the statement is true and 0 if the statement is false (fig. 1). But the statement 'X is approximately equal to 5' (expressed as $X \cong 5$) is fuzzy in nature due to the linguistic variable 'approximately'. Here the latter statement may be characterized as subjective evaluations of X which is essentially influenced by the perceptions of the evaluator. The transition between membership to nonmembership is a continuous one. Such a reasoning is called fuzzy reasoning and is shown in fig. 2.
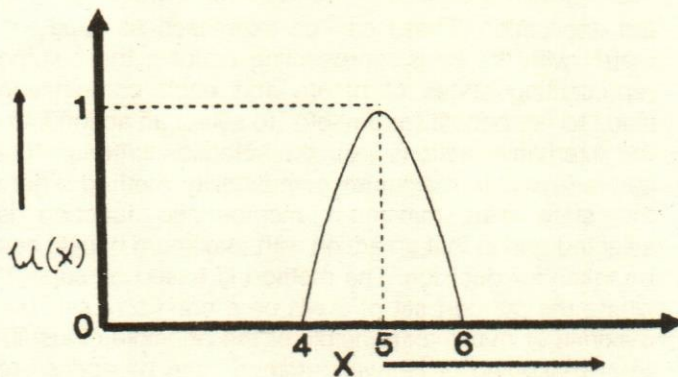


**Fig. 2.** Fuzzy Reasoning

### Theory of Fuzzy Subset

Generally, the fuzzy subset A is presented as an ordered pair $\{x, u_A(x)\}$, where x is an element of a referential set and $u_A(x)$ is the membership function of x in a subset A and $u_A(x) \rightarrow [0,1]$.

In a fuzzy environment, the decision is viewed as the intersection of the fuzzy constraints and fuzzy goal. As shown in fig. 3, the decision, itself is fuzzy in nature and the point where the membership function is highest, is taken into consideration.
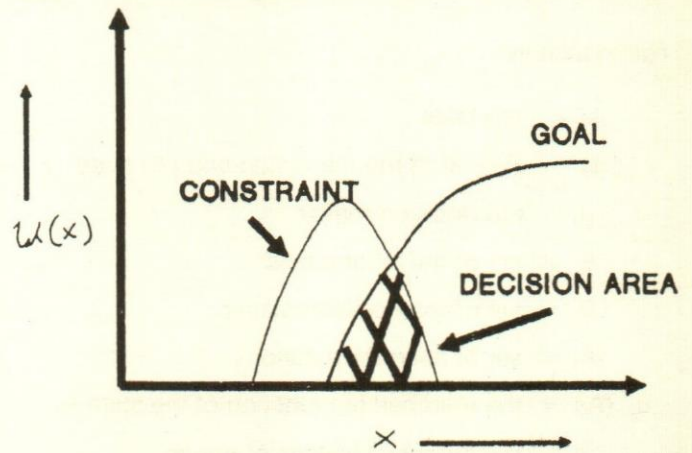


**Fig. 3.** Fuzzy decision

The following are the different principles (Zebda, 1984) in fuzzy theory:

- Extension Principle 1: If the elements of two sets are mapped by a function, then the fuzzy subset of one set has a fuzzy image in the other set.

- Extension Principle 2: If the elements of a cartesian product of two sets have a mapping with the elements of a third set, then the fuzzy subsets of the first two subsets have a fuzzy image in the third set.

*Operation of fuzzification:* It transforms a fuzzy (or non-fuzzy) set A into an approximating set Ã which is more fuzzy than A. Thus the operation of fuzzification can be used as a way of handling situations in which the elements in the initial set X are fuzzy sets of another set. For example, if A is a fuzzy set of another set, say Y, then A can be expressed as a fuzzy set of Y as follows:

> **The operation of fuzzification can be used as a way of handling situations in which the elements in the initial set are fuzzy sets of another set.**

$$A = \{u_A(y)/y\},$$

where $\quad u_A(y) = \max_{y \in f^{-1}(A)} [u_A(x) * u_x(y)]$

$u_A(x)$ is the membership function of A and is the membership function of X.

## Models Used in Fuzzy Reasoning

*Nomenclature*

$s_i$ = i-th state

$B_{ij}$ = Pay-off of the i-th action and j-th state

$d_i$ = i-th decision-maker

$S_t$ = set of the input states

$D_t$ = set of the decision-maker

$A_t$ = set of alternative actions

$u_{s_i}(A_t)$ = the membership function of the state $s_i$

$n$ = the number of states of nature

$m$ = the number of alternative actions (decisions)

$p(s_i)$ = the probability measure of state i

$b_L$ = net benefit

$D_o$ = a fuzzy optimal decision set

$u_{Do}(d_j)$ = a measure of the relative merit of the decision $d_j$

$u_{B_{ij}}$ = the membership function associated with net benefit $b_L$

$B_j$ = a fuzzy set of fuzzy net benefit (of the j-th state)

$u_{B_j}(B_{ij})$ = the membership function of the benefit $B_{ij}$

$B_{jL}$ = a fuzzy set of non-fuzzy benefits

$u_{B_{jL}}$ = the membership function of the net fuzzy benefit $b_L$

$X$ = a set of all possible net benefit values

$B_{jM}$ = maximizing set for decision $d_j$ $D_t$

$b_{max}$ = maximum net benefit values

$Y$ = an integer chosen depending upon the application

$u_{B_{jM}}$ = the degree to which $b_L$ approximates the maximum possible net benefit ($b_{max}$)

$S_{t+1}$ = the set of output states

$Q_{ijk}$ = a set of fuzzy probabilities that the output state is $s_k \in S_{t+1}$ with the input state $s_i \in$ and decision $d_j \in D_t$

$q_k$ = the possible probabilities vary in [0,1] interval

$u_{Q_{ijk}}(q_k)$ = compatibility function associated with every $q_k$

$B_{ijk}$ = fuzzy net benefit with input $s_i \in S_t$, output $s_k \in S_{t+1}$ and decision $d_j \in D_t$

$b_k$ = the generic point associated with the $B_{ijk}$

$u_{B_{ijk}}(b_k)$ = the membership function associated with each $b_k$

$EB_{ij}$ = the expected value of an action

$u_{EB_{ij}}(b_L)$ = the membership function associated with every $b_L$

### Model 1 (Rathore & Latha, 1990; Zebda 1984)

*Assumptions*

1. Decisions (Actions) are deterministic

2. States of nature ($S_t$) are fuzzy, and

3. Pay-offs ($B_{ij}$) is deterministic.

*Computation*

Associated with each decision $d_j \in D_t$ input $s_i \in S_t$, there is an output state. And corresponding to each output state, there is a return function i.e., benefit $B_{ij}$. Every state $s_i \in S_t$ can be described by a fuzzy set $s_i = \{u_{s_i}(X_t)/X_t\}$ where $X_t$ is the attribute depending upon the application. These can be expressed as a pay-off matrix with the rows representing actions, the column representing states of nature and each combination leads to net benefit (or pay-off). To select an action from the alternative actions ($A_t$), the selection criterion that can be used is maximum compatibility method where the state with maximum membership function is selected and in that an action with maximum benefit can be taken for decision. The method is based on support where the support set of S will be a non-fuzzy set. The maximin or maximax principle or the principle of insufficient reasoning or Hurwicz method can be applied to solve the problem. The expected value criterion may also be applicable for the purpose.

### Model 2 (Rathore & Latha, 1990; Zebda, 1984)

*Assumptions*

1. Actions are deterministic,

2. States of nature ($S_t$) are fuzzy, and

3. Pay-offs ($B_{ij}$) are fuzzy.

The outcome or net benefit ($B_{ij}$) can be represented by:

$$B_{ij} = \{u_{B_{ij}} (b_L)/b_L\}.$$

The net benefit $b_L$ can be taken as any value from the universe $B = \{0,1,....\}$. The proposed solution is based on formulating a fuzzy set, $D_o = \{u_{D_o} (d_j)/d_j\}$. The optimal alternative is that decision having the highest grade of membership in the set $D_o$.

By applying the extension principle 1, the net benefit ($B_j$) associated with decision $d_j$ can be found out. By using the operation of fuzzification, which provides a means for handling situations in which the elements of the initial set are a fuzzy set of another set, $B_j$ can be reduced to a fuzzy set of non-fuzzy net benefits ($B_{jL}$). The optimal decision can now be selected, based either on the maximum net benefit ($b_L$) or on the highest grade of membership $u_{B_{jL}}$ ($b_L$) in the sets $B_{jL}$s. However, these two methods of selecting the optimal may lead to an improper decision. To accomplish these dual considerations, the concept of maximization for a function will be used. It is also known as *Jain's Reduction Rule*. According to Jain, "the maximizing set $B_{jM}$ of a set $B_{ij}$ is a fuzzy set such that the grade of membership of $b_L \in B_{ijk}$ in $B_{jM}$ (i.e., $u_{B_{jm}}$ ($b_L$)) represents the degree which $b_L$ approximates to supreme of $B_{ij}$ (i.e., $b_{max}$) in some specified sense".

Both kinds of information can be combined by formulating a new fuzzy set (denoted by $B_{jo}$) as the intersection of sets $B_{jM}$ and $B_{jL}$. The fuzzy set $D_o = \{u_{D_o} (d_j)/d_j\}$, representing the fuzzy optimal decision space, can now be formulated. The degree of membership of each decision $d_j$ in $D_t$ is given by:
$u_{D_o} (d_j) = U_L u_{B_{jo}} (b_L)\}$.

The optimal decision, $d_o$, is then the one having the highest degree of membership in set $D_o$, $u_{D_o} (d_j) = U_j u_{D_o} (d_j)$.

## Model 3 (Zebda, 1984)

### Assumptions

1. The net benefit $B_{ijk}$ (which can be represented by an $m \times n$ matrix) is assumed to be defined fuzzily.

2. The state of output states $S_{t+1}$ is assumed to be related to the state of input states $S_t$ through a transformation function

$$S_{t+1} = f (S_t, D_t)$$

### Computation

In model 2, the transformation function was considered as deterministic whereas here it is assumed to be stochastic in nature. The decision maker uses his judgement about the probabilities by using some statements like 'approximately 30 per cent', 'roughly 20 per cent' etc. Each fuzzy probability is defined by a fuzzy set represented by:

$$Q_{ijk} = \{u_{Q_{ijk}} (q_k)/q_k\}$$

These probabilities can be represented by an m ö n matrix. This can be first solved by obtaining the net expected benefit associated with every $d_j \in D_t$, given $s_i$. $EB_{ij}$ is given by:

$$EB_{ij} = \sum_{k=1}^{n} B_{ijk} \cdot Q_{ijk}$$

The points in B and Q are replaced by fuzzy sets of $B_{ijk}$ and $Q_{ijk}$ by using extension principle 2, and the fuzzy expected value ($EB_{ij}$) may be found out. This expected value considers the condition that $\sum q_k = 1$. Once the expected net benefits for the decisions are obtained, they can be treated as the case in the deterministic one, i.e., the solution is reduced to the deterministic solution.

## Model 4 (Zebda, 1984)

### Assumptions

The function of transformation from input to output is assumed as fuzzy in nature.

### Computation

The performance is described by a fuzzy relation (mapping) R: $S_t \times D_t \times S_{t+1}$. For any given decision $d_j \in D_t$, the relationship is described by:

$$R (S_t, S_{t+1} || d_j) = \{u_R (s_i, s_k || d_j)/(s_i, s_k || d_j)\}$$

where $u_R$ ($s_i$, $s_k$ || $d_j$) is a membership function that associates with every pair ($s_i$, $s_k$) in $S_t \times S_{t+1}$. This relationship can be represented by an $n \times n$ matrix.

Since the system is assumed to b described by a fuzzy mapping, the response of the system to a fuzzy

input state will be fuzzy. To calculate such fuzzy responses, the compositional rule of inference is used. If X and Y are two universes and R is a fuzzy relation from X to Y with a membership function $u_R(x,y)$ and also if A is fuzzy set of X with a membership function $u_A(x)$, then a fuzzy subset B of Y can be inferred from R & A. The membership function for the set B is given by $u_B(y) = \max_{x \in X} : [u_A(x) \cap u_R(x, y)]$

Hence, the compositional rule of inference can be used to obtain, for any $d_j \in D_t$, the fuzzy $S_{t+1}$, given the fuzzy $S_t$ and the fuzzy mapping $R(S_t, S_{t+1} \mid\mid d_j)$. Now the fuzzy net benefit $B_j$ associated with each decision can be obtained by applying extension principle 1. It can be seen that $B_j$ is a fuzzy set of fuzzy net benefits. By the operation of fuzzification, $B_j$ can be reduced to a fuzzy set of nonfuzzy net benefits ($B_{jL}$). Now, the problem is reduced to a deterministic type and the fuzzy optimal decision set $D_o$ can be found out. Then a decision with the highest grade of membership function can be obtained.

## Application of Fuzzy Reasoning

The theory of fuzzy subset is applied in many areas of management—some of which are:

* Financial ratio analysis (Rathore & Latha, 1990)

* Investigation of Cost Variance (Zebda, 1984)

* Delphi Technique (Kaufman & Gupta, 1988)

* Critical Path Method (Kaufman & Gupta, 1988)

* Flow Shop Scheduling Problem (Ishibushi et al. 1994)

* Capital Budgeting Problem (Agarwal & Gupta, 1989; 1991)

The first and second applications are based on the earlier mentioned four models. These are as follows:

## Financial Ratio Analysis

Conventionally, in ratio analysis, states of nature are inferred by comparing the variation between the standard value and the actual value. The formal decision model based on crisp classification of states (such as correct and incorrect states) is beset with severe limitations which seriously impair the utility of these ratios. In actual practice, managers interpret the information in an imprecise manner. If a manager is informed that the quick ratio is 1.2, he is quite likely to describe the cash position as 'good', 'poor',

'reasonably good', 'satisfactory' etc. Hence, the states are fuzzy. In these cases, the quantitative information given by the ratios is interpreted in verbal, linguistic terms. Considering these facts, Rathore and Latha (1990) have solved these types of problems using models 1 and 2.

## Investigation of Cost Variance

In a standard costing system, deviations (variances) of actual cost from standard cost should be investigated in order to help the management identify the causes of the variances and the persons responsible for them before corrective actions are taken. In reality, however, actual cost is rarely equal to the standard cost. Hence, many variances occur and all of these cannot be investigated due to cost, time and manpower constraints. These two conflicting factors— the necessity of investigating cost variances and the impracticality of investigating all the variances present the management with the problem of deciding which variances to investigate. For pinpointing the cost variances which are to be investigated further, models 2, 3 and 4 may be applied.

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## Delphi Technique

The Delphi Technique is used for forecasting and in various areas of decision making. This tool uses different statistical techniques assuming a random problem. The theory of fuzzy subset can be used in the Delphi technique for the following reasons:

* The long range forecasting problem is an uncertain, but not a random problem.

* The technique uses the opinions of a number of experts which involve a lot of subjectivity.

In this case, the expert is asked to give three predictions such as the earliest time, the maximal presumption time and the latest time i.e., a triangular fuzzy number (TFN).

1. The expert $i \in (1, n)$ is required to give a TFN $(A_1{}^{(i)}, B_1{}^{(i)}, C_1{}^{(i)})$. Here 1 indicates that this is the first phase of the process.

2. These responses from n experts form a sheaf. The mean of this sheaf is calculated $(A_1{}^m, B_1{}^m, C_1{}^m)$ and sent to the individual experts and for each expert, the divergence (shown in fig. 4) computed is

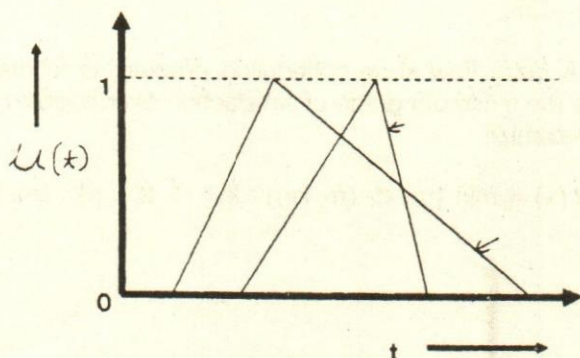$$\{A_1{}^m - A_1(i), B_1{}^m - B_1{}^{(i)}, C_1{}^m - C_1{}^{(i)}\}$$



**Fig. 4.** Divergence between experts

3. Each expert now gives a new TFN, i.e. a new phase is started. The TFN is $(A_2{}^{(i)}, B_2{}^{(i)}, C_2{}^{(i)})$ for the i-th expert.

4. The process is repeated. If necessary, a study of partial group opinion is realized using the normalized distance (Kaufman & Gupta, 1988) between the TFNs.

The information about these results (non-nominative) can be mailed to the interested experts.

The process is stopped when the mean is sufficiently stable. The forecasting can be re-evaluated if any change takes place.

**Critical Path Method**

In the conventional CPM and PERT method, generally the repetitive one-time and three-time estimate data are collected from some experts. But, in actual practice, the estimates of the experts vary widely. Hence a set of fuzzy numbers is collected from a group of experts which forms a sheaf. The following steps are carried out in this technique:

1. Experts must be selected for each operation, the number selected being determined by the type of operation and the uncertainty involved. Each must give his subjective opinion in the form of a TFN.

2. For each operation, a major TFN and a minor TFN are selected and for each major TFN and minor TFN, the associated ordinary number must be computed.

3. To determine the pessimistic critical path, major TFNs and their associated ordinary numbers are employed. For optimistic path, minor TFNs and the corresponding ordinary numbers are selected.

4. The floating times are then calculated using associated ordinary numbers for vertices which are not on the critical path.

5. Following these calculations, the experts re-evaluate their TFN estimates and the process is repeated.

Here the major TFN is that which dominates all the other TFNs and the minor TFN is that which is dominated by all others in the sheaf. The criterion for dominance is one of the following three in the order given:

* The greatest ordinary number $A = (a_1 + a_2 + a_3)/4$
  where $a_i$ is a minor TFN in the sheaf and $A^*$ is a major TFN in the sheaf.

* If (i) does not separate the two TFNs, those which has maximal presumption (in the mode) is chosen.

* If (i) and (ii) do not separate the TFNs, the divergence is used as the third criterion.

**Flow Shop Scheduling Problem**

In conventional scheduling problems, with the criterion of minimizing the number of tardy jobs, the due date of each job is given by a crisp value (as shown in fig. 5). On the other hand, in fuzzy scheduling problems, the grade of satisfaction gradually decreases after the completion time t has exceeded $t_d$ as shown in fig. 6. Here $t_f$ and $t_d$ can be viewed as pessimistic due date and optimistic due date, respectively. the function may also be calculated. In this paper, the authors (Ishibushi

et al. 1994) assume non-linear membership function which is supposed to reflect the actual situation.
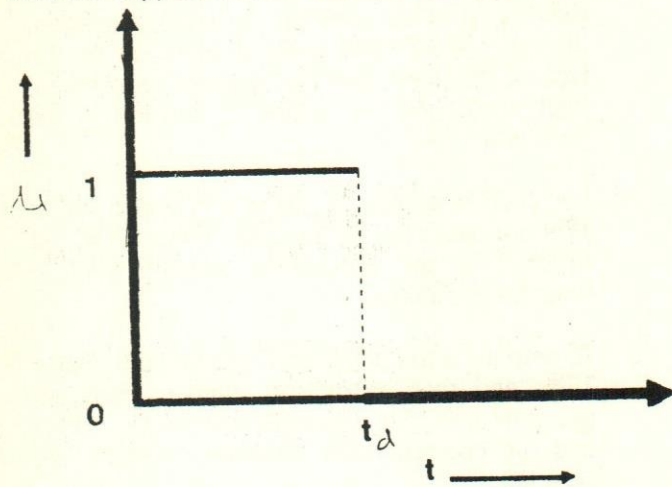


**Fig. 5.** Conventional Scheduling Problem
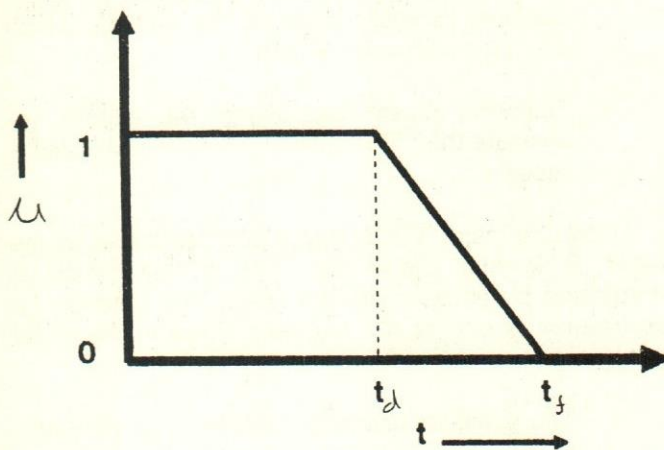


**Fig. 6.** Fuzzy Scheduling Problem

## Problem

There are m number of machines and n number of jobs. Let the processing time and the completion time of job j on machine i be $t_p(i, j)$ and $t_c(i, j)$, respectively. The sequence of n jobs is denoted by an n-dimensional vector $x = (x_1, x_2, .....x_n)$ where $x_k$ represents the k-th processing job. The completion time of the each job corresponding to the sequence x can be calculated as

$$t_c(1, x_1) = t_p(1, x_1), \qquad \text{Eq. (1)}$$

$$t_c(1, x_1) = t_c(i-1, x_1) + t_p(i, x_1) \text{ for } i = 2, 3 ... m \qquad \text{Eq. (2)}$$

$$t_c(1, x_k) = t_p(i-1, x_k) + t_p(i, x_k) \text{ for } k = 2, 3 ... n; \qquad \text{Eq. (3)}$$

$$t_c(1, x_k) = \max t_c(i-1, x_k), + t_c(i, x_{k-1})\} + t_p(i, x_k) \text{ for } i = 2, 3, ... m; k = 2, 3, ...n. \quad \text{Eq. (4)}$$

Flow shop scheduling problem may be defined as determination of the sequence x of n jobs on a specific criterion such as minimization of makespan.

*Fuzzy flow shop scheduling problem*

When the sequence of each n jobs is given as x, the grade of satisfaction of job $x_k$ is represented as:

$u_{x_k}(t_c(m, x_k))$ where $t_c(m, x_k)$ is the completion time of the job $x_k$ which is calculated by Eqs. (1-4), for all i = 2, 3, .....m.

A fuzzy flow shop scheduling problem is to maximize the minimum grade of satisfaction over n jobs, i.e., to maximize

$$f(x) = \min \{u_{x_k}(t_c(m, x_k)) : k = 1, 2, ...n\} \quad \text{Eq. (5)}$$
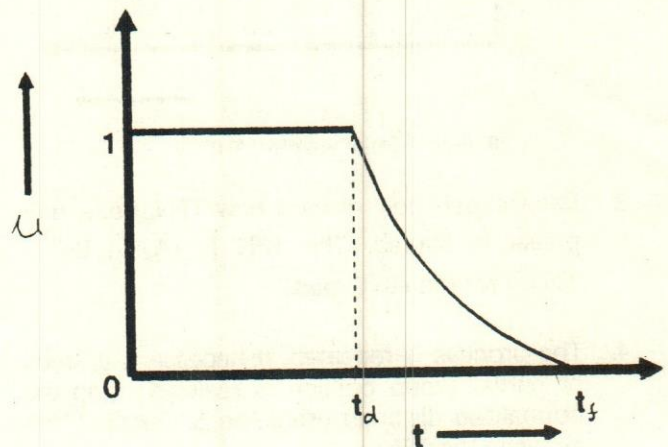


**Fig. 7.** The Membership Function
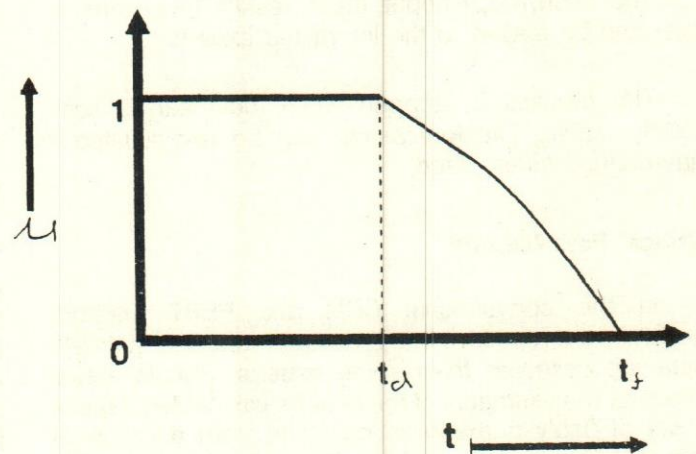


**Fig. 8.** The Membership Function

In this case, the membership function which is totally subjective, is taken as a non-linear one. Figures 7 and 8 show the membership function. The equation can be given by:

$$u_j(t) = \begin{cases} 1, & \text{if } 0 < t \le t_d; \\ \left\{1 - (t - t_d)/(t_f - t_d)\right\}^u, & \text{if } t_d < t \le t_f; \\ 0, & \text{if } t_f < t. \end{cases}$$

This type of problems can then be solved by applying local search algorithm, taboo search algorithm or simulated annealing algorithm.

## Capital Budgeting Problem

Capital budgeting decisions of a firm are concerned with the allocation of the scarce resources among the available investment opportunities. Agarwal & Gupta's (1989) multiple objective programming model proposes Goal Programming formulation for solving capital budgeting problems with more than a single objective or criteria of capital allocation. The model may be shown as:

Find X such that

$$G(X) \le B$$

Subject to $A(X) \le H$

and $X \le 0$.      (M1)

where $G(X) \equiv$ Goals $\equiv [g_1(x),....g_m(x)]^T$

$B \equiv$ Aspiration level $\equiv [b_1,.....b_m]^T$

$A(X) \equiv$ Constraints $\equiv [a_1(x),....a_k(x)]^T$

$H \equiv$ Maximum availability of various resources $\equiv [h_1,.....h_k]$

$X \equiv$ Instrumental variable $\equiv [x_1,.....x_n]^T$

M1 can be modelled as a Goal Programming model.

Min. $f(D^+, D^-)$

Subject to $G(X) - D^+ + D^- = B$,

$A(X) \le H$,

$d_j^+ d_j^- = 0$ for $j = (1,...m)$     (M2)

$X, D^+, D^- \le 0$

Where $[D^+ \equiv [d_1^+,......d_m^+]^T$,

$[D^- \equiv [d_1^-,......d_m^-]^T$;

Here $D^+$ and $D^-$ represent over and under achievement vector of goals respectively. These two models are crisp and demand a crisp distinction between the goals and constraints. But while modelling for economic and social models, where human judgement and preferences play a crucial role, the information is full of subjectivity and of ambiguity i.e., fuzzy. To capture these limitations, the theory of fuzzy subset can be applied.

## Fuzzy Model

M1 can be called a fuzzy model if the $\le$ is a fuzzy version and means 'essentially less than or equal to'. If fuzzy goals and constraints are characterized by the membership functions $u_G(X)$ and $u_A(X)$ where $X \to [0, 1]$, M3 can be stated as:

Find X such that

$$u_D(X) = \cap (u_G(X), u_A(X)) \text{ for each } x \in X. \quad (M3)$$

Here D is a fuzzy decision, the following modification may be proposed.

Select $X^*$ such that

Max s

$s \in [0, 1]$     (M4)

Subject to $s \le u_G(X)$, $s \le u_A(X)$ and $X \le 0$.
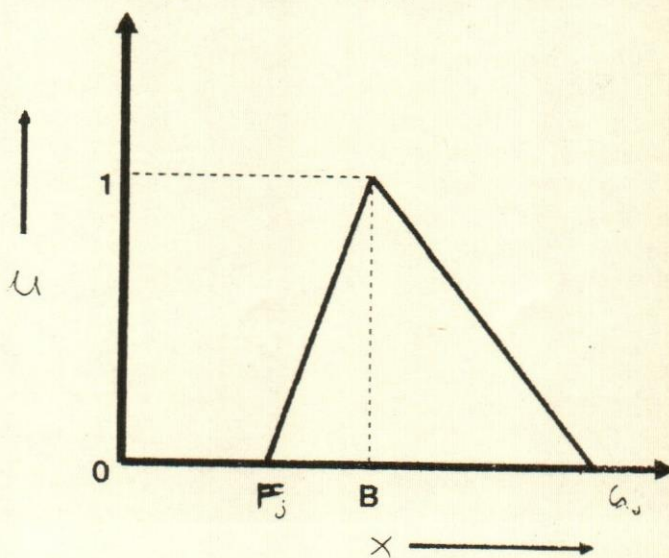


Fig. 9. Fuzzy Triangular Number

M4 can be transformed into an equivalent crisp linear programming model by taking a linear membership function for $u_G(X)$ and $u_A(X)$. If a fuzzy triangular number (as shown in fig. 9) is assumed, then the model will be like this:

Mas. s

$s \in [0, 1]$

subject to

$$(F_j - G_j(X))/FG_j \le s, \quad j=1,...m;$$
$$(A_i - B_i(X))/AB_i \le, \; s, \quad i=1,...k; \qquad \text{(M5)}$$

M5 is the usual crisp problem and can be solved by Simplex algorithm.

## Conclusion

Fuzzy reasoning is now getting adapted more due to its great feasibility. A good mathematical model may be too academic, while a fuzzy model may be more realistic. Fuzzy numbers which are the generalization of ordinary numbers, have the algebraic rules appreciably more complicated, but at the same time, they are very diversified. Instead of having only one available theory, many theories are available in explaining fuzzy reasoning process. Often, the choices are too diversified.

In the paper, only six managerial areas have been covered, which may merely be a part of the large set of studies and applications of fuzzy concept in management. Fuzzy set concept is primarily used both as a modeling language and as an algorithmic tool, the ultimate objective of which is modelling of imprecise human opinions.

> **Fuzzy set concept is primarily used both as a modeling language and as an algorithmic tool, the ultimate objective of which is modelling of imprecise human opinions.**

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# Implementation of Just-in-Time Manufacturing System: An Overview

## Subhash Chandra & Rambabu Kodali

*The horizons of the industrial world are changing rapidly from high volume, low variety to forecast manufacturing to provide the speed and flexibility necessary to respond to changing customer taste and competitor activity. Just-in-Time manufacturing system is the ideal strategy to achieve these desired objectives. However, its implementation poses many problems. In this paper a multi-attribute decision model has been developed using analytical hierarchy process (AHP) for the justification of JIT manufacturing system in Indian industries. The authors also present a case situation followed by a few observations and conclusions.*

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Just-in-Time manufacturing system is a highly integrated production, sales and distribution system leading to continuous flow to produce the kind of units needed, at the time needed and in quantities needed. It entails the combination of purchasing, inventory control and production management functions. The ideal JIT manufacturing system can be achieved through four prerequisites; design of process, standardization of jobs, smoothening of production, and information system called Kanban (Yashuhiro, 1981).

JIT manufacturing system is a comprehensive framework which enables one to conceive, design, implement and operate a manufacturing and supporting system, as an integrative whole, based on the principles of continuous improvement and elimination of waste. It aims at simultaneous goals of perfect quality, quick delivery, low cost and high degree of flexibility. JIT system is a natural state of simplicity where all obstacles have disappeared, so materials and components move in perfect synchrony. The major objectives of JIT manufacturing system are to eliminate waste in the form of inventory, excess lead time, over production, poor space utilization, and conventional waste such as scrap, rework, equipment downtime etc. Since JIT system is a highly integrated purchase, production, sales, and distribution, an organisation cannot implement it in isolation of any of its environment—internal or external.

> **The major objectives of JIT manufacturing system are to eliminate waste in the form of inventory, excess lead time, over production, poor space utilization, and conventional waste such as scrap, rework, equipment downtime etc.**

## Implementation Problems

The JIT manufacturing system has been widely discussed and well received all over the world. Raghunathan & Subba Rao (1991) acknowledge that Japanese manufacturing systems are quality producers of manufactured goods at low cost, and go on to focus on the applicability of these systems in Indian conditions. Schonberger (1984) had discussed JIT manufacturing system in detail with total quality control (TQC), which are important in improving quality, productivity and economic growth. Attempts have been made to transfer these concepts to the developing countries. The chief obstacle identified in the rapid adoption of JIT and TQC is lack of training. Another objection has been that the concept of manufacturing excellence is rooted in Japanese cultural itself and hence is untenable in other environment. However, the present work is inspired with the belief that the fundamental principles underlying JIT with Total Quality Management (TQM) are as applicable in Indian (or any) environment as they are in Japan (Sharad, 1992). there is nothing so Japanese about JIT manufacturing system within the framework of manufacturing system which could not be applied in India. Prem Vrat et al (1993) have presented the results of a Delphi study conducted to examine the applicability of JIT concepts in Indian industrial environment. Karlene (1988) has identified five classes of implementation problems and eight classes of operating problems, and also discussed the benefit potential of JIT manufacturing system. David (1989) and Ahsanuddin (1996) have discussed in detail the critical factors in successful implementation of JIT purchasing. Mehran (1986) has presented a test of hypothesis for successful modification and implementation of Toyota Production system in an automobile plant in USA.

Despite the worldwide attention, JIT is not fully understood and the implications of implementing JIT in developing countries have not been adequately appreciated, its applicability in developing countries still being debatable (Zipkin, 1991). For all the enthusiasm and literature on it, a storm of confusion and controversy still swirls around JIT. This is because of an unwieldly list of factors and concepts presented in the contemporary literature to explain JIT manufacturing system. Hence a few widely recognized JIT elements were considered for the purpose of overall synthesis of manufacturing system and a model was developed to justify JIT system in Indian industries.

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## Development of the Model

The analytical hierarchy process (AHP) has been well received in literature (Roger, 1987) with applications of this methodology reported in numerous fields. The general approach of this AHP model is to decompose the problem and make pairwise comparisons of all the elements on a given level with reference to a related element in the level just above. A highly user-friendly computer model is developed which assists the user in evaluating his choice. The schematic of the model is shown in fig. 1.

A thorough analysis of the problem is required along with the identification of the important attributes involved. The selection of attributes is determined through literature survey combined with discussions held with experts. The attributes and sub-attributes used in AHP to achieve a common goal are as follows:

| | |
|---|---|
| *Organisation & People* | [ORG] |
| *   Organisation in Module/Cells | [OMC] |
| *   Highly Motivated Workforce | [HMW] |
| *   Respect to Humanity and Creativity | [RHC] |
| *   Top Management Support | [TMS] |
| *   Continuous Improvement (Kaizen) | [COI] |
| *   Flexible Workforce (Sojinka) | [FLW] |
| *Plant and Equipment* | [PLA] |
| *   Focused Factor (Flow & Layout) | [FOF] |
| *   Group Technology | [GRT] |
| *   Reliable Equipments | [REE] |
| *   Automation | [AUT] |
| *   Efficient material handling System & Standard Containers | [MHS] |
| *   Preventative Maintenance | [PRM] |
| *Process and Production System* | [PRO] |
| *   Smooth Build-up Rate (Heijunka) | [SBR] |
| *   Reduced Set-up Time | [RST] |
| *   House Keeping (Seiri Seiton Seiso) | [HOK] |
| *   Simplification of Product and Process | [SPP] |
| *   Kanban System | [KAS] |
| *   Total Quality Management | [TQM] |
| *Suppliers/Vendors* | [SUP] |
| *   Small Lot Frequent Deliveries | [SLF] |
| *   Vendor Reliability | [VER] |
| *   Few Committed Suppliers | [FCS] |
| *   Vendor Flexibility | [VEF] |
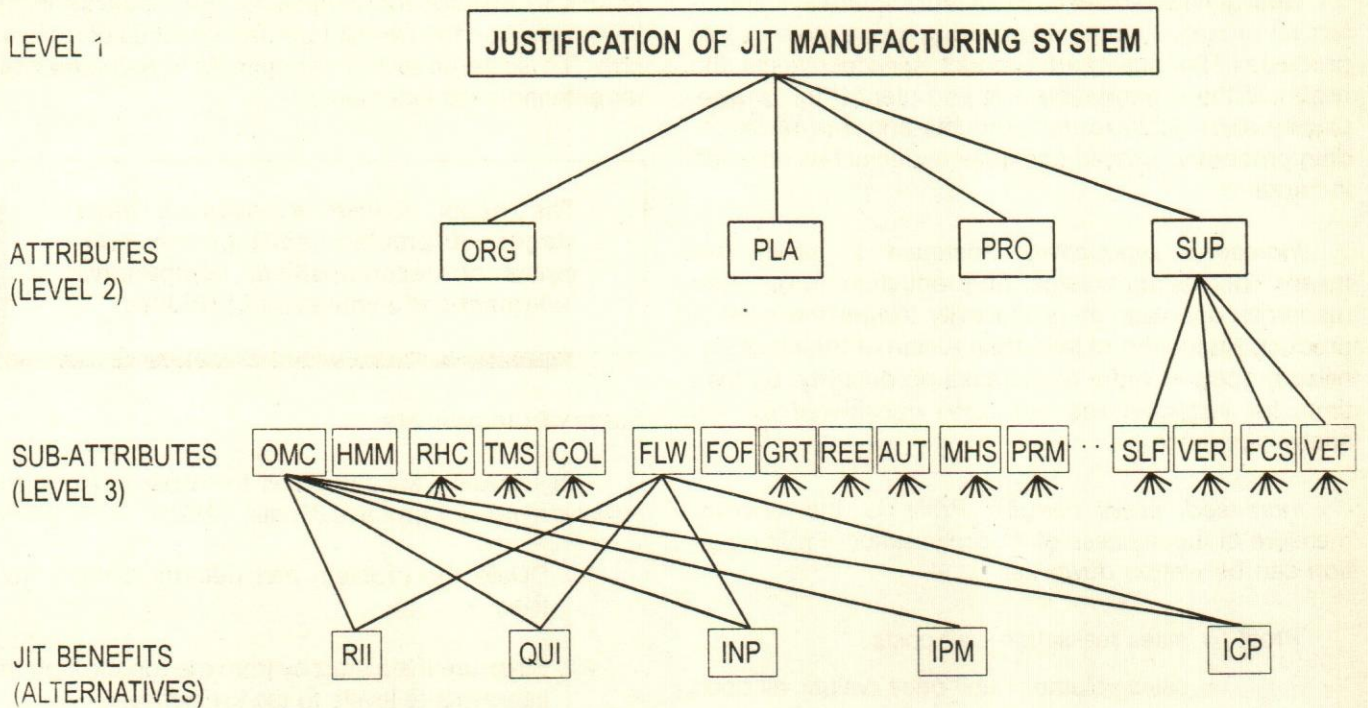
Fig. 1. Schematic of the AHP Model

## Alternatives

The alternatives are the five major benefit potentials of JIT manufacturing system (fig. 2) which are to be evaluated and compared from the given set of JIT elements. These major benefits of JIT manufacturing system are:

*   Reduction in Inventory           [RII]
*   Quality Improvement          [QUI]



Fig. 2. JIT Benefits Profile

*   Increased Productivity         [INP]
*   Increased Profit Margin       [IPM]
*   Improved Competitive Position   [ICP]

*Reduction in inventory:* Inventory protects the organisation against problems such as uncertain equipment breakdown, late deliveries, demand fluctuations etc. High inventory creates problems viz. high set-up time, quality defects, equipment down-time, production planning deficiencies, and etc. There should be a continuous drive from top to bottom to minimize all types of inventories: work-in-process, raw material, finished goods, component parts, and so on. A significant amount of inventory can be reduced by reducing the inaccuracies of demand predictions at different points of production of flow. Electronic Data interchanges can be used connotating other JIT techniques to lessen inventories. A forecast can be generated based on the previous day's sales and the demand signal should be sent electronically to all concerned suppliers. However, this technique is not fully developed in India.

A significant amount of inventory can be reduced by reducing the inaccuracies of demand predictions at different points of production of flow.

*Quality improvement:* JIT manufacturing system offers an organisation the means to produce more usable products. The quality of product service reflects the health of the organisation and its potential for growth. Quality adds value to the products and is a never-ending process to exceed customer expectations now and in future.

*Increased productivity:* Increase in production means increasing volume of production from given resources. Increase in productivity lowers the cost of product. Reduction of lead time is one of the most significant goals in order to increase productivity. So lead time, for instance, has not been considered for the analysis purpose.

*Increased profit margin:* Profit is the ultimate measure of the success of an organisation. Profit equation can be written down as:

Profit = sales realisation – all costs

= sales volume × unit price (value)–all costs

Profit can be increased by boosting the sales of products, increasing the value/quality of the products, and reducing the cost of production by means of increasing productivity.

*Improved competitive position:* Develop, produce and sell new products faster than your competitor. Competitive edge can be built-up only if your organisation works harder and performs better than your competitors.

### Analytical hierarchy process theory

The analytical hierarchy process (Roger, 1987; Satty 1982) was developed in 1972 as a practical approach to solving relatively difficult decision problems. It enables the decision maker to represent the simultaneous interaction of many factors in complex, unstructured situations. It helps them to identify and set priorities on the basis of their objective and their knowledge and experience of each problem. Our feelings and intuitive judgments are probably more representative of our thinking and behaviour than our verbalization of them. The new framework organises feelings and intuitive judgments as well as logic so that we can map out complex situations as we perceive them. It reflects the simple, intuitive way to actually deal with problems, but improves and streamlines the process by providing a structured approach to decision making. The theory of AHP is based on three stages of problem solving: the principles of decomposition, comparative judgement and synthesis of priorities. The methodology of AHP at-

tempts to analyze the impacts of the elements in the lowest level on the overall objective or focus of a hierarchy. The scale given in the appendix is recommended for entering such judgments.

> **The theory of AHP is based on three stages of problem solving: the principles of decomposition, comparative judgment and synthesis of priorities.**

### Steps of the process

The following are the steps to follow in using the analytic hierarchy process (Roger, 1987):

1. Define the problem and determine the objective.

2. Structure the hierarchy from the top through the intermediate levels to the lowest level.

3. Construct a set of pairwise comparison matrices for each of the lower levels. An element in the higher level is said to be a governing element for those in the lower level, since it contributes to or affects it. The elements in the lower level are then compared to each other based on their effect on the governing element above. This yields a square matrix of judgments. The pairwise comparisons are done in terms of which element dominates another. These judgments are then expressed as integers. If element A dominates over element B, then the whole number integer is entered in row A, column B and the reciprocal is entered in row B, column A. If the elements being compared are equal, one is assigned to both positions.

4. There are $n(n-1)/2$ judgments required to develop the set of matrices in step 3 (reciprocals are automatically assigned in each pairwise comparison).

5. Once the data is entered, the consistency is determined using the eigenvalue [$Aw = \gamma$ (max) w]. The consistency index C.I. derived from the departure of the (max) from n is compared with the corresponding average values for random entries yielding the consistency ratio (C.R.).

6. Steps 3-5 are performed for all levels and clusters in the hierarchy.

7. Hierarchical composition is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy.

8. The consistency of the entire hierarchy is found by multiplying each consistency index by the priority of the corresponding criterion and adding them together. The result is then divided by the same type of expression using the random consistency index corresponding to the dimensions of each matrix weighted by the priorities as before. The Consistency Ratio (C.R.) should be about 10 per cent or less to be acceptable. Else, the quality of the judgements should be improved, perhaps by revising the manner in which questions are asked in making pairwise comparisons.

9. The desirability index for each alternative is calculated by multiplying each value in 'weight of subcriteria' column by the respective value in 'criteria weight' column, then multiplying by the value for each respective alternative and summing the results.

The consistency ratio (C.R.) should be about 10 per cent or less to be acceptable. If not, the quality of the judgments should be improved, perhaps by revising the manner in which questions are asked in making pairwise comparisons. If this fails to improve consistency, then it is likely that the problem should be more accurately structured; that is, grouping similar elements under more meaningful criteria. A return to step 2 would be required, although only the problematic parts of the hierarchy may need revision. It is important to note that if firm numbers are not available, their ratios could be estimated and the problem could still be solved. The attributes are compared with each other on a pairwise comparison with respect to the case situation described in table 1. The relative weights of priorities are obtained. A highly user-friendly software, the multi-attribute decision model (AHP) has been developed in Borland C package to aid the user in pairwise comparison of the attributes as well as for the alternatives and for analysing the user inputs. The relative importance and consistency of each of these attributes are given in table 2. From the Analysis, it appears that the JIT manufacturing system is the best under the circumstances of the developed case situation (see tables 3, 4, 5). The reliability of the judgments supplied by the user can be estimated from the graphs (Figs. 3-7) that are generated among the principal vector for each alternative and its corresponding deciding criteria.

**Table 1:** Case Situation

| Country | : | India |
|---|---|---|
| Type of Industry | : | Medium Scale industry |
| Nature of Product | : | Automobile parts |
| Market | : | Both domestic and international |

**Table 2:** Weightages for Different Attributes

| Attribute | | Principal Vector (PV) |
|---|---|---|
| Organisation and People | [ORG] | 0.126 |
| Plant & Equipments | [PLA] | 0.308 |
| Process and Production System | [PRO] | 0.332 |
| Suppliers/Vendors | [SUP] | 0.235 |

**Table 3:** Weightages of Attributes for Alternatives

| Subcr. | Wt. of Subcr. Level 3 | Wt. of Criteria Level 2 | RII | QUI | INP | IPM | ICP |
|---|---|---|---|---|---|---|---|
| OMC | 0.110 | 0.126 | 0.126 | 0.257 | 0.302 | 0.047 | 0.269 |
| HMW | 0.169 | 0.126 | 0.150 | 0.387 | 0.260 | 0.121 | 0.083 |
| RHC | 0.063 | 0.126 | 0.177 | 0.370 | 0.276 | 0.110 | 0.067 |
| TMS | 0.110 | 0.126 | 0.082 | 0.173 | 0.221 | 0.082 | 0.442 |
| COI | 0.203 | 0.126 | 0.098 | 0.242 | 0.315 | 0.098 | 0.248 |
| FLW | 0.344 | 0.126 | 0.176 | 0.076 | 0.409 | 0.220 | 0.220 |
| FOF | 0.090 | 0.308 | 0.136 | 0.055 | 0.241 | 0.512 | 0.055 |
| GRT | 0.170 | 0.308 | 0.149 | 0.082 | 0.438 | 0.250 | 0.082 |
| REE | 0.090 | 0.308 | 0.149 | 0.435 | 0.255 | 0.115 | 0.046 |
| AUT | 0.310 | 0.308 | 0.082 | 0.250 | 0.438 | 0.082 | 0.149 |
| MHS | 0.170 | 0.308 | 0.135 | 0.074 | 0.241 | 0.414 | 0.135 |
| PRM | 0.170 | 0.308 | 0.082 | 0.250 | 0.149 | 0.082 | 0.438 |
| SBR | 0.066 | 0.332 | 0.444 | 0.089 | 0.153 | 0.262 | 0.053 |
| RST | 0.339 | 0.332 | 0.124 | 0.124 | 0.394 | 0.124 | 0.234 |
| HOK | 0.202 | 0.332 | 0.190 | 0.066 | 0.190 | 0.366 | 0.190 |
| SPP | 0.066 | 0.332 | 0.069 | 0.212 | 0.386 | 0.212 | 0.120 |
| KAS | 0.202 | 0.332 | 0.160 | 0.099 | 0.307 | 0.307 | 0.126 |
| TQM | 0.126 | 0.332 | 0.099 | 0.313 | 0.313 | 0.099 | 0.176 |
| SLF | 0.351 | 0.235 | 0.463 | 0.066 | 0.116 | 0.228 | 0.128 |
| VER | 0.189 | 0.235 | 0.137 | 0.577 | 0.107 | 0.043 | 0.137 |
| FCS | 0.109 | 0.235 | 0.082 | 0.082 | 0.149 | 0.250 | 0.438 |
| VEF | 0.351 | 0.235 | 0.082 | 0.082 | 0.149 | 0.250 | 0.438 |
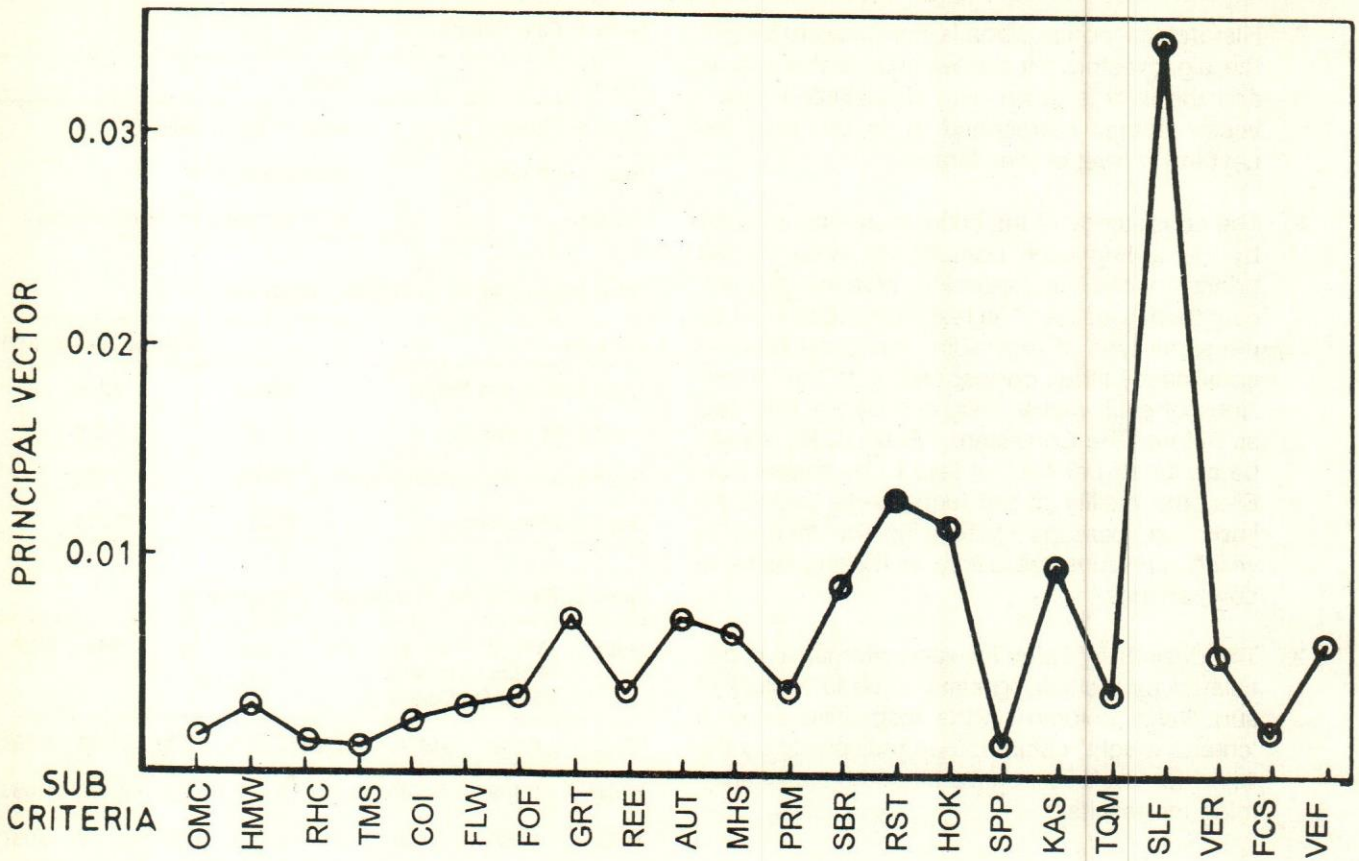
**Fig. 3.** Data Summary Graph Alternative: RII
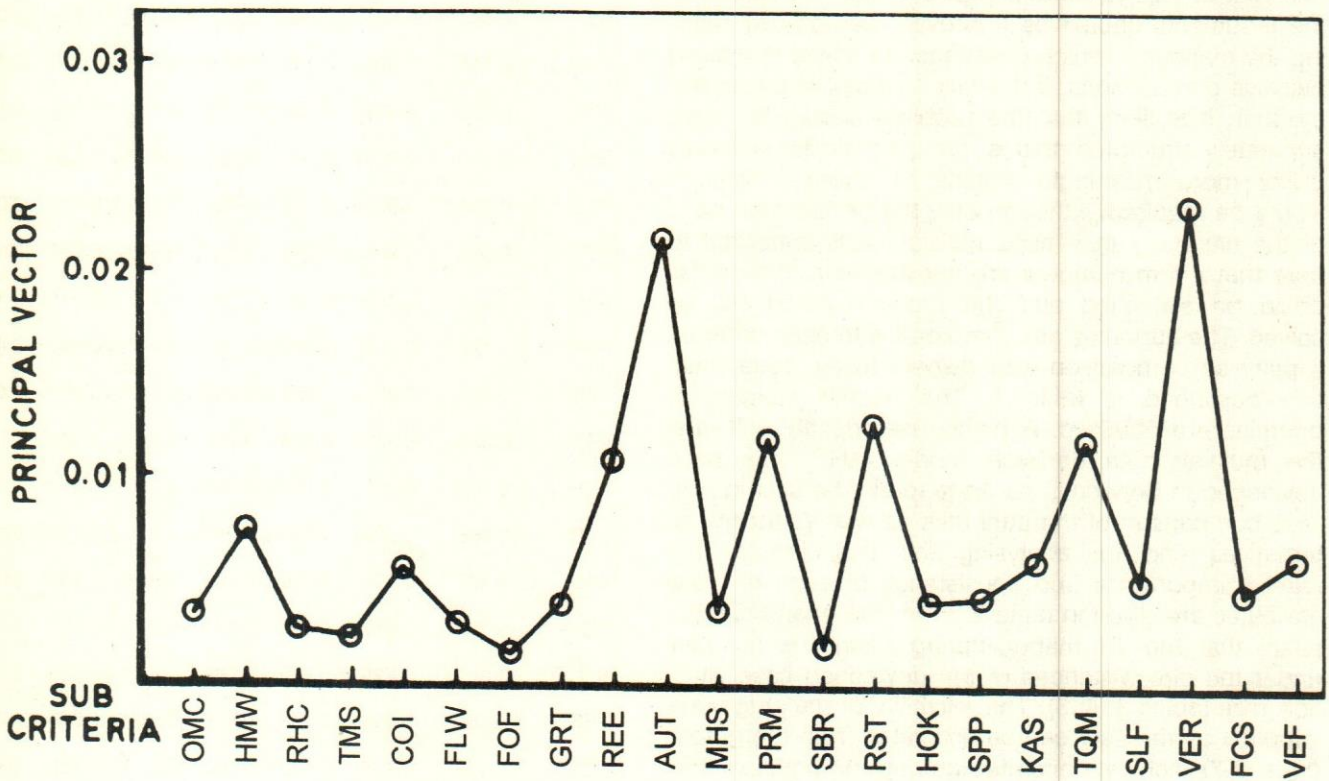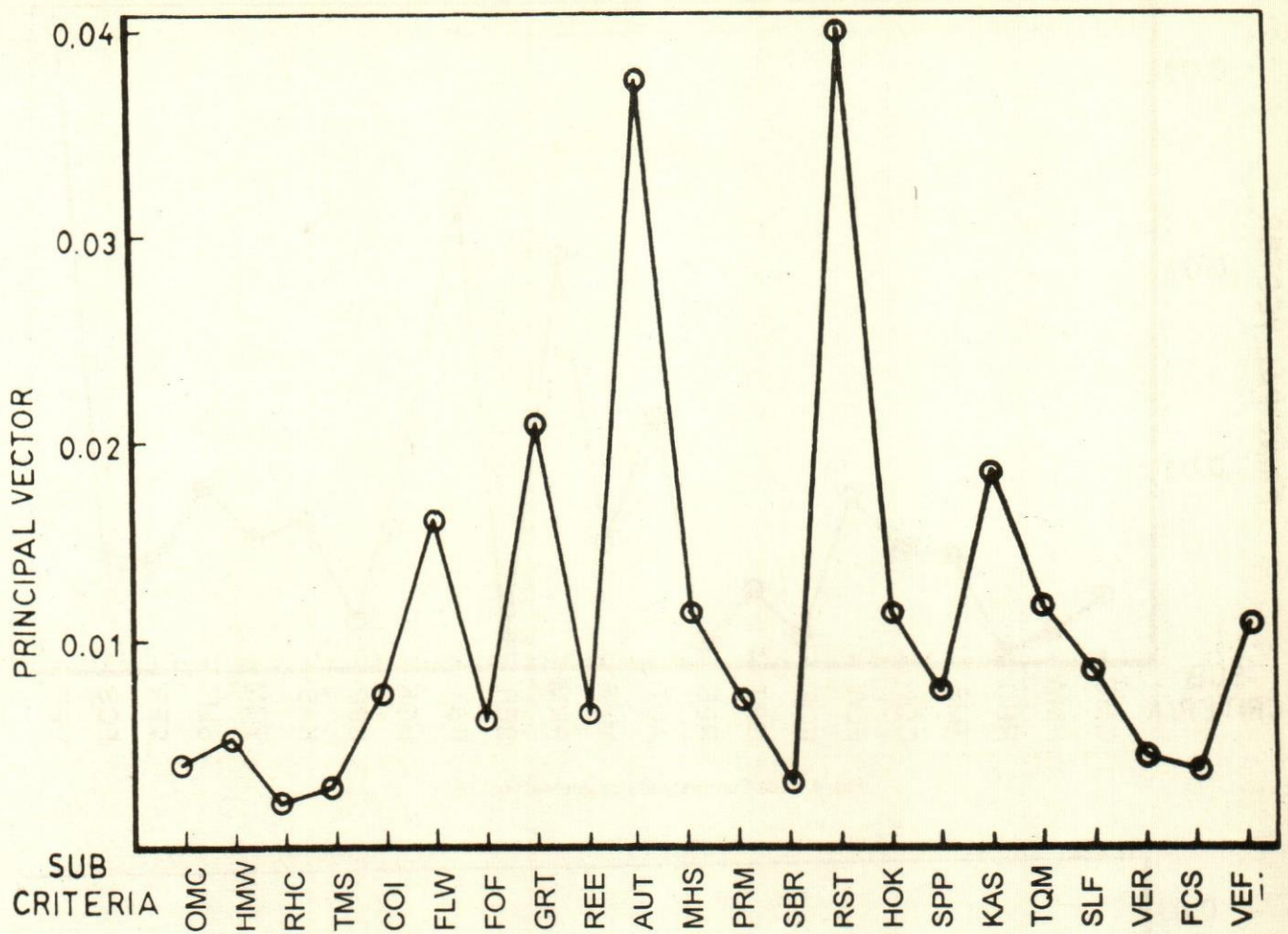


**Fig. 4.** Data Summary Graph Alternative: QUI

**Fig. 5.** Data Summary Graph Alternative: INP

**Table 4:** Data Summary

| Subcr. | RII | QUI | INP | IPM | ICP | Weightages |
|--------|-----|-----|-----|-----|-----|------------|
| OMC | 0.002 | 0.004 | 0.004 | 0.001 | 0.004 | 0.015 |
| HMW | 0.003 | 0.008 | 0.006 | 0.003 | 0.003 | 0.022 |
| RHC | 0.001 | 0.003 | 0.002 | 0.001 | 0.001 | 0.008 |
| TMS | 0.001 | 0.002 | 0.003 | 0.001 | 0.006 | 0.013 |
| COI | 0.002 | 0.006 | 0.008 | 0.002 | 0.006 | 0.024 |
| FLW | 0.003 | 0.003 | 0.018 | 0.010 | 0.010 | 0.044 |
| FOF | 0.004 | 0.002 | 0.007 | 0.014 | 0.002 | 0.029 |
| GRT | 0.008 | 0.004 | 0.023 | 0.013 | 0.004 | 0.052 |
| REE | 0.004 | 0.012 | 0.007 | 0.003 | 0.001 | 0.052 |
| AUT | 0.008 | 0.024 | 0.042 | 0.008 | 0.014 | 0.096 |
| MHS | 0.007 | 0.004 | 0.013 | 0.022 | 0.007 | 0.053 |

| Subcr. | RII | QUI | INP | IPM | ICP | Weightages |
|--------|-----|-----|-----|-----|-----|------------|
| PRM | 0.004 | 0.013 | 0.008 | 0.004 | 0.023 | 0.052 |
| SBR | 0.010 | 0.002 | 0.003 | 0.006 | 0.001 | 0.022 |
| RST | 0.014 | 0.014 | 0.044 | 0.014 | 0.026 | 0.112 |
| HOK | 0.013 | 0.004 | 0.013 | 0.024 | 0.013 | 0.067 |
| SPP | 0.002 | 0.005 | 0.008 | 0.005 | 0.003 | 0.023 |
| KAS | 0.011 | 0.007 | 0.021 | 0.021 | 0.008 | 0.068 |
| TQM | 0.004 | 0.013 | 0.013 | 0.004 | 0.007 | 0.041 |
| SLF | 0.038 | 0.005 | 0.010 | 0.019 | 0.011 | 0.083 |
| VER | 0.006 | 0.026 | 0.005 | 0.002 | 0.006 | 0.045 |
| FCS | 0.002 | 0.005 | 0.004 | 0.008 | 0.007 | 0.026 |
| VEF | 0.007 | 0.007 | 0.012 | 0.021 | 0.036 | 0.083 |
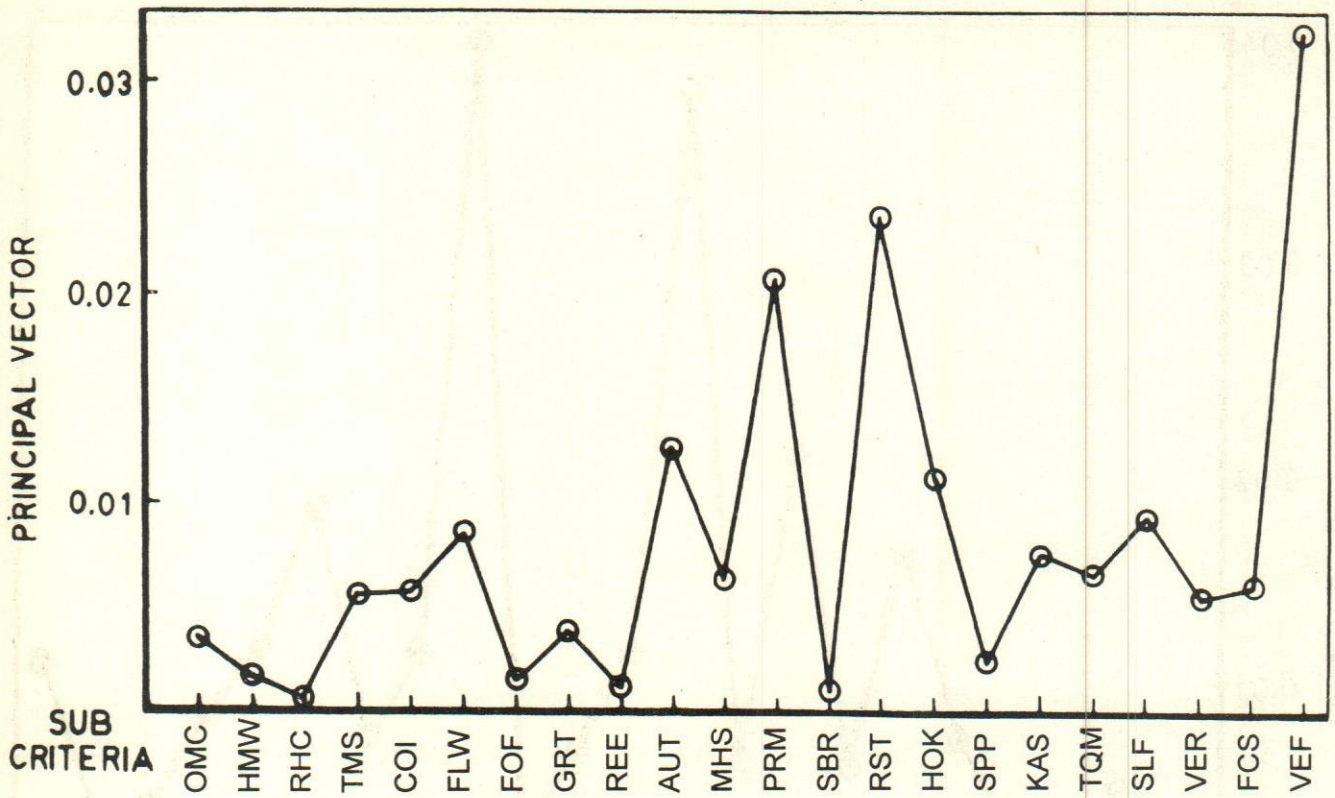
**Fig. 6.** Data Summary Graph Alternative: ICP
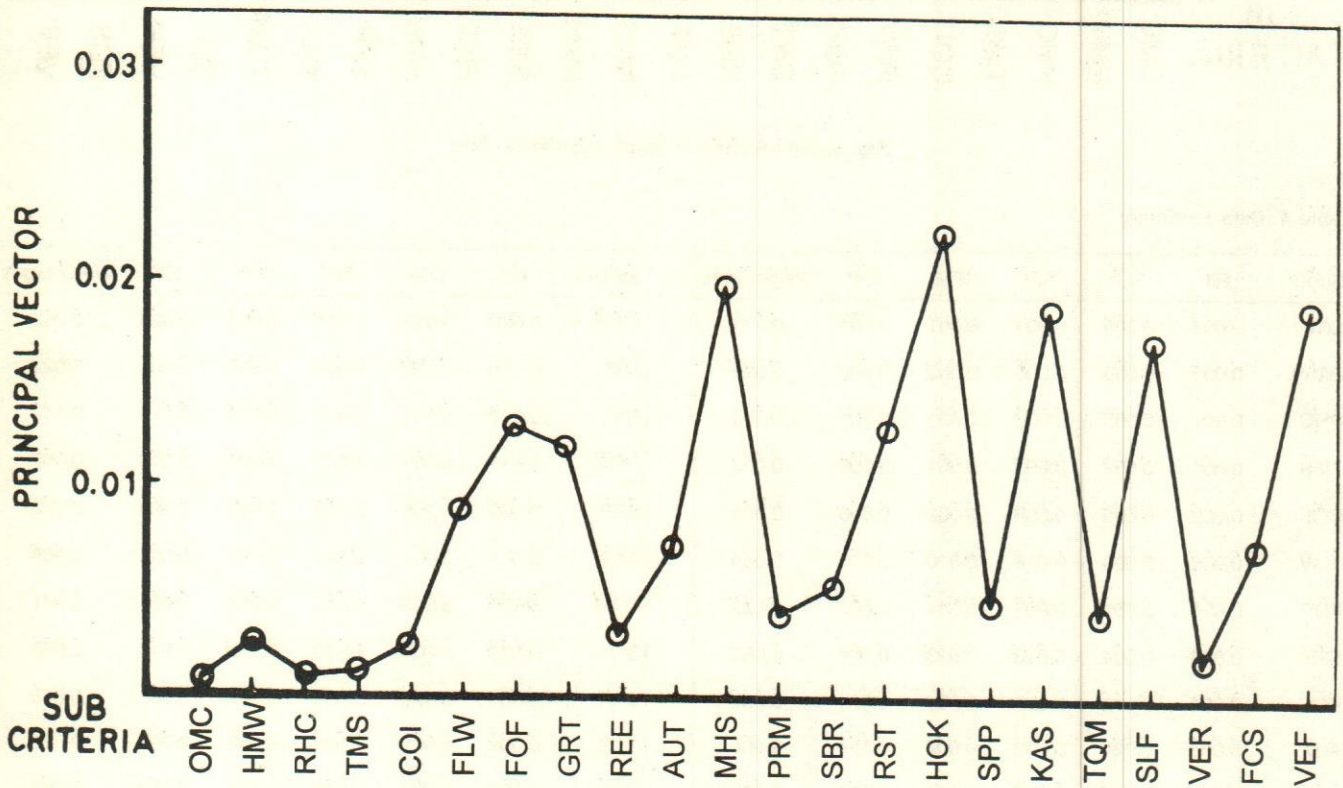


**Fig. 7.** Data Summary Graph Alternative: IPM

**Table 5:** Decision Index for the Desirability of each Alternative

| JIT Benefits (Weightage) | RII | QUI | INP | IPM | ICP |
|---|---|---|---|---|---|
| Decision Index | 0.1539 | 0.1723 | 0.2726 | 0.2037 | 0.1974 |

## Usefulness of the model

The model developed is able to corroborate the justification of JIT manufacturing system for Indian industries for the case situation. The inputs help to clarify the goals of the organisation as constructive discussion requires insights.

### *Comments on the model*

Like all models that attempts to solve the challenging question of justification of JIT manufacturing system for Indian industries, the present model also has few limitations:

* The pairwise comparisons make the input time large and cumbersome.

* It requires that the user be clear on his goals and objectives.

* The number of attributes and alternatives cannot be too large in number, as the number of comparisons to be made will increase sharply.

* The model gives a decision based on a single user input. It does not account for multi-user input. However, these responses could be adequately aggregated to get the final ranking.

## Conclusions

Analytical hierarchy process provides an excellent method in justification studies of many tangible and intangible sets of JIT elements and JIT benefits for Indian industries.

JIT benefits are manifold to an organisation but some of the benefits attributed to JIT manufacturing system for Indian industries are quantified in descending order: increased productivity, increased profit margin, improved competitive position, quality improvement and reduction in inventory (See Decision Index table 5). The prioritization of attributes can often be facilitated by assessing easy-to-understand graphs (Figs. 3-7) for any of the benefit sought. Careful attention can be given to the bottlenecks identified while implementing JIT manufacturing system in Indian situations. A highly user-friendly, menu-driven software has been developed to aid this analysis. The usefulness of this approach has been highlighted using a case situation. The model developed is able to solve the problem well.

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# Attributes for JIT Purchasing & Supplier Evaluation: A Survey

Dixit Garg, S.G. Deshmukh & O.N. Kaul

*Just-in-Time (JIT) system has been accepted as a leading manufacturing strategy by a number of researchers and practitioners for making organisations world class. Purchasing has been found to be an important area of JIT application because of its potential for quality improvement and cost savings. On the basis of a survey of 31 Indian companies this paper attempts to analyse the importance of the attributes identified by Stamm & Golhar pertaining to JIT purchasing and supplier evaluation criteria.*

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Just-in-Time (JIT) system is a globally accepted manufacturing strategy which has been found capable of reducing cost in all areas with emphasis on waste reduction.

It is an approach to eliminate waste and achieve excellence in a manufacturing company. Its areas of application include total quality management, engineering design, setup time and lot size reduction, purchasing (including supplier management), product development, inventory reduction at every stage, marketing, lead time reduction, smoothing of production, kanban system, inbound freight, order splitting etc.

## JIT Management in Purchasing

Many researchers including Grieco et al (1988), Ansari & Modarress (1988, 1990), Grande & Satir (1994). Fawcett & Scully (1995), and Nassimberi (1995) confirm that there is a potential for quality and cost saving in the area of purchasing using JIT. In JIT purchasing environment, purchase is carried out in small lots with frequent deliveries in small standard containers used to hold the exact quantity of required specifications from a nearby located single supplier with a long term contract (Ansari & Modarress, 1990). JIT purchasing is the uninterrupted flow of 100 per cent acceptable material delivered on due dates, at optimal cost, 100 per cent of the time (Grieco, 1988). The four tenets of JIT philosophy are: elimination of waste; employee involvement in decision making; supplier participation; and total quality control (Golhar & Stamm, 1991). These tenets must be applied

> The four tenets of JIT philosophy are: elimination of waste; employee involvement in decision making; supplier participation; and total quality control.

across the three basic functions of manufacturing: purchasing, production and marketing.

Stamm & Golhar (1993) have identified 34 attributes of JIT purchasing and 15 attributes of supplier evaluation criteria. These attributes can be classified into input and outcome attributes and further grouped into 4 types, buyer action, supplier action, joint buyer-supplier action and output attributes (Fig. 1). The relative importance of all these attributes is determined on the basis of frequency of their citation in the literature pertaining to JIT purchasing.
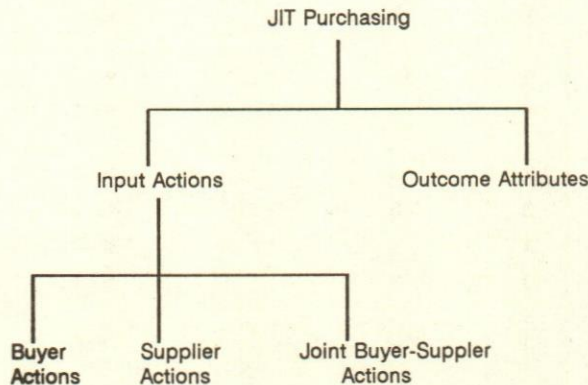


**Fig. 1.** JIT Purchasing Attributes

## Survey

A study was attempted to determine the degree of importance being given to the JIT purchasing and supplier evaluation criteria attributes and a questionnaire was sent to 70 different companies. 31 responses (response rate = 44.3%) were obtained. Majority of the companies are around Delhi and Chandigarh because of logistic reasons. The general profile of these companies is given in table 1.

## Analysis

Data collected was analysed with the help of factor analysis on a scale (0-100) (tables 2 to 4). Scope of JIT implementation is found to be 70 on the scale (0-100), and can be said to be 'fairly good'. An earlier Delphi study carried out by Vrat et al (1993) indicated the JIT index to be 23.38 on a 40 point scale (0-40), implying that though quite difficult, JIT implementation in India is possible. It may take 10-20 years before JIT can be fully implemented in Indian industries. Garg et al (1996) have found JIT index as 2.23 on a scale (0-4), indicating that the professionals of Indian companies are not very optimistic about the scope of JIT implementation in India. However, the current study has predicted better scope

**Table 1:** General Profile of Companies

| Type of Company | Automobile (6), Heavy machine (7), Textile (7), Others (10) |
|---|---|
| Annual Turnover (crores) | Maximum (3300), Minimum (0.5), Average (211) |
| Number of Employees | Maximum (30000), Minimum (25), Average (1930) |
| Percentage of Material Cost to Total Cost | Maximum (90), Minimum (20), Average (47) |
| Number of Suppliers | Maximum (400), Minimum (2), Average (75) |
| Scope of JIT Implementation | Very Good (3), Good (12), Fair (3) Little (2), Not at all (2), No response (9) (70 on a scale 0-100) |

of JIT implementation in India compared to these earlier studies. Table 2 presents the importance of JIT purchasing attributes as perceived by respondents. The mean score of these attributes on a scale (0-100) has been arranged in decreasing order, and shown in table 4. It is found that high quality, mutual trust and co-operative relationship, reliable (on-time) deliveries, exact quantity, increased customer (buyer) support to supplier, supplier evaluation, stable production schedule, reliable network of suppliers, reduced delivery lead time, quality circle, long-term contract, continuous improvement, fewer suppliers, increased volume to supplier have been given a high degree of importance by the surveyed companies. Supplier involvement in design, joint value analysis programme, supplier plant audit, and supplier training and development have been given less attention. In general, Indian companies are giving fairly good importance to JIT purchasing attributes and outcome attributes are accorded priority as compared to other groups (table 3).

Table 5 indicates the state of importance being given by surveyed companies to attributes pertaining to supplier evaluation criteria. The mean score of all the attributes was also determined on a scale (0-100), arranged in decreasing order (table 6). Quality, reliable delivery, co-operative relationships, exact quantity, technical expertise, price, communication, financial stability of supplier, and frequent delivery are the important sup-

> **Quality, reliable delivery, co-operative relationships, exact quantity, technical expertise, price, communication, financial stability of supplier, and frequent delivery are the important supplier evaluation criteria attributes.**

**Table 2:** Importance of JIT Purchasing Attributes as perceived by respondents

| Attribute | Score | | | | | | Aggregate score |
|---|---|---|---|---|---|---|---|
| | Very Good | Good | Fair | Little | Not at all | No response | |
| | 4 | 3 | 2 | 1 | 0 | | 0-100 |
| *Buyer Action Attributes* (B) | | | | | | | |
| Fewer suppliers | 15 | 8 | 5 | 2 | 1 | – | 77.4 |
| Long term contract | 18 | 6 | 3 | 1 | 3 | – | 78.2 |
| Increased volume to suppliers | 13 | 9 | 7 | – | 2 | – | 75 |
| Supplier evaluation | 18 | 10 | 2 | 1 | – | – | 86.3 |
| Supplier certification | 11 | 7 | 9 | 2 | 2 | – | 68.5 |
| Supplier training and development | 3 | 6 | 8 | 7 | 7 | – | 42.7 |
| Supplier plant audit | 7 | 3 | 5 | 4 | 10 | 2 | 44 |
| Buyer responsible for inbound freight | 7 | 9 | 3 | 7 | 4 | 1 | 56.7 |
| Freight consolidation | 5 | 6 | 10 | 7 | 3 | – | 52.4 |
| Contract carrier | 10 | 8 | 4 | 3 | 5 | – | 62.5 |
| Stable production schedule | 19 | 8 | 2 | 1 | 1 | – | 84.7 |
| Emphasize performance not specifications | 12 | 8 | 3 | 3 | 3 | 2 | 69.8 |
| Reliable network of suppliers | 15 | 14 | 1 | 1 | – | – | 84.7 |
| *Supplier Action Attributes* (S) | | | | | | | |
| Statistical process control | 9 | 6 | 4 | 5 | 7 | – | 54 |
| Close proximity | 6 | 13 | 5 | 2 | 4 | – | 62.5 |
| Quality circle | 18 | 5 | 2 | 1 | 3 | 2 | 79.3 |
| Flexible suppliers | 9 | 10 | 9 | 2 | – | – | 71.7 |
| Reduced set-up | 7 | 10 | 4 | 8 | 2 | – | 59.7 |
| Increased customer support | 17 | 11 | – | 1 | – | 2 | 87.9 |
| *Joint Buyer-Supplier Action Attributes* (B–S) | | | | | | | |
| Mutual trust and co-operative relationship | 21 | 6 | 3 | – | – | 1 | 90 |
| Increased information sharing | 12 | 7 | 9 | 2 | – | 1 | 74.2 |
| Supplier involvement in design | 6 | 6 | 5 | 5 | 7 | 2 | 49.1 |
| Continuous improvement | 13 | 9 | 4 | 3 | – | 2 | 77.6 |
| Joint value analysis programme | 6 | 5 | 7 | 4 | 9 | – | 46 |
| Standardized packaging | 11 | 9 | 6 | 3 | 1 | 1 | 71.7 |
| *Outcome Attributes* (O) | | | | | | | |
| Frequent deliveries | 11 | 8 | 4 | 6 | 2 | – | 66.1 |
| Reliable delivery (on-time) | 20 | 8 | 1 | 1 | – | 1 | 89.2 |
| Small shipment size | 3 | 13 | 3 | 7 | 1 | 4 | 1 |
| Exact quantity | 20 | 7 | 3 | – | – | 1 | 89.2 |
| Reduced delivery lead time | 17 | 6 | 2 | 3 | – | 3 | 83 |
| High quality | 20 | 8 | 1 | – | – | 2 | 91.4 |
| Elimination of receiving inspection | 11 | 4 | 3 | 9 | 1 | 3 | 63.4 |
| Fair price | 12 | 8 | 2 | 4 | 1 | 4 | 74.1 |
| Reduced paperwork | 9 | 9 | 5 | 5 | 1 | 2 | 67.2 |

plier evaluation criteria attributes as perceived by surveyed companies. Proximity, flexibility, and statistical process control have been accorded less priority.

**Table 3:** Importance of JIT Purchasing Attributes of Different Categories

| Attribute Type | Mean Score |
|---|---|
| Buyer actions (B) | 67.9 |
| Supplier actions (S) | 69.2 |
| Joint buyer-supplier actions (B–S) | 68.1 |
| Outcome (O) | 75.9 |

Grand Mean Score = 70.3

**Table 4:** Importance of JIT Purchasing Attributes (in decreasing order)

| Attribute | Mean Score Maximum = 100 |
|---|---|
| High quality | 91.4 |
| Mutual trust and co-op. relationship | 90 |
| Reliable delivery (on-time) | 89.2 |
| Exact quantity | 89.2 |
| Increased customer support | 87.9 |
| Supplier evaluation | 86.3 |
| Stable production schedule | 84.7 |
| Reliable network of suppliers | 84.7 |
| Reduced delivery lead time | 83 |

*(Table 4 Contd.)*

| | |
|---|---|
| Quality circle | 79.3 |
| Continuous improvement | 78.2 |
| Fewer suppliers | 77.6 |
| Increased volume to suppliers | 75 |
| Increased information sharing | 74.2 |
| Fair price | 74.1 |
| Flexible suppliers | 71.7 |
| Standardized packaging | 71.7 |
| Emphasize performance not specifications | 69.8 |
| Supplier certification | 68.5 |
| Reduced paperwork | 67.2 |
| Frequent deliveries | 66.1 |
| Elimination of receiving inspection | 63.4 |
| Close proximity | 62.5 |
| Contract carrier | 62.5 |
| Reduced set-up | 59.7 |
| Small shipment size | 59.3 |
| Buyer responsible for inbound freight | 56.7 |
| Statistical process control | 54 |
| Freight consolidation | 52.4 |
| Supplier involvement in design | 49.1 |
| Joint value analysis programmes | 46 |
| Supplier plant audit | 44 |
| Supplier training and development | 42.7 |

**Table 5:** Importance of Supplier Evaluation Criteria Attributes as perceived by respondents

| Attributes | Scale | | | | | | Mean Score |
|---|---|---|---|---|---|---|---|
| | Very Good | Good | Fair | Little | Not at all | No Response | 0-100 |
| | 4 | 3 | 2 | 1 | 0 | | |
| Quality | 25 | 4 | – | – | – | 2 | 96.6 |
| Reliable delivery | 22 | 4 | 3 | – | – | 2 | 91.4 |
| Frequent delivery | 13 | 5 | 9 | 2 | 1 | 2 | 75 |
| Exact quantity | 19 | 5 | 4 | – | – | 3 | 88.4 |
| Small quantity | 6 | 10 | 9 | 1 | 2 | 5 | 70.2 |
| Technical expertise | 18 | 6 | 4 | – | – | 3 | 87.5 |
| Price | 18 | 5 | 5 | 1 | – | 2 | 84.5 |
| Statistical Process Control | 7 | 7 | 5 | 4 | 5 | 3 | 56.3 |
| Communication | 13 | 12 | 3 | 2 | – | 1 | 80 |
| Product Design & Development | 12 | 5 | 4 | 3 | 2 | 5 | 71.2 |
| Co-operative relationship | 19 | 5 | 2 | – | – | 5 | 91.3 |
| Proximity | 6 | 14 | 5 | 2 | 1 | 3 | 69.6 |
| Flexibility | 10 | 9 | 6 | 3 | 2 | 1 | 68.3 |
| Capital investment | 10 | 10 | 4 | 2 | 2 | 3 | 71.4 |
| Financial stability | 14 | 8 | 6 | – | 1 | 2 | 79.3 |

Grand Mean Score = 78.7

**Table 6:** Importance of Supplier Evaluation Criteria Attributes (in decreasing order)

| Attribute | Mean Score |
|---|---|
| Quality | 96.6 |
| Reliable delivery | 91.4 |
| Co-operative relationship | 91.3 |
| Exact quantity | 88.4 |
| Technical expertise | 87.5 |
| Price | 84.5 |
| Communication | 80.0 |
| Financial stability | 79.3 |
| Frequent delivery | 75.0 |
| Capital investment | 71.4 |
| Product design development | 71.2 |
| Small quantity | 70.2 |
| Proximity | 69.6 |
| Flexibility | 68.3 |
| Statistical process control | 56.3 |

## Concluding Remarks

Many studies have indicated and accepted the potential of JIT purchasing for quality improvement and cost saving. Perfect implementation of JIT purchasing may not be feasible in many Indian industries. However, the system definitely merits trial. Role of supplier is most critical for successful implementation of JIT purchasing. Attention must be focussed on the identified important attributes in the Indian industrial environment so that the maximum benefits can be obtained out of JIT implementation. The study presents a macro view of the state of JIT purchasing in Indian industries. It may be worthwhile to carry out such studies in individual units and a group of the same type of industry based upon turnover, size, product being manufactured etc. to gleana micro view. Delphy study, statistical tests and Analytical Hierarchy Process (AHP) may also be applied to revalidate the results.

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# Economics of Seed vis-à-vis Non-Seed Crops in Punjab

M.S. Sidhu & S.S. Grewal & J.R. Gupta

*The importance of quality seed is a well recognised factor in the augmentation of agricultural production and the level of return from a crop. In fact, no other method of agricultural improvement meets with the level of ready response and adoption from the farmers as the use of quality/improved seeds. This is because it is one of the easier and relatively less costly of improved practices for the majority of crops. The study presents the logistics of seed and non seed crop production in Punjab.*

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The Punjab State is well ahead in the seed improvement and seed development programme in India. The Government of India launched the National Seeds Programme (NSP) Phase I with financial support of the World Bank in 1976 covering four States, viz.: Andhra Pradesh, Haryana, Maharashtra and Punjab. The State of Punjab was selected in NSP-I because it had made rapid strides in the field of agriculture. Blessed with highly fertile and alluvial soil and assured means of irrigation and energetic farmers, Punjab holds a big potential for the production of quality seeds. Punjab has also been one of the main producers of wheat and paddy seed for the National Seeds Corporation (NSC) since its establishment in 1963. Moreover, Punjab had two distinct advantages in the seed production of principal crops like wheat, paddy and cotton: It had the highest yield compared to any other State for these crops and thus had a high seed multiplication ratio (SMR). Secondly, it was surplus in these commodities, thus making it possible to procure seeds at lower cost than in most other States.

> **Blessed with highly fertile and alluvial soil and assured means of irrigation and energetic farmers, Punjab holds a big potential for the production of quality seeds.**

Many factors affect the rate of growth and expansion of the seed industry. The economics of seed production and the procurement price structure that will attract progressive growers to take up seed production as a regular activity are the chief factors responsible for the success or failure of seed development in the country.

## Methodology

A study was undertaken to examine the economics of principal seed and non-seed crops in Punjab. Five principal crops, i.e., wheat, paddy, cotton (American), rapeseed and mustard and potato were selected. These crops occupied about 80 per cent of the total cropped area of the State in 1991-92. A separate list of seed growers for different crops was obtained from the Punjab State Seeds Corporation (PSSC) for the year 1992-93. The PSSC had certified the seed production programme on contract basis in the case of wheat, paddy, cotton (A) and rapeseed and mustard in that year. It did not have any such programme for potato in 1992-93. Therefore, in case of potato, the list of seed growers was taken from the NSC for Punjab.[1]

The growers were randomly selected for different crops. In all, data was collected from 100 seed growers and for each crop, the number depended on the percentage area under the crop to the total cropped area in the State during 1991-92. Thus, 50 growers were selected for wheat, 30 for paddy and 10 for cotton (A). For rapeseed, mustard and potato crops, however, a minimum number of five seed growers each was selected. 21 growers in the sample for different crops had seed production for more than one crop, i.e. two crops. One seed grower of rapeseed and mustard also had wheat and cotton (A) seed production for the PSSC in 1992-93. Thus, the ultimate sample consisted of 58 growers for wheat, 42 for paddy and 12 for cotton (A). The number of growers was five each in case of rapeseed, mustard and potato.

Data was collected from the growers about the size of operational holdings, source of draft power and irrigation, educational qualifications, experience as seed grower, varietal position of seed and on-seed crops, area, production and yield of seed and non-seed crops, area allocated by the public seeds agencies, area actually sown/planted, area rejected due to isolation, diseases, etc., area approved by the certification agency, production of certified seeds, quantum of seeds actually delivered to the PSSC/NSC, price and premium received, storage of seeds, disposal of undersized seeds, rejected seeds, etc. Information was also obtained about the input use and its price in case of selected seed and non-seed crops. Further, data was collected about the sale price of different non-seed crops.

Seed growers in Punjab are mostly large farmers as only those can face the additional costs involved in seed production, late payments, risk of rejection of seed crops, lengthy and cumbersome procedure of certification etc. The overall size of operational holding of the selected seed growers was 32.40 hectares compared to 3.77 hectares for the farmers of the State as a whole.

Further, the cost of cultivation for different crops given for the seed growers was not fully representative of the cost of cultivation for Punjab agriculture in general as the sample seed growers were large farmers. The use of inputs like fertilizer, insecticides/pesticides/weedicides, etc. was high in case of sample seed growers. Their yield of different crops was also high in most of the cases. The data used in the study relates to the year 1992-93. The net returns from the seed and non-seed crops were worked out by deducting the cost of cultivation of the respective crops from the gross returns of these crops.

### Results & Discussion

*Wheat*

The various components of the cost of cultivation of wheat for grain and seed crops for the selected seed growers are given in table 1. Cost of cultivation of wheat for grain and seed crop was about Rs. 10357 and Rs. 11570 per hectare respectively. On raising seed crop, the growers incurred additional operational cost on human labour, machine labour, foundation seed, fertilizer, weedicides, roguing, miscellaneous charges, etc., which worked out to be about Rs. 1094 per hectare. Similarly, the growers incurred an additional fixed cost of about Rs. 120 per hectare on the seed crop. It was

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1. Seed growers/growers mean contract seed growers of the public seeds agencies.

Table 1: Cost of Cultivation of Grain and Seed Crops of Wheat, Paddy and Cotton (A) in Punjab, 1992-93

| Item | Grain crop | %age to total cost | Seed crop | %age to total cost | Grain crop | %age to total cost | Seed crop | %age to total cost | Commercial crop | %age to total cost | Seed crop | %age to total cost |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Operational Cost** | 5756.65 | 55.58 | 6850.32 | 59.21 | 9608.17 | 65.06 | 10758.68 | 67.09 | 10754.19 | 67.51 | 11163.71 | 67.77 |
| Human labour | 1639.58 | 15.83 | 1840.21 | 15.91 | 3212.30 | 21.75 | 3527.88 | 22.00 | 3289.90 | 20.65 | 3376.12 | 20.50 |
| Bullock labour | 134.14 | 1.30 | 134.14 | 1.16 | 208.92 | 1.41 | 208.92 | 1.30 | 542.43 | 3.41 | 542.43 | 3.29 |
| Machine labour | 1188.17 | 11.47 | 1375.63 | 11.89 | 1035.86 | 7.01 | 1328.54 | 8.28 | 864.85 | 5.43 | 864.85 | 5.25 |
| Seed | 481.24 | 4.65 | 835.20 | 7.22 | 180.96 | 1.23 | 244.80 | 1.53 | 278.69 | 1.75 | 329.00 | 2.00 |
| Fertilizer | 1500.76 | 14.49 | 1587.74 | 13.72 | 1683.62 | 11.40 | 1756.17 | 10.95 | 910.32 | 5.70 | 910.32 | 5.53 |
| Manure | 24.07 | 0.23 | 24.07 | 0.21 | 87.77 | 0.59 | 87.77 | 0.55 | 16.89 | 0.11 | 16.89 | 0.10 |
| Weedicides | 350.64 | 3.39 | 370.97 | 3.21 | 1399.58 | 9.48 | 1548.13 | 9.65 | 4184.71 | 26.27 | 4184.71 | 25.40 |
| Irrigation charges | 245.50 | 2.37 | 245.50 | 2.12 | 1482.61 | 10.04 | 1482.61 | 9.25 | 326.24 | 2.05 | 326.24 | 1.98 |
| Roguing | – | – | 161.16* | 1.39 | – | – | 171.66* | 1.07 | – | -- | 209.73* | 1.27 |
| Misc. charges | 18.11 | 0.17 | 68.11 | 0.59 | 25.39 | 0.17 | 76.18 | 0.48 | 14.28 | 0.09 | 65.13 | 0.40 |
| Interest on working capital @ 12.5% p.a. for three months | 174.44 | 1.68 | 207.59 | 1.79 | 291.16 | 1.98 | 326.02 | 2.03 | 325.88 | 2.05 | 338.29 | 2.05 |
| **Fixed Cost** | 4600.17 | 44.42 | 4719.97 | 40.79 | 5160.18 | 34.94 | 5278.07 | 32.91 | 5176.16 | 32.49 | 5308.98 | 32.23 |
| Land rent | 3800.00 | 36.69 | 3800.00 | 32.84 | 4500.00 | 30.47 | 4500.00 | 28.06 | 4800.00 | 30.13 | 4800.00 | 29.14 |
| Land revenue, cesses and taxes | 3.33 | 0.03 | 3.33 | 0.03 | 3.68 | 0.02 | 3.68 | 0.02 | 17.06 | 0.11 | 17.06 | 0.10 |
| Depreciation on implements and farm buildings | 144.03 | 1.39 | 144.03 | 1.24 | 93.87 | 0.64 | 93.87 | 0.59 | 84.26 | 0.53 | 84.26 | 0.51 |
| Registration and inspection fee | – | – | 102.86 | 0.89 | – | – | 104.94 | 0.65 | – | -- | 126.12 | 0.77 |
| Interest on fixed capital | 652.81 | 6.31 | 669.75 | 5.79 | 562.63 | 3.81 | 575.58 | 3.59 | 274.84 | 1.72 | 281.54 | ·171 |
| Total cost (a+b) | 10356.82 | 100.00 | 11570.29 | 100.00 | 14768.35 | 100.00 | 16036.75 | 100.00 | 15930.35 | 100.00 | 16472.69 | 100.00 |

\* Roguing cost included grain loss @ 18.53 kgs. per hectare for wheat, @ 24.71 kgs. per hectare for paddy and @ 12.36 kgs. per hectare for cotton (A).

mainly on registration and inspection fee (Rs. 102.86) per hectare.[2] Thus, the total additional cost on seed crop was about Rs. 1213 per hectare.

The economics of grain and seed crop of wheat with the selected growers is shown in table 2. The gross returns for the grain and seed crops were about Rs. 1664 and Rs. 21155 per hectare respectively. The gross return in case of seed crop was about Rs. 16893 and Rs. 2699 per hectare from processed and undersized seed respectively. The net returns were about Rs. 6307 and Rs. 9584 per

hectare in case of grain and seed crops respectively. The additional net return for seed of wheat crop was about Rs. 3278 per hectare. This was mainly because of the high yield of seed crop (48.69 quintals) in comparison to grain crop (46.02 quintals). Moreover, the price of processed seed given by the PSSC was also high (Rs. 417 per quintal) compared to Rs. 330 per quintal of grain crop. Besides the growers also sold the undersized seed at Rs. 330 per quintal during the lean season. hence, the seed growing for wheat was a profitable proposition for the growers in 1992-93.

*Paddy*

The cost of cultivation of paddy for grain and seed crops with the selected seed growers is shown in table 1. Cost of cultivation of paddy for grain and

2. Registration fee was charged on per grower basis, whereas inspection fee was on per hectare basis. Registration fee on per hectare basis has been worked out by dividing the total registration fee with the area under the seed crop.

**Table 2:** Economics of Grain and Seed Crops of Wheat, 1992-93

| Particulars | Grain crop | Seed crop |
|---|---|---|
| Yield (qtls. per hectare) | 46.02 | 48.69 (raw seed) |
| Processed seed (83.21% of raw seed) | – | 40.51 |
| Undersized seed* (16.79% of raw seed) | – | 8.18 |
| Sale proceeds — processed seed (Rs. per hectare) (40.51 qtls. × Rs. 417.00) | – | 16892.67 |
| Sale proceeds — undersized seed (Rs. per hectare) (8.18 qtls. × Rs. 330.00) | – | 2699.40 |
| Sale proceeds — grain crop (Rs. per hectare) (46.02 qtl. × Rs. 330.00) | 15186.60 | – |
| Value of by-product (Rs. per hectare) | 1476.99 | 1562.68 |
| Gross returns (Rs. per hectare) | 16663.59 | 21154.75 |
| Cost of cultivation (Rs.) | 10356.82 | 11570.29 |
| Net returns (Rs. per hectare) | 6306.77 | 9584.46 |

\* Included inert matter also.

**Table 3:** Economics of Grain and Seed Crops of Paddy, 1992-93

| Particulars | Grain crop | Seed crop |
|---|---|---|
| Yield* (qtls. per hectare) | 64.94 | 67.86 (raw seed) |
| Drying losses @ 5% of raw seed** (3.39 qtls. × Rs. 290.00) – Rs. per hectare | – | 983.10 |
| Yield after drying (qtls.) (67.86-3.39) | – | 64.47 |
| Processed seed (qtls.) (85.60% of raw seed after drying) | – | 55.19 |
| Undersized seed (qtls.)*** (14.40% of raw seed after drying) | . – | 9.28 |
| Sale proceeds — processed seed (Rs. per hectare) (55.19 qtls. × Rs. 386.00) | – | 21303.34 |
| Sale proceeds — undersized seed (Rs. per hectare) (9.28 qtls. × Rs. 290.00) | 18832.60 | – |
| Value of by-product (Rs. per hec.) | 91.26 | 94.73 |
| Gross returns (Rs. per hectare) | 18923.86 | 23996.47 |
| Cost of cultivation (Rs.) | 14768.35 | 16036.75 |
| Net returns (Rs. per hectare) | 4155.51 | 6976.62 |

\* The yield has been taken at 18 per cent moisture content in paddy.

\*\* The drying losses have been taken as per the norm fixed by PSSC.

\*\*\* The undersized seed included inert matter also.

**Note:** The drying losses have been included as a cost component while working out net returns for seed crop of paddy.

seed crops was about Rs. 14768 and Rs. 16037 per hectare, out of which 65 and 67 per cent was operational cost and 35 and 33 per cent fixed cost respectively. The additional operational cost for the cultivation of seed crop worked out to be about Rs. 1151 per hectare. Similarly, for seed crop, an additional fixed cost of about Rs. 118 per hectare was incurred, out of which registration and inspection fee accounted for Rs. 104.94. Hence, the total additional cost on raising one hectare of seed crop of paddy was Rs. 1268.40.

The economics of grain and seed crop of paddy is shown in table 3. The gross returns for the grain and seed crops were about Rs. 18924 and Rs. 23996 per hectare respectively. The gross return of seed crop was about Rs. 21303 and Rs. 2598 per hectare from processed and undersized seed respectively. The net returns were about Rs. 4156 and Rs. 6977 per hectare for grain and seed crop was Rs. 2821.11 per hectare, with the high yield of seed crop (67.86 quintals) compared to grain crop (64.94 quintals). High price of processed seed given by the PSSC (Rs. 386 per quintal) in comparison to Rs. 290 per quintal of grain crop. Moreover, the growers also disposed of the undersized seed at Rs. 280 per quintal during the lean season. Therefore, seed growing of paddy was a profitable enterprise for the growers in 1992-93.

### Cotton (A)

The various components of cost of cultivation of cotton (A) for commercial and seed crops with the selected seed growers are given in table 1. The variety grown as commercial crop was mainly Jhorar[3] which although not recommended by Punjab Agricultural University (PAU) was a high yielder. On the other hand, the varieties multiplied for seed (LH900, LH886, LH1134, F414, F505, F846 and F1054) although recommended and notified, were lower yielders. The cost of cultivation of cotton (A) for commercial and seed crops was about Rs. 15930 and Rs. 16473 per hectare, out of which the operational cost was 67.51 and 67.77 per cent and fixed cost 32.49 and 32.23 per cent respectively. The growers incurred a little additional operational cost on human labour, foundation seed, roguing, miscellaneous charges, etc., which was about Rs. 410 per hectare for the seed crop. Similarly, the additional fixed cost incurred on seed crop was about Rs. 133 per hectare. It was mainly on registration and inspection fee (Rs. 126.12 per hectare). Thus, the total additional cost on raising the seed crop was Rs. 542.34 per hectare.

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3. As reported by the sample seed growers, Jhorar is a local variety of cotton (A) introduced by a farmer of Faridkot District. The study brought out that about 80 per cent area of cotton (A) was under Jhorar variety in Punjab in 1992-93.

**Table 4:** Economics of Commercial and Seed Crops Cotton (A), 1992-93, Rapeseed and Mustard, 1992-93

| Particulars | Cotton (A) 1992-93 | | Rapeseed and Mustard 1992-93 | |
|---|---|---|---|---|
| | Commercial crop | Seed crop | Commercial crop | Seed crop |
| Yield (qtls. per hectare) | 18.07 | 17.53 | 10.98 | 13.48 |
| Sale proceeds—seed crop (Rs. per hectare (17.53 qtls. × Rs. 1095.00) | – | 19195.35 | – | 13298.02 |
| Sale proceeds—commercial crop (Rs. per hectare) | 18973.50 (18.07 qtl. × Rs. 1050.00) | – | 9026.66 (10.98 qtls. × Rs. 822.10) | – |
| Value of by-product (Rs. per hect.) | 586.18 | 562.50 | 109.80 | 115.23 |
| Gross returns (Rs. per hectare) | 19559.68 | 19757.85 | 9136.46 | 13413.25 |
| Cost of cultivation (Rs.) | 15930.35 | 16472.69 | 7719.38 | 8590.05 |
| Net returns (Rs. per hectare) | 3629.33 | 3285.16 | 1417.08 | 4823.20 |

**Note:** There was raw seed system of purchase by PSSC.

**Table 5:** Cost of Cultivation of Commercial and Seed Crops of Rapeseed and Mustard and Potato in Punjab, 1992-93

(Rs. per hectare)

| Item | Rapeseed and Mustard | | | | Potato | | | |
|---|---|---|---|---|---|---|---|---|
| | Commercial crop | Percentage to total cost | Seed crop | Percentage to total cost | Commercial crop | Percentage to total cost | Seed crop | Percentage to total cost |
| **Operational Cost** | 4054.63 | 52.53 | 4776.48 | 55.60 | 16557.66 | 78.32 | 21998.66 | 82.26 |
| Human labour | 1280.61 | 16.59 | 1439.28 | 16.76 | 2681.03 | 12.68 | 2908.19 | 10.87 |
| Bullock labour | 109.47 | 1.42 | 109.47 | 1.27 | 59.86 | 0.28 | 59.86 | 0.22 |
| Machine labour | 506.16 | 6.56 | 506.16 | 5.89 | 2377.91 | 11.25 | 2594.55 | 9.70 |
| Seed | 67.71 | 0.88 | 98.19 | 1.14 | 5930.40 | 28.05 | 10335.60 | 38.65 |
| Fertilizer | 847.23 | 10.98 | 959.91 | 11.17 | 3181.87 | 15.05 | 3181.87 | 11.90 |
| Manure | 14.51 | 0.19 | 14.51 | 0.17 | 234.38 | 1.11 | 234.38 | 0.88 |
| Insecticides/Fungicides | 916.14 | 11.87 | 1163.23 | 13.54 | 1235.53 | 5.84 | 1235.53 | 4.62 |
| Irrigation charges | 185.33 | 2.40 | 185.33 | 2.16 | 494.19 | 2.34 | 494.19 | 1.85 |
| Roguing | – | – | 100.91* | 1.18 | – | – | 432.43* | 1.62 |
| Misc. charges | 4.60 | 0.06 | 54.75 | 0.64 | 24.58 | 0.12 | 73.11 | 0.27 |
| Interest on working capital @ 12.5% p.a. for three months | 122.86 | 1.58 | 144.74 | 1.68 | 337.91 | 1.60 | 448.95 | 1.68 |
| **Fixed Cost** | 3664.75 | 47.47 | 3813.57 | 44.40 | 4584.68 | 21.68 | 4743.84 | 17.74 |
| Land rent | 3000.00 | 38.86 | 3000.00 | 34.92 | 3700.00 | 17.50 | 3700.00 | 13.84 |
| Land revenue, cesses and taxes | | 17.96 | 0.23 | 17.96 | 0.21 | 17.96 | 0.08 | 17.96 |
| Depreciation on implements and farm buildings | 126.67 | 1.64 | 126.67 | 1.47 | 216.04 | 1.02 | 216.04 | 0.81 |
| Registration and inspection fee | – | – | 127.70 | 1.49 | – | – | 136.57 | 0.51 |
| Interest on fixed capita | 520.12 | 6.74 | 541.24 | 6.31 | 650.68 | 3.08 | 673.27 | 2.51 |
| Total cost (a+b) | 7719.38 | 100.00 | 8590.05 | 100.00 | 21142.34 | 100.00 | 26742.50 | 100.00 |

* Roguing cost included crop loss @ 7.41 kgs. per hectare for rapeseed and mustard 2.44 quintals per hectare for potato.

The economics of commercial and seed crop of cotton (A) with the selected growers is shown in table 4. The additional net return from commercial crop was about Rs. 344 per hectare. This was mainly because of high yield of commercial crop (18.07 quintals) in comparison to seed crop (17.53 quintal).[4] This phenomenon is attributed to the cultivation of high yielding Jhorar variety of cotton (A).

The yield of the unnotified variety was more than that of the notified and recommended varieties. PSSC provided a premium of Rs. 45 per quintal on the seed crop but the seed growers reported it to be low. The study brought out that in case the seed crop of cotton (A) was to compete with the commercial crop, an additional premium of Rs. 19.63 per quintal was required, i.e., a premium of Rs. 64.63 per quintal compared to the existing Rs. 45 per quintal.

*Rapeseed and mustard* [5]

The cost of cultivation of rapeseed and mustard for commercial and seed crops with the selected growers is shown in table 5. The cost for commercial and seed crop was about Rs. 7719 and Rs. 8590 per hectare respectively, the total additional cost on raising one hectare of seed crop of rapeseed and mustard was about Rs. 871 in 1992-93.

The economics of the commercial and seed crops of rapeseed and mustard is shown in table 4. The per hectare gross returns in case of commercial and seed crops were about Rs. 9136 and Rs. 13413, while net returns were about Rs. 1417 and Rs. 4823 respectively. The additional net return from the seed crop was about Rs. 3406 per hectare. It was due to high yield of seed crop (13.48 quintals) compared to commercial crop (10.98 quintals). Moreover, for the seed crop, the growers also got a premium of 20 per cent over the market price of commercial produce. Therefore, seed growing of rapeseed and mustard appeared to be a profitable proposition.

*Potato*

The various components of cost of cultivation of potato for commercial and seed crops with the selected growers are given in table 5. The cost of cultivation of potato for commercial and seed crops was about Rs. 21142 and Rs. 26743 per hectare respectively, out of

which the operational costs were as high as about 78 and 82 per cent, and fixed cost about 22 and 18 per cent respectively. For seed crop, the cost of foundation seed alone was about 39 per cent of the total cost while for commercial crop, the seed cost was about 28 per cent. The total additional cost on seed crop was about Rs. 5600 per hectare.

The economics of commercial and seed crop of potato (table 6) shows that the gross returns per hectare were about Rs. 22914 and Rs. 28238 respectively. In case of seed crop, the grower earned Rs. 22155.20 from graded variety and Rs. 6082.35 from oversized/undersized seeds or seeds with cuts. Further, net return was more from commercial crop (about Rs. 1771 per hectare) than seed crop (about Rs. 1495 per hectare). The additional net return from commercial crop was about Rs. 276 per hectare from the sale of produce in the month of January, 1993.

**Table 6:** Economics of Commercial and Seed Crops of Potato for Sale in January, 1993

| Particulars | Commercial crop | Seed crop |
|---|---|---|
| Yield (qtls. per hectare) | 183.31 | 197.81 (ungraded seed) |
| Graded seed (70% of total seed) | – | 138.47 |
| Oversized/undersized seed (30% of total seed) | – | 59.34 |
| Sale proceeds—graded seed (Rs. per hec) (138.47 qtls. × Rs. 160.00) | – | 22155.20 |
| Sale proceeds—oversized/ undersized seed (Rs. per hec.) (59.34 qtls. × Rs. 102.50) | – | 6082.35 |
| Sale proceeds—commercial crop (Rs. per hect.) (183.31 qtls. × Rs. 125.00) | 22913.75 | – |
| Gross returns (Rs. per hectare) | 22913.75 | 28237.55 |
| Cost of cultivation (Rs.) | 21142.34 | 26742.50 |
| Net returns (Rs. per hectare) | 1771.41 | 1495.05 |

This was mainly because of the low price of oversized/undersized tubers. Moreover, after grading, the percentage of tubers with cuts remained high, resulting in low net return. Only nine growers took this programme of certified seed production from the NSC in Punjab during 1992-93. Out of the certified seed delivered to the NSC, 95.24 per cent was again purchased by the same growers for the next crop. The selected growers reported that they put this condition verbally to the NSC staff posted at the Area Office, Jalandhar and it was accepted by them. Whatever the office record of the NSC may reveal, this was the real

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4. The yield of commercial and seed crop is in terms of unginned cotton.

5. Rapeseed and mustard consist of raya, sarson, taramira and toria. But the sample seed growers raised raya and sarson only.

picture reported to the researcher by the sample growers. This analysis revealed that seed production programme of the NSC in case of potato in Punjab was a mere formality in 1992-93. Due to similar problems, the PSSC has almost abandoned the certified seed production programme of potato in Punjab.

> **Seed production programme of the NSC in case of potato in Punjab was a mere formality in 1992-93.**

Table 7: Economics of Commercial Crop of Potato for Sale in September, 1993

| Particulars | Amount in Rs. |
| --- | --- |
| Grading of potato filling stitching of bags etc. @ Rs. 2.00 per quintal | 366.62 |
| Packing material @ Rs. 15.00 per quintal | 2749.65 |
| Transportation charges @ Rs. 5.00 per qtl. | 916.55 |
| Cold storage charges @ Rs. 43.75 per qtl. for season | 8019.81 |
| Interest @ Rs. 12.50% p.a. for seven months on the sale proceeds of commercial crop in January 1993 (i.e. Rs. 22913.75) | 1670.70 |
| Sub-total (1 to 5) | 13723.33 |
| Sale proceeds—commercial crop (Rs. per hect.) (183.31 qtls. × Rs. 285.00) | 52243.35 |
| Total cost borne by grower (Rs. 21142.34 + Rs. 13723.33) | 34865.67 |
| Net returns (Rs. per hectare) | 17377.68 |

The economics of commercial crop of potato further revealed that net returns were about Rs. 17378 per hectare for sale in Jalandhar market in the month of September, 1993 (table 7). The net returns increased in the lean season as the market price was Rs. 285 per quintal in September, 1993 in comparison to Rs. 125 per quintal in January, 1993. The growers had to incur an additional cost of about Rs. 13723 per hectare on cold store, packing material, transportation, etc., for sale in lean season. In spite of these additional costs, the net returns were about ten times more from the sale in lean season in comparison that in the post-harvest period. Keeping in view these facts, the progressive potato growers did not prefer the certified seed production programme of public seed agencies in Punjab.

## Conclusion

The study brought out that wheat, paddy and rapeseed and mustard seed crops raised by the selected contract seed growers were more economical compared to non-seed crops. These three seed crops provided additional net returns to the growers to the extent of about Rs. 3278, Rs. 2821 and Rs. 3406 per hectare respectively in 1992-93. However, the net returns were less in case of cotton (A) and potato seed crops compared to the non-seed crops. The latter provided additional net returns amounting to about Rs. 344 per hectare in case of cotton (A) and about Rs. 276 per hectare for potato (sale of the produce in January, 1993), with net return increasing to about Rs. 17378 per hectare for sale in Jalandhar market in September, 1993.

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# Technical Efficiency in Wheat Production on Reclaimed Alkali Soils

Vijay Paul Sharma & K.K. Datta

*This paper seeks to investigate whether existing wheat yields on reclaimed alkali soils can be significantly increased through improving the efficiency of individual farmers. Production frontiers are estimated and technical efficiencies predicted from primary data collected from Karnal district in Haryana. There were significant degrees of inefficiencies. Overuse of inputs was widespread and was guided by the farmers' perceptions about yield response. These findings indicate that the productivity of wheat can not be sustained by applying higher doses of inputs but the efficiency of these resources can not be ignored.*

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Soil alkalinity is one of the factors which adversely affect crop production and restrict the economic utilization of the available land and water resources, particularly in the arid and semi-arid regions of the country. Out of an estimated area of 8.5 million ha of degraded salt affected soils in the country, over 40 per cent is affected with soil alkalinity (Singh, 1992). The problem of alkali soils occurs primarily in the states of Punjab, Haryana and Uttar Pradesh. To feed the population growing at the rate of more than 2 per cent, there are two options for increasing the agricultural production: bringing more area under cultivation and/or increasing per hectare production per unit time. Land being a scarce resource, further expansion in acreage is possible to a very limited extent only. The per hectare productivity, however, can be increased by adopting appropriate management practices as there exists a wide gap between potential crop yield and the actual yield at the farmers' fields. Therefore, maximization of technical efficiency is the best option to enhance productivity growth where available resources are limited.

> **Maximization of technical efficiency is the best option to enhance productivity growth where available resources are limited.**

The measurement of technical efficiency is challenging in developing and developed countries. There are three distinct approaches to measurement based on profits, costs or production functions. Farrel (1957) developed the concept of technical efficiency based on input-output relationships which can be used empirically to measure technical and allocative efficiencies. Technical inefficiency arises when the observed output from a given input mix is not consistent with cost minimization. The analysis of efficiency should help to identify the

possibilities for increasing output while conserving resource use, the role of increased efficiency may be viewed as a viable complement to any set of policies to stimulate domestic production and/or to promote resource conservation. The present study uses a frontier production function approach to measure the technical efficiency in wheat production on reclaimed alkali soils.

## The frontier production function

Approaches available to study technical efficiency include the frontier production function model. Consider a production function

$$Q = f(m_k) e^u \qquad , u \leq 0 \qquad (1)$$

and in Cobb-Douglas form,

$$\ln Q = a_0 + \sum_{k=1}^{n} a_k \ln X_k + u \qquad , u \leq 0 \qquad (2)$$

$$\ln Q = a_0 + a_1 \ln FERT + a_2 \ln MACH + a_3 \ln HLAB + a_4 \ln IRRI + u \qquad , u \leq 0 \qquad (3)$$

where    Q is the value of out of wheat measured in Rs./ha including by-products

FERT is the value of fertilizers and manures (Rs./ha);

MACH is the machinery cost (Rs./ha);

HLAB is the total labour expenditure per hectare, i.e., wages paid to hired labour and valuation of unpaid family labour

IRRI is the total water costs and

u is the random disturbance term assumed to follow one sided distribution (e.g. truncated normal, gamma, exponential, etc.) and to be independently and identically distributed. In addition, the set of inputs ($X_k$) are assumed to be independent of the disturbances.

Corrected Ordinary Least Squares (COLS) technique is chosen as the most convenient means of estimating Eq. (3). That is, as a first step, Ordinary Least Squares (OLS) technique is applied to Eq. (3), yielding best linear unbiased estimates of $a_k$ coefficients. The intercept estimate is then corrected by shifting the function until no residual is positive and one is zero. Green (1980) has shown that a consistent though biased estimate of $a_0$ which imposes the sign uniformity on the residuals, will be generated by this procedure. The function becomes,

$$\ln Q^* = a_{0*} + a_1 \ln FERT + a_2 \ln MACH + a_3 \ln HLAB + a_4 \ln IRRI + u \qquad , u \leq 0 \qquad (4)$$

## Technical efficiency measures

Equation (3), alongwith the data on actual input and output levels on each farm, provides the information base for the construction of the measures of technical efficiency.

### Kopp measures of technical efficiency

The Kopp (1981) measure of technical efficiency measures the actual level of input use to the level which could be used if the farmer i was located on the frontier, given the actual output of farmer i and given the same ratios of input use.

Let $K_1 = MACH/FERT$, $K_2 = HLAB/FERT$, $K_3 = IRRI/FERT$ and let $FERT^*$, $MACH^*$, $HLAB^*$ and $IRRI^*$ denote the optimum use of inputs on farm i for output level $Q_i$. Then,

$$\ln FERT^* = [\ln Q_i - a_0^* - a_2 \ln(K_1) + a_3 \ln(K_2) + a_4 \ln(K_3) + /\sum_{k=1}^{4} a_k$$

Similarly,

Let, $K_1 = FERT/MACH$, $K_2 = HLAB/MACH$ and $K_3 = IRRI/MACH$, then,

$$\ln MACH^* = [\ln Q_i - a_0^* - a_1 \ln(K_1) + a_3 \ln(K_2) + a_4 \ln(K_3)] / \sum_{k=1}^{4} a_k$$

Let, $K_1 = FERT/HLAB$, $K_2 = MACH/HLAB$ and $K_3 = IRRI/HLAB$, then,

$$\ln HLAB^* = \ln Q_i - a_0^* - Q_1 \ln(K_1) + a_2 \ln(K_2) + a_4 \ln(K_3)] / \sum_{k=1}^{4} a_k$$

Let, $K_1 = FERT/IRRI$, $K_2 = MACH/IRRI$ and $K_3 = HLAB/IRRI$, then,

$$\ln IRRI^* = [\ln Q_i - a_0^* - a_1 \ln(K_1) + a_2 \ln(K_2) + a_3 \ln(K_3)] / \sum_{k=1}^{4} a_k$$

Technical efficiency then may be computed as,

$$TE_I = FERT^*/FERT = MACH^*/MACH = HLAB^*/HLAB = IRRI^*/IRRI$$

## Timmer Measure of Technical Efficiency

The Timmer (1971) measure of technical efficiency of farm is the ratio of actual output to potential output, given the level of input use on farm i. It thus indicates how much extra output could be obtained if a farmer i was on the frontier.

As the revised residuals are defined as

$$e_i = \ln Q_i - \ln Q_i^* \quad i = 1, 2, 3, \text{------}, 70.$$

$$\text{Timmer } TE_i = \exp(e_i) = Q_i/Q_i^* \leq 1$$

If the production function exhibits constant returns to scale, the Timmer and Kobb measures would be identical.

### The data

The basic farm level data for this study pertain to wheat crop grown on reclaimed alkali soils during the crop year 1994-95 in Karnal district of Haryana. Data on farm production, input prices and costs were collected from 70 farmers through survey method. Input costs were measured in terms of prices paid by each farmer for each input. Descriptive statistics for the relevant variables are presented in table 1.

**Table 1:** Descriptive statistics of variables used in the study

| Variable | Unit | Minimum | Maximum | Mean | Std. deviation |
|---|---|---|---|---|---|
| Value of output | (Rs/ha) | 5,795 | 17,360 | 10,961 | 2548 |
| Fertilizer | (Rs/ha) | 806 | 3,234 | 1,941 | 509 |
| Machinery | (Rs/ha) | 1,260 | 3,410 | 2,290 | 535 |
| Human labour | (Rs/ha) | 780 | 1,525 | 1,137 | 144 |
| Irrigation | (Rs/ha) | 325 | 1,133 | 577 | 165 |

## Results & Discussion

The estimates of production function Eq. (3) are given in table 2. The estimated value of $R^2$ is 0.64, implying that the input variables included in the production function explained 64 per cent of the variation in the output of wheat.

Fertilizer, machinery and irrigation had significant positive regression coefficients, indicating thereby a large scope for increasing the wheat output with higher levels of fertilizers, machinery and irrigation water.

Fertilizer, machinery and irrigation had significant positive regression coefficients, indicating a large scope for increasing the wheat output with higher levels of fertilizers.

**Table 2:** Estimates of Cobb-Douglas production function for Wheat crop

| Variables | Coefficients | t-ratios |
|---|---|---|
| Fertilizer | +0.1926 | 2.135 |
| Machinery | +0.2740 | 2.347 |
| Human Labour | +0.2295 | 1.342 |
| Irrigation | +0.2375 | 2.236 |
| Constant | +2.5976 | – |
| $R^2$ | 0.64 | – |
| $\sum_{k=1}^{4} a_k$ | 0.9356 | – |

**Table 3:** Frequency distribution of farmers based on the level of farm-specific technical efficiency from Cobb-Douglas production frontier

| Technical efficiency (TE) | Kopp measure | | Timmer measure | |
|---|---|---|---|---|
| | No. of farmers | Frequency distribution (%) | No. of farmers | Frequency distribution (%) |
| <40% | 1 | 1.43 | 2 | 2.86 |
| 40% <TE <50% | 1 | 1.43 | 1 | 1.43 |
| 50% <TE <60 | 2 | 2.86 | 1 | 1.43 |
| 60% <TE <70% | 36 | 51.43 | 35 | 50.00 |
| 70% <TE <80% | 20 | 28.57 | 19 | 27.14 |
| 80% <TE <90% | 7 | 10.00 | 9 | 12.86 |
| 90% and above | 3 | 4.28 | 3 | 4.28 |
| Mean Efficiency | 71.00 | | 72.00 | |
| S.D. | 11.19 | | 10.73 | |
| Minimum | 36.00 | | 38.00 | |
| Maximum | 100.00 | | 100.00 | |
| Total number of Farmers | 70 | 100.00 | 70 | 100.00 |

The largest positive estimated residual recorded by the sample farmer was 0.3458 and therefore, following the appropriate shift in the intercept, the frontier production function becomes,

$$Q^* = e^{2.5976} \text{ FERT}^{0.1926} \text{ MACH}^{0.2740} \text{ HLAB}^{0.2295} \text{ IRRI}^{0.2375}$$

**Table 4:** Actual and frontier levels of input use (Rs/ha)

| Rank of farmer | Actual use | | | | Frontier use | | | |
|---|---|---|---|---|---|---|---|---|
| | FERT | MACH | HLAB | IRRI | FERT* | MACH* | HLAB* | IRRI* |
| 1 | 955 | 1662 | 1171 | 325 | 955 | 1662 | 1171 | 325 |
| 2 | 955 | 1662 | 1171 | 324 | 890 | 1549 | 1091 | 303 |
| 3 | 2096 | 2416 | 1044 | 443 | 1926 | 2220 | 960 | 407 |
| 4 | 2214 | 2574 | 1525 | 768 | 1970 | 2290 | 1357 | 684 |
| 5 | 1872 | 2790 | 1431 | 1017 | 1649 | 2456 | 1260 | 895 |
| 6 | 2405 | 2554 | 1050 | 625 | 2099 | 2229 | 916 | 545 |
| 7 | 2277 | 2628 | 873 | 1042 | 1964 | 2268 | 753 | 899 |
| 8 | 2046 | 2232 | 880 | 417 | 1763 | 1923 | 759 | 359 |
| 9 | 2096 | 2415 | 1144 | 443 | 1735 | 1999 | 947 | 366 |
| 10 | 2078 | 1835 | 1140 | 482 | 1652 | 1459 | 907 | 383 |
| – | – | – | – | – | – | – | – | – |
| – | – | – | – | – | – | – | – | – |
| 69 | 2009 | 2996 | 1089 | 547 | 1333 | 1943 | 723 | 363 |
| 70 | 1803 | 2624 | 1260 | 578 | 635 | 924 | 444 | 204 |

where $Q^*$ denotes the maximum value of output obtainable for given levels of the inputs.

The frontier production function together with the data on actual output and input levels of each farmer is used for measuring the technical efficiency. The Timmer measure of technical efficiency of $i^{th}$ farmer was obtained by dividing the actual output ($Q_i$) with potential output ($Q_{i*}$), given the level of input use of the farmer. This indicates how much extra output could be obtained if the farmer was on the frontier. The Timmer technical efficiency measures are given in table 3. The sample of farmers has a mean efficiency level of 72 per cent with a standard deviation of 10.73. The Kopp measure of technical efficiency compares the actual level of input use to the optimum use of inputs. The Kopp measures of technical efficiency are also presented in table 3. The Timmer and Kopp measures would be identical, if the production function exhibits constant returns to scale. Since in this study slightly decreasing returns to scale are found, Kopp measures are slightly lower than those of Timmer. However the ranking of efficiency levels is almost the same in both cases.

The average efficiency was more than 70 per cent in both the cases, implying that, on an average, about 30 per cent of the output can be increased without increasing any cost on inputs. Table 3 and the corresponding histograms in figure 1 show the frequency distribution of the estimates of the efficiencies for all farmers. The results show a wide variation across farms. The maximum and minimum efficiencies in the case of Timmer

measure were 38 per cent and 100 per cent, respectively. The corresponding figures in the case of Kopp measures were 35 and 100 per cent. From table 3 it is clear that approximately 44 per cent of the farmers were atleast 71 per cent efficient, 50 per cent of the farmers were 61-70 per cent efficient and only 6 per cent of the farmers were below 60 per cent efficiency.

**Table 5:** Average levels of actual and efficient input use and crop output in wheat crop

| Inputs/Output | Units | actual usage | Efficient usage | Excess use (%) |
|---|---|---|---|---|
| Fertilizer | (Rs/ha) | 1941 | 1285 | 51.05 |
| Machinery cost | (Rs/ha) | 2289 | 1535 | 49.12 |
| Human labour cost | (Rs/ha) | 1137 | 779 | 45.96 |
| Irrigation cost | (Rs/ha) | 576 | 385 | 49.61 |
| Output | (Rs/ha) | 10816 | – | – |
| Output* | (Rs/ha) | 15284 | – | – |
| Change in output | (%) | +41.31 | | |

**Note:** * Efficient level of output at existing level of inputs.

The frontier levels of input use, from which efficiency indices have been calculated, were also computed. The actual and frontier usage of inputs for the ten most efficient farmers and the two least efficient farmers are presented in table 4. The results show that there were considerable differences between the actual and frontier
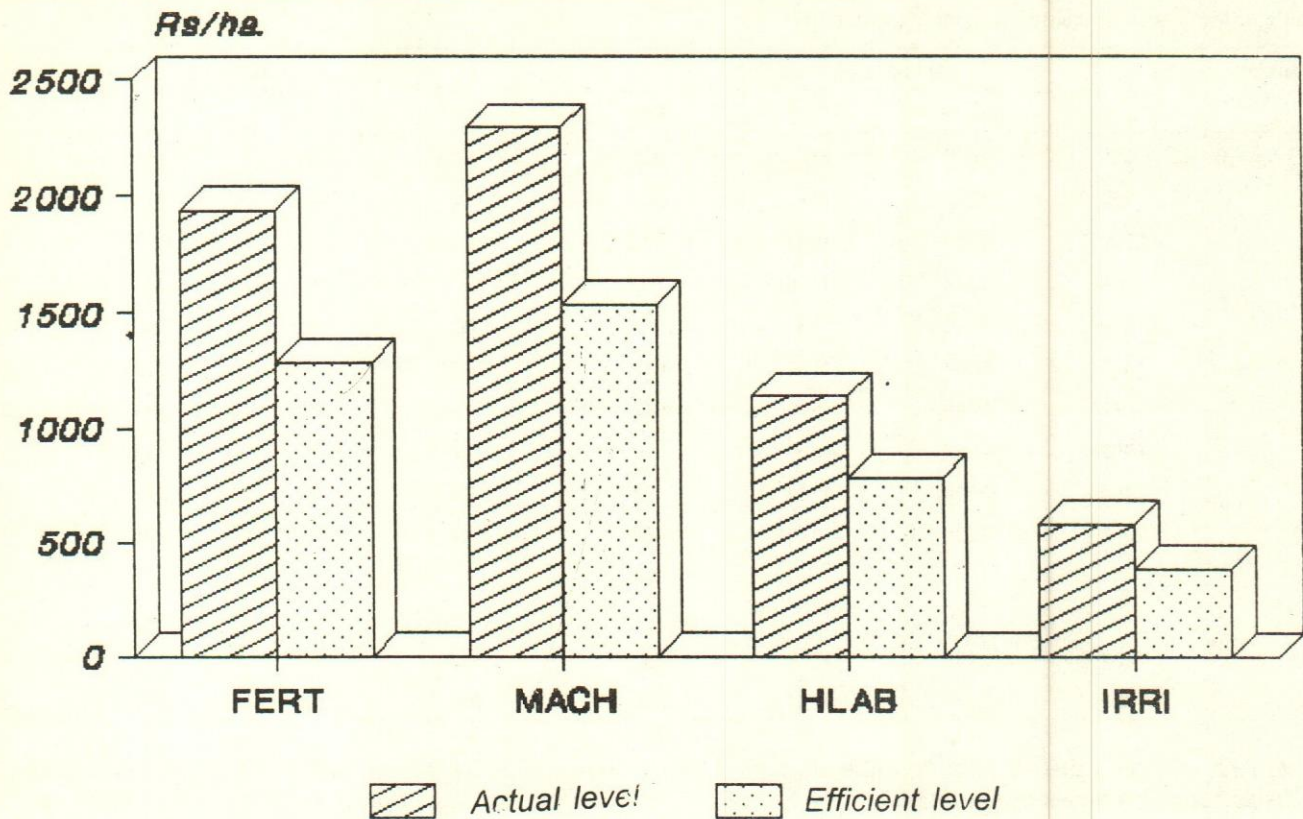
**Fig. 1.** Actual and Efficient Levels of Input Usage in Wheat Production

levels of input use and farmers were excessively using all the inputs. The results also indicated that the level of output of the least efficient farmer would be achieved by an efficient farmer with about 65 per cent less of all inputs.

> **Wheat yields on reclaimed alkali soils can be significantly improved through increasing the efficiency of individual farmers.**

The average levels of actual and efficient input use were calculated and are presented in table 5 and Fig. 1. The results showed that on an average the farmers were using higher levels of inputs varying from 45.96 per cent in case of human labour to 51.05 per cent of fertilizers. The farmers resorted to higher allocation of different inputs in order to increase the crop output. According to Timmer measure of techni-

cal efficiency, Rs. 15,284 per hectare can be obtained at the existing level of input use, if the farmer is technically efficient. Therefore, if the field level technical efficiency could be increased, it is possible to get 41.31 per cent higher output as compared to the actual level of output. The results of this analysis suggest that the existing wheat yields on reclaimed alkali soils can be significantly improved through increasing the efficiency of individual farmers.

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# Optimisation of Farm Income: Compromise Programming Technique

G.N. Nagaraja, S.R. Subramanian & J.V. Venkataram

*The present study assesses the potentialities for increasing farm income and employment through efficient farming systems. The study was conducted in Bangalore rural district of Karnataka in India during 1993-94. The selection of an efficient farming system that will have minimum income variability was considered. The data was analysed using linear programming and its complement multi objective programming and compromise programming. The compromise efficient farm plan would result in maximum increase in the income by 124 per cent for crop + poultry system in marginal farms, 53 per cent for crop + sericulture system in small farms and 85 per cent for crop + dairy + sericulture system in medium farms. The efficient farm plan generates maximum employment from crop + sericulture system in all categories of farms.*

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Population and food production have been increasing in tandem, with human ingenuity and labour contributing to the effort of keeping up with the ever increasing demand for food. In a developing country like India, where the agrarian sector plays a prominent role, the declining trend in the average size of farm holding poses serious problem. The average size of the operational holding has declined from 2.30 hectares (ha) in 1970 to 1.67 ha in 1985. In this context, it is imperative to evolve a suitable strategy for augmenting the income from farms by combining more than one enterprise to increase productivity and supplement the income.

Integration of different enterprises in a farm ensures recycling of residues, optimum resource use, and higher employment, minimises risk and uncertainties and provides for stable farm income. The various enterprises that could be included in farming systems are crop, dairy, poultry, sericulture and fishery. Knowledge of the linkages and complementarities existing among these enterprises will help develop a farming system in which the waste (output) of one enterprise is more efficiently used as input in another within the system. The present study is an attempt in this direction.

> **Integration of different enterprises in a farm ensures recycling of residues, optimum resource use, and higher employment, minimises risk and uncertainties and provides for stable farm income.**

## Methodology

A study was undertaken to assess the potential for increasing farm income and employment through an efficient farming system.

It was conducted in Bangalore rural district of Karnataka, with a sample of 180 farms. The information collected related to the agricultural year 1993-94 from primary and secondary sources. The data was analysed using linear programming and its complement multi-objective programming (MOP) and compromise programming (CP). Further, four objectives, some of them conflicting, were optimised simultaneously in the MOP model – while gross margin and meeting the consumption requirement objectives were maximised, income variability and hired labour were minimised by the decision maker. A set of models were developed by giving weights to different objectives while using CP as a technique of multiple objective optimisation. The main emphasis of the study was to demonstrate the use of MOP and CP in the context of farming system modelling under indian conditions.

## The Mathematical Model

Multi objective programming or vector optimisation technique tackles simultaneous optimisation of several objectives subject to a set of constraints, usually linear. As an optimisation solution cannot be defined for several objectives, MOP is used for obtaining the set of feasible solutions which are efficient (Pareto optimal) solutions rather than to locate a single optimum solution. The elements of this efficient set are feasible solutions such that there are no other feasible solutions that can achieve the same or better performance for all the objectives and strictly better for atleast one objective.

Thus to generate the efficient set, the MOP model could be formulated as:

Eff. $Z_1 (\underline{X}) = [ z, (\underline{X}), z_2 (\underline{X}) .........z_q (\underline{X}) ]$ ⠀⠀⠀(1)

Subject to

$\underline{X} \in \underline{F}$ ⠀⠀⠀⠀⠀⠀(2)

Where

Eff. means the search for the efficient solutions (in a minimising and maximising sense)

$\underline{F}$ ⠀represents the feasible set, and

$\underline{X}$ ⠀indicates the vector of the decision variables.

Compromise programming was used to choose the optimum element from a set of efficient solutions as proposed by Zeleny (1973) and Romero and Rehman (1989). CP starts by establishing the ideal point whose

**When the ideal point is infeasible, the optimum element or compromise solutions is given by the efficient solution that is closer to the ideal point.**

co-ordinates are given by the optimum values of the various objectives of the decision maker. The ideal point is usually infeasible. (If it is feasible then there is no conflict among objectives). When the ideal point is infeasible, the optimum element or compromise solutions is given by the efficient solution that is closer to the ideal point. Thus, the degree of closeness as relative deviation $d_j$ between the $j^{th}$ objective and its ideal value is defined by:

$$d_j = \frac{Z_j^* - Z_j (X)}{Z_j^* - Z_{*j}}$$ ⠀⠀⠀(3)

where $Z_j^*$ and $Z_{*j}$ were the ideal and anti-ideal values for the $j^{th}$ objective. Relative rather than absolute deviations had to be used as the units of measurement of the different objectives were not the same.

$X$ is vector of the decision variables and $Z_j$ is the $j^{th}$ objective function sought to be optimised.

In order to measure the distances between each solution and the ideal point, the following distance function was used:

$$L_p (\delta, K) = \left[ \sum_{j=1}^{k} (\delta_j, d_j) \right]^{1/p}$$ ⠀⠀⠀(4)

where $P$ was taken as 1 $(L_1)$ and $(L_\infty)$ representing the 'longest' and 'shortest' (Chebyseb) distances in the geometric sense. The parameter $P$ in the above expression weights the deviations according to their magnitudes. Greater weight is given to the largest deviation as the magnitude of $P$ increases. Thus with $P = \infty$, the maximum of the individual deviation is minimised, $\delta_j$ represented the weight to $d_j$ signifying the importance of the discrepancy between the $j^{th}$ objective and its ideal value. In the study, four sets of $\delta_j$ were considered to obtain the different compromise solutions under the assumptions of varying weights for the discrepancies. The magnitude of $K$ in the present case was also four i.e., the number of objectives considered for optimisation.

$L_1$ representing the longest distance geometrically was minimised by using the following linear programming problem for obtaining the best compromise farm plan:

**Table 1:** Compromise Farm Plan for Various Farming Systems of Marginal Farms

(Area in hectares)

| Farm enterprises | Crop + dairy farming system | | | Crop + poultry farming system | | | Crop + sericulture farming system | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi | Summer | Kharif | Rabi | Summer | Kharif | Rabi | Summer |
| Dryland | | | | | | | | | |
| Groundnut + red gram (8:2) HYV | 0.38 | – | – | 0.38 | – | – | 0.38 | – | – |
| Ragi HYV + avare | 0.20 | – | – | 0.20 | – | – | 0.20 | – | – |
| Tubewell | | | | | | | | | |
| Tomato hybrid | 0.17 | – | – | 0.17 | – | – | 0.10 | – | – |
| Mulberry M-5 | – | – | – | – | – | – | 0.07 | 0.07 | 0.07 |
| Potato – kufri jyothi | – | 0.07 | – | – | 0.17 | – | – | 0.10 | – |
| Brinjal HYV | – | – | 0.17 | – | – | 0.17 | – | – | 0.10 |
| Tank irrigated | | | | | | | | | |
| Paddy HYV | – | – | 0.03 | – | – | 0.03 | – | – | 0.30 |
| Dairy (No.) | 1.50 | 1.50 | 1.50 | – | – | – | – | – | – |
| Poultry (No.) | – | – | – | 500 | 500 | 500 | – | – | – |
| Net Farm Income (Rs.) | 44,897 (109)[*] | | | 54,838 (124)[*] | | | 66,019 (128)[*] | | |

\* Figures in parentheses indicate percentage to total

$$\text{Min } L_1 = \frac{\delta_j \left[ Z_j^* - Z_j (X) \right]}{Z_j^* - Z_{*j}} \qquad (5)$$

subject to

$$X \in F \qquad (6)$$

where

$F$ is the set of all feasible farm plans and

$X$ is the vector of the decision variables

$X \in F$ thus denotes the linear constraints and non-negativity restrictions being component of the standard LP problem.

For $L = \infty$ where the maximum of the individual deviations is minimised, the best compromise farm plan was obtained by solving the following linear problems:

$$\text{Min } L_\infty = d_\infty \qquad (7)$$

subject to

$$\frac{\delta_1 \left[ Z_1^* - Z_1 (x) \right]}{Z_1^* - Z_{*1}} \le d_\infty \qquad (8)$$

$$\frac{\delta_n \left[ Z_2^* - Z_2 (x) \right]}{Z_2^* - Z_{*2}} \le d_\infty \qquad (9)$$

$$\frac{\delta_n \left[ Z_n^* - Z_n (x) \right]}{Z_n^* - Z_{*n}} \le d_\infty \qquad (10)$$

$$X \in F \qquad (11)$$

It is established now that $L_1$ and $L_\infty$ matrix defined the two bounds of all compromise solutions. Thus all other best compromise solutions fall between them.

**Results & Discussion**

The compromise programming technique used was able to bring about compromise solutions among the different conflicting objectives of the absolute deviation between each solution and its ideal point is minimum.

*Efficient set for various farming systems*

The compromise efficient farm plan under various farming systems of marginal farms is furnished in table 1. The result recommended only a 7 crop enterprise as compared to 15 crops presently being cultivated by the farms. The recommendation in crop + sericulture farming system was 0.10 hectare (ha) of tomato hybrid and 0.07 ha mulberry M-5 for all three seasons of the year. The crop included in rabi was 0.17 ha of potato – kufri

**Table 2:** Compromise Farm Plan for Various Farming Systems of small Farms

(Area in hectares)

| Farm enterprises | Crop + dairy farming system | | | Crop + poultry farming system | | | Crop + sericulture farming system | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi | Summer | Kharif | Rabi | Summer | Kharif | Rabi | Summer |
| Dryland | | | | | | | | | |
| Ragi HYV + avare | 0.20 | – | – | 0.20 | – | – | 0.20 | – | – |
| Groundnut + red gram | 1.30 | – | – | 1.03 | – | – | 1.03 | – | – |
| Tubewell | | | | | | | | | |
| Tomato hybrid | 0.52 | – | 0.38 | 0.52 | – | 0.38 | 0.18 | 0.14 | 0.18 |
| Potato – kufri jyothi | – | 0.52 | – | – | 0.52 | – | – | 0.18 | – |
| Cabbage hybrid | – | – | 0.14 | – | – | 0.14 | 0.14 | – | 0.14 |
| Mulberry M-5 | – | – | – | – | – | – | 0.20 | 0.20 | 0.20 |
| Tank irrigated | | | | | | | | | |
| Paddy HYV | – | – | 0.21 | – | – | 0.21 | – | – | 0.21 |
| Dairy (No.) | 2.00 | 2.00 | 2.00 | – | – | – | – | – | – |
| Poultry (No.) | – | – | – | 600 | 600 | 600 | – | – | – |
| Fisheries (fingerlings) | – | – | – | – | – | – | – | – | – |
| Net Farm Income (Rs.) | 62,893 (38)* | | | 72,713 (43)* | | | 98,504 (53)* | | |

\* Figures in parentheses indicate percentage to total

Table 2 Contd.)

| Farm enterprises | Crop + fisheries farming system | | | Crop + dairy poultry farming system | | | Crop + dairy sericulture farming system | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi | Summer | Kharif | Rabi | Summer | Kharif | Rabi | Summer |
| Dryland | | | | | | | | | |
| Ragi HYV + avare | 0.20 | – | – | 0.20 | – | – | 0.20 | – | – |
| Groundnut + red gram (8:2) HYV | 1.30 | – | – | 1.03 | – | – | 1.03 | – | – |
| Tubewell | | | | | | | | | |
| Tomato hybrid | 0.52 | – | 0.38 | 0.52 | – | 0.38 | 0.40 | – | 0.26 |
| Potato – kufri jyothi | – | 0.52 | – | – | 0.52 | – | – | 0.40 | – |
| Cabbage hybrid | – | – | 0.14 | – | – | 0.14 | – | – | 0.14 |
| Mulberry M-5 | – | – | – | – | – | – | 0.12 | 0.12 | 0.12 |
| Tank irrigated | | | | | | | | | |
| Paddy HYV | – | – | 0.21 | – | – | 0.21 | – | – | 0.21 |
| Dairy (No.) | – | – | – | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Poultry (No.) | – | – | – | 300 | 300 | 300 | – | – | – |
| Fisheries (fingerlings) | 250 | – | – | – | – | – | – | – | – |
| Net Farm Income (Rs.) | 36,759 (47)* | | | 71,946 (31)* | | | 81,171 (38)* | | |

\* Figures in parentheses indicate percentage to total

jyothi and 0.17 ha of brinjal HYV in summer for crop + dairy, and crop + poultry systems. In crop + sericulture farming systems, it was suggested to have 0.10 ha of brinjal HYV. Due to the economic rationale of the farmers to mix subsistence enterprises with a commercial enterprise, even while selecting commercial enterprise the plan took into consideration the risk—return trade-off. The other enterprises included 1.50 cross bred dairy cow and 500 poultry fowls for crop + dairy and crop + poultry systems. Thus the by product of one enterprise could form the input of the other enterprise.

**Table 3:** Compromise Farm Plan for Various Farming Systems of Medium Farms

(Area in hectares)

| Farm enterprises | Crop + dairy farming system | | | Crop + poultry farming system | | | Crop + sericulture farming system | | |
|---|---|---|---|---|---|---|---|---|---|
| | Kharif | Rabi | Summer | Kharif | Rabi | Summer | Kharif | Rabi | Summer |
| Dryland | | | | | | | | | |
| Pure red gram HYV | 1.59 | – | – | 1.59 | – | – | 1.59 | – | – |
| Ragi HYV + avare | 1.00 | – | – | 1.00 | – | – | 1.00 | – | – |
| Tubewell | | | | | | | | | |
| Tomato hybrid | 0.36 | – | 0.12 | 0.36 | – | 0.12 | 0.36 | – | 0.88 |
| Brinjal HYV | 0.82 | – | – | 0.82 | – | – | 0.58 | – | – |
| Mulberry M-5 | – | – | – | – | – | – | 0.24 | 0.20 | 0.24 |
| Cabbage hybrid | – | 1.18 | – | – | 1.18 | – | – | 0.94 | 0.14 |
| Tank irrigated | | | | | | | | | |
| Paddy HYV | – | – | 0.24 | – | – | 0.24 | – | – | – |
| Dairy (No.) | 3.00 | 3.00 | 3.00 | – | – | – | – | – | 0.24 |
| Poultry (No.) | – | – | – | 1,000 | 1,000 | 1,000 | – | – | – |
| Fisheries (fingerlings) | – | – | – | – | – | – | – | – | – |
| Net Farm Income (Rs.) | 1,07,178 (80)* | | | 1,14,860 (67)* | | | 1,24,201 (52)* | | |

* Figures in parentheses indicate percentage to total

(Table 3 Contd.)

| Farm enterprises | Crop + dairy farming system | | | Crop + poultry farming system | | |
|---|---|---|---|---|---|---|
| | Kharif | Rabi | Summer | Kharif | Rabi | Summer |
| Dryland | | | | | | |
| Pure red gram HYV | 1.59 | – | – | 1.59 | – | – |
| Ragi HYV + avare | 1.00 | – | – | 1.00 | – | – |
| Tubewell | | | | | | |
| Tomato hybrid | 0.36 | – | 0.12 | 0.35 | – | 0.12 |
| Brinjal HYV | 0.82 | – | – | 0.68 | – | – |
| Mulberry M-5 | – | – | – | 0.14 | 0.14 | 0.14 |
| Cabbage hybrid | – | 1.18 | – | – | 1.04 | – |
| Tank irrigated | | | | | | |
| Paddy HYV | – | – | 0.24 | – | – | 0.24 |
| Dairy (No.) | – | – | – | 2.00 | 2.00 | 2.00 |
| Poultry (No.) | – | – | – | – | – | – |
| Fisheries (fingerlings) | 400 | 400 | 400 | – | – | – |
| Net Farm Income (Rs.) | 77,247 (79)* | | | 1,11,137 (85)* | | |

* Figures in parentheses indicate percentage to total

The efficient farm plan for various farming systems of small farms is presented in table 2. It suggests increased area under mulberry M-5. This is due to the low income variability of this crop thereby minimising farm income risk. Production of ragi, paddy and milk would be more than the domestic consumption requirement in the compromise plan. The excess production can be marketed for income. Cowdung and sericulture waste produced in the farm could be used for a biogas plant to generate gas for cooking and lighting purposes. The digested cowdung could be recycled as a manure to increase the productivity of the soil.

**Table 4:** Labour Employment in Compromise Farm Plan

(Men, Women & Bullock labour days)

| Farming system | Marginal farms | | | Small farms | | | Medium farms | | |
|---|---|---|---|---|---|---|---|---|---|
| | Men | Women | Bullock | Men | Women | Bullock | Men | Women | Bullock |
| Crop + dairy farming system | 528 (31) | 498 (12) | 88 (12) | 631 (27) | 391 (26) | 167 (14) | 741 (44) | 389 (34) | 232 (12) |
| Crop + poultry farming system | 522 (24) | 546 (38) | 86 (9) | 612 (43) | 386 (45) | 169 (11) | 744 (32) | 397 (25) | 239 (11) |
| Crop + sericulture farming system | 572 (55) | 547 (18) | 108 (15) | 668 (46) | 458 (32) | 183 (1) | 802 (52) | 487 (67) | 250 (16) |
| Crop + fisheries farming system | – – | – – | – – | 569 (28) | 478 (36) | 154 (14) | 723 (29) | 359 (37) | 224 (14) |
| Crop + dairy + poultry farming system | – – | – – | – – | 641 (32) | 536 (24) | 151 (11) | – – | – – | – – |
| Crop + dairy + sericulture farming system | – – | – – | – – | 662 (33) | 574 (27) | 156 (7) | 742 (41) | 378 (38) | 238 (18) |

(Figures in parentheses indicate the increase in employment in days over the existing farming system)

> **The efficient farm plan for farming systems of small farms It suggests increased area under mulberry M-5. Due to the low income variability of this crop thereby minimising farm income risk.**

The details of the compromise efficient plan under various farming systems is given in table 3. It could be seen from the table that there is an increase in the farm income by 85 per cent in the crop + dairy + sericulture system, 80 per cent in crop + dairy system and 79 per cent in crop + fisheries farming system. The increase in income might be due to the fuller utilisation of land under tubewell irrigation. The result also revealed that based on the weightage given to each objective includes seven crop enterprises consisting of a combination of subsistence crops (ragi and paddy) to meet domestic consumption requirements and commercial crops like tomato hybrid, cabbage hybrid and potato — kurfi jyothi and sericulture.

*Labour employment*

The details of employment in the compromise efficient plan are presented in table 4. It could be seen from the table that the plan would generate 31, 24 and 55 mandays, 12, 38 and 18 womandays and 12, 9 and 15 bullockdays of additional labour in crop + dairy, crop + poultry and crop + sericulture farming systems, respectively, in marginal farms over the existing level of employment. The efficient farm plan of small farms would provide increased employment over the existing system to an extent of 46, 43 and 33 mandays, 32, 45 and 27 womandays and 11, 11 and 7 bullockdays in crop + sericulture, crop + poultry and crop + dairy + sericulture systems, respectively. For medium farms, the compromise plan for crop + dairy + sericulture system would increase employment by 55, 44 and 41 mandays, 67, 34 and 38 womandays and 16, 12 and 18 bullock days, respectively.

## Conclusions

The efficient farming systems developed through compromise programming exhibited potential for realising higher income and employment. Labour availability in the farms (particularly family labour) encourages crop + sericulture farming system intensively in all categories of farms. In this context, there is a further role that the farming systems specialists should play in training the extension workers with respect to whole farm approach. The CP approach aids arriving at the decision regarding the most efficient farming system which in closer to reality than the one obtained by optimising a single objective as is normally done by a majority of farm management experts at present.

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# Book Reviews

Planning and Economic Policy in India: Evaluation and Lessons for the Future. Ed. by *Manabendu Chattopadhyay et al.,* Sage Publications, New Delhi, 1996, p. 215, Rs. 275.

Eminent macroeconomists, developments experts and policy planners gathered at the sprawling campus of Amrapali in Calcutta sometime in 1993 to pay centennial tribute to Professor P.C. Mahalanobis. An outcome of the prestigious conference is the present volume titled Planning and Economic Policy in India: Evaluation and Lessons for the Future edited by Manabendu Chattopadhyay, Pradip Maiti and Mihir Rakshit. As the title of the book suggests, the ten chapters of the volume have a common theme of evaluating Indian development planning in general and the Mahalanobis strategy in particular and have drawn lessons for the future course of planning in the perspective of recent attempts of globalisation and liberalisation.

The editors to the volume in their introduction set the tone by putting the rest of the chapters in a perspective and providing a broad review of each of them. Chapters 2 to 6 evaluate the plan strategy followed in India since the mid-fifties. But the perception of the papers differ leading to different conclusions. Rangarajan and Parikh, for instance, are of the view that planning of the Mahalanobis type is no longer valid in the present, and planning of the indicative type has to hold good in this new era. This view is at variance with that of especially Bose or for that matter, even Guha or Sengupta. Chapters 7 to 10 deal with different aspects of economic development in India such as growth and poverty, employment and agricultural growth, determinants of industrial production, and the impact of the current stabilisation programme on fiscal deficit, inflation and growth which would guide in formulating future economic policies both at the aggregate and the sector specific levels.

The main outcome of the Mahalanobis strategy is in terms of the development of the wide industrial base. The study by Rao and Maiti identifies the bottlenecks, both demand and supply, which constrain the growth of industrial output during 1951 to 1990. In the case of consumer goods industries, it is found that the demand side variables consisting of autonomous expenditure and agricultural output provide a fairly good explanation. Though government intervention has direct impact on the capital goods output for the eighties, the study re-iterates the earlier findings of import of capital goods substituting domestic production during the period after 1959-60. This seems to support the view that with the creation of substantial capacities in the capital goods industries during the second plan period, it became a largely demand constrained sector. This fact falsifies the Mahalanobis belief of demand being generated in the process of growth. However, experience during the nineties does not lend support to the above findings on substitution between production and imports of capital goods.

The Mahalanobis strategy is often accused of ignoring agricultural production. In this context, Vaidyanathan does not find enough meaning in treating agriculture as a separate sector as the later input-output models of planning did. Vaidyanathan deals with agricultural growth and the associated causes for such growth, but views that the pool of received knowledge on the issue is far from consensus.

The other important dimension of the growth process during the plans has been the growth in merchandise trade. The faults with the Mahalanobis scheme lay with the total neglect of the effective demand and generation of investible resources from export surplus. Rangarajan (p. 31) stresses that the Mahalanobis outcomes considerably change when trade is introduced into the model. The ISI regime, as received wisdom suggests, has been most detrimental to the merchandise trade sector via the overvaluation of the exchange rate and the resultant anti-export bias. However, in the present volume, there is no specific discussion on the impact of the ISI regime on the external sector during the plans and the future course ahead. This is the only serious shortcoming of this volume. This assumes importance when the domestic market loses primacy in the context of unification of the global market with India

adapting less to the changing global order when compared to some other developing countries who depended on trade for higher growth.

The other consideration of the plan is growth trickling down to reduce inequality and poverty. While Guha highlights that it is due to the contradictions in the ISI scheme the prevalent inequality in the economic system has deepened, Bose views that it is not the fault of the strategy per se but it is the private industrialists and big farmers who manipulated the gains of the process of growth to their utility and hence accentuated the inequality in the economy.

Tendulkar's paper addresses this precise question of trickle down. Using fractile graph dominance and Lorenz dominance criteria and various poverty indices, Tendulkar shows that during the eighties, with rapid increase in per capita GDP, growth led to improvements not only in social welfare but also reductions in social deprivations in all its different dimensions.

But the eighties also witnessed the emergence and gradual expansion of public action in the realm of poverty alleviation. Rangarajan views that the direct intervention for poverty eradication does not show that trickle down does not hold good, but on the other hand shows that it is insufficient to take care of poverty. However Tendulkar's contention is that the scope of such programmes was limited mainly to the rural population. The distributional outcome, thus, for the urban population has to be attributed to the growth process alone as PDS, the only urban public action, was untargeted to the urban poor. Nevertheless, these programmes have certainly provided consumption supplement to the poor households. Though public distribution or drought relief certainly helped in relieving the acute distress caused by harvest failure, their lasting impact on raising the economic viability of the poor household remains doubtful. The decomposition exercise by Tendulkar however gives only indirect support to this fact. It is often found that, with structural adjustment in place, incidence of poverty increases along with the slow down in the rate of economic growth.

It is on the latter issue that Balakrishnan has provided some incisive insights in his progress report on stabilisation experience.

Most of the studies have identified the future course of development planning through development in physical infrastructure such as irrigation, energy, transport and communication with public sector involvement clearly defined. The other aspect of planning would be to improve social infrastructure by making provisions for primary health care facilities, basic primary education,

population control and environment. The development of social infrastructure can be a way to skill accumulation essential for development.

The promotion of agriculture also assumes prime importance, as the chapters 7 to 10 bring out, especially during the future ahead. In addition, the editors have identified such unresolved issues as 'savings, investment and growth', 'efficiency and public intervention' and 'economic reforms and poverty alleviation', studies on which would help the future course of planning in India.

The articles in this volume clearly bring out the erudition of the scholars on the respective issues. The editors to the volume were careful enough to make it a rich tribute to the scholarship of Mahalanobis on policy planning. The directions provided by these articles should be referred to at every stage in future, especially when the Ninth plan is in the making, so that the earlier mistakes of planning are not repeated!

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**Reclaiming Higher Ground — Creating Organisations that Inspire the Soul, by _Lance H.K. Secretan,_ Response Books (A Division of Sage India Pvt. Ltd.), New Delhi, p. 258, Rs. 450 (HB).**

Human resource development (HRD) has become a catchword in the last decade — many corporate think-tanks are focussing on it probably as a panacea for all organisational ills. A number of HRD instrumentalities are being used or suggested to enhance employee morale and productivity. Concepts like teams, TQM, employee empowerment, career planning have become buzzwords. Secretan, a former management professor and now a consultant to some high performance organisations in U.S.A., through this path-breaking book, aims at proving that we have hit the wall with the current management theory so far as these issues are concerned.

Traditional HRD processes and concepts such as downsizing, re-engineering reflect just doing "more of the same things faster". The hallmark of this book is its assumption that instead of looking for ready answers in concepts such as those mentioned, we rather need to raise questions to comprehensively understand the way people and organisations work.

Most questions that Secretan has raised relate to the growing conflict between the needs of the personality and

of the soul. He argues that the management theory has abandoned souls in favour of personalities. Emphasis on the latter provides only temporary, management-by-cliché solution and nourishes only exploitative tendencies such as greed, selfishness and power. Apart from the introduction and the epilogue, the book consists of 18 chapters which are broadly classified into three parts. Part one is titled, The Heart; part two, The Mind; and part three, the Bottom Line. A whole range of issues have been discussed, which are eventually aimed at making the workplace a sanctuary whereby working people are enabled to realise a deeper meaning of life.

Secretan emphasizes that a sanctuary is "not a collection of parts but integrated system of souls".

A sanctuary is a condition of serenity, inspiration, love and personal development. It is a place that beckons us because it speaks directly to the needs of the soul. In a personality driven, mechanical organisation, 80 per cent of the employees hate their work and distrust their leaders because the organisation has lost its soul. In a sanctuary, work and life are sacred. This is the environment in which the soul is able to exercise its one essential birthright, which is to express itself—to be real.

In Secretan's conception of sanctuary, people demonstrate such feelings: "I want to work; I love what I do; I love the people I work with; my work is special part of my life; and I am having fun!" (p. 235). How could such a state be achieved? Among others, the points that he elaborates are: the role of corporate democracy in freeing the soul; value shifts; promise-keeping; courage to live with grace; alchemy of the soul; blithe spirit; designing reward systems for the soul; and environments that make soul.

As is evident, the policy of liberalization and globalization has led to unitarist workplace governance structures, and in most cases even to unbridled individualism. Some of the direct consequences of this dispensation are: competition, downsizing, intimidation, dilution of the efficacy of employee collectives, and eventual loss of employee morale. In their effort to cope with such a situation managers should consider Secretan's proposition of soul nourishing very seriously. The new dispensation is fraught with the added dangers of employee alienation. And this is likely to be a dominant concern of an increasing number of managers, meriting a fuller articulation of Secretan's argument. Some readers might dismiss his formulations as idealistic or Utopian. But he cites a number of organisations where focus on soul is being practised successfully e.g. Mary Kay Cosmetics, The Body Shop, Digital Equipment, IBM and Northern Telecom. Interestingly, the Body Shop proposes a strategy that the workplace should be made a soulspace that becomes a little more like home.

Secretan's thesis can surely be interpreted as a facet of the social responsibilities of business; but his approach is not of philanthrophy. He has in effect articulated a strategic human resources development model (though he has refrained from using this term)—a model in which the present HRD policies of most companies, including MNCs, don't even fall on fringe. His model of Reclaiming Higher Ground is one that requires on the part of managers, emotional maturity, patience, courage, and listening.

Despite the immense merits of this book, the reader encounters a serious problem in the analysis made. Secretan is completely silent on the adverse influence of the liberalization policies on trade unions almost all over, and the relationship of these developments on his "soul nourishment". The pluralist perspective of industrial working which is manifestly fading away, postulates that employees as interest groups have an innate desire to form collectives so as to fulfil their need for self expression on workplace matters and also to demonstrate their countervailing power. But the soul nourishing model is completely silent on this aspect. It appears, he doesn't consider it essential that in order to derive fulfilment employees should form unions. Had he expressed himself on this aspect, his argument would have been more comprehensive and convincing. This book was first published by Macmillan Canada in 1996. Within a short period the Indian edition has been brought out, which is a great service to the Indian reader. The book contains a seminal work in strategic HRM, as well as in corporate social responsibilities, interestingly though Secretan doesn't use any of these two terms in his model. I recommend this book as an essential reading for all managers especially CEOs, academics as well as MBA students. And, they should read it from cover to cover. It is full of novel perspectives—both in terms of thinking and action.

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**Voluntary Retirement; Problems and Prospects of Rehabilitation; by *B.P. Guha*, Shri Ram Centre for Industrial Relations and Human Resources, Jhandewalan Extn., New Delhi 1996, p. 224, Rs. 275.**

The economic reforms in India initiated in mid-eighties and pursued with vigour since the beginning of this decade have become accepted as irreversible.

These economic reforms have been and are being widely discussed under the term New Economic Policy (NEP) since its announcement in 1991. The employer's support to this policy has been forthcoming in the background of likely enhanced returns on their investments. It is the workers who had rather been apprehensive about the NEP, primarily, because of its likely effect on their employment. However, while the process of the reforms is gaining momentum over the years with debates and critiques from different segments of the society trying to analyse the several specific features of the reform process, there has hardly been any effort to take a comprehensive look into its most vital component which is rehabilitation of surplus labour generated out of the reform initiative.

The book under review is the first comprehensive and authentic treatise on voluntary retirement — problems and prospects of rehabilitation in the Indian context. This book is based on the research study — 'Rehabilitation After Voluntary Retirement — Problems and Prospects' sponsored by Ministry of Finance and Fredrich Ebert Stiftung (FES). Therefore, its conclusion and recommendations are more reliable than many seminar and symposium papers which are based on opinions and hunches of individuals or class of people.

The author has dealt with the entire subject in six comprehensive chapters. The author builds the conceptual framework of labour redundancy and restructuring from the first industrial revolution and presents the economic reforms in the global context by aptly describing the Indian scenario and its legal protection of employment. The experiences of some developed, developing and underdeveloped countries in voluntary severance like Bangladesh, China, Pakistan, Japan, U.K., U.S.A., Canada and Scandinavian countries like Norway and Sweden have been highlighted and the relevance to Indian scenario has been summed up at the end.

Then the author dwells upon the genesis of the study, and the sample size, region, industrial sector (states, city and no. of workers) chosen, and infrastructure available for conducting the study. He also gives the reasons for voluntary retirement being initiated by workers as well as the management of the unit and also the external factors of Government policy, changing economic environment etc. He openly admits that the analysis and inference drawn in this book be viewed as indicative but not as representative because the sample was small compared to the vastness of our country.

Next the author describes the VR package, its kind and quantum, pattern of utilisation, its impact on the economic and social life of V.R. workers, reaction and response of V.R. workers on the status in family and society after taking V.R.S. Describing the various aspects of the social, economic and family relations of workers after V.R. the author pleads for the maintenance of the social fabric (family relation) of the Indian Society and advises the younger members to look after the elders. Family is the only institution which supports the workers in their hour of crisis morally, psychologically and physically in the absence of any other comprehensive social security system in India unlike other developed countries.

The utilisation of VRS package and its impact on the voluntarily retired workers, their families and the society are next described. Priority items for expenditure of VRS money have been found to be land, savings, education, marriage and settlement of children, repayment of debts, construction of house and other social obligations. Those workers who were educated and literate and planned their VR well ahead in time and invested their money judiciously enhanced their status in the family and society whereas those who were uneducated did not plan their VR and wasted their money in unproductive items suffered in status.

Initiatives taken for Rehabilitation by Govt. under NRF (National Renewal Fund) are then described. The results of the survey conducted, training imparted to rationalised workers age wise, trade wise and location wise by five EACs (Nodal agencies), namely Gandhi Labour Institute, (Ahmedabad), ASSOCHAM (Kanpur), SISI (Indore), CII (Bombay), NSIC (Calcutta) are delineated. This not only gives the result of the efforts in rehabilitation but also fares as a comparative study of effort and factors of the five nodal agencies. Though 10 more nodal agencies at 49 different locations have been established by the Dept. of Industrial Development, Ministry of Industry in the second phase of programme, the author expresses his inability to report about them. Some corrective measures for the shortcomings in the rehabilitation scheme have also been suggested which will be helpful for policy makers and implementors in correcting their formulation and actions in future.

The author concludes by clearing some misgivings about VRS and its impact. Some suggestions given in the book like greater transparency in negotiation about VRS package and manpower rationalisation, faster clearance of legal bottlenecks in rehabilitation, making contributory pension as the ideal safety net, involvement of management and Trade Unions in the rehabilitation process and associating NGOs, with the creation of V.R. fund are worth considering in making rehabilitation a real success.

The author could have avoided clubbing expenditure on education with unproductive items such as pay-

ment of old dues, marriage expenditure etc. Education is one of the most appropriate investments. Had the author included examples of countries like Mexico & Brazil alongwith other countries where this effort has failed, it would have given a more comprehensive picture about the subject.

However, based on research this book is a good (of course first) treatise about the problems and prospects of rehabilitation which should be gone through by all policy makers, management experts, executives, Trade-Union leaders, researchers and social workers engaged in social safety net and rehabilitation programme.

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**Show Me: The Complete Guide to Storyboarding and Problem Solving by** *Harry I. Forsha,* **Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1996, p. xv + 300, Rs. 295.**

The Storyboard, as an instrument is a powerful visual medium which can be used to convey interesting stories as well as to solve complex problems. By combining pictures, words and numbers (the basic elements of a Storyboard) important messages and precise information could be delivered. A striking example of Storyboards is the 'Cave paintings' which provide inspiring accounts of bygone eras.

Clearer thinking, improved organisational relationships and more effective problem solving are just a few of the results that come from using Storyboards. Besides advertising industry, Storyboards find application in Management, Quality Control, Engineering Research and Education etc.

This book under review exemplifies 'Practice What You Teach' philosophy. Written in a lucid style, the reader is invited to explore the field of storyboarding as a meta-tool. The book urges one to open closed doors, inculcate the art of making effective presentations, to indulge in mind mapping, and to develop better communication skills by using Storyboarding techniques.

The book delves on—how to use quality improvement tools, importance of team work, and selection of suitable problem solving techniques in order to construct an emphatic Storyboard. The author succinctly points out that since everyone has a blind spot, one could benefit from deriving ideas from people with different points-of-view to be able to see the 'whole picture'. This is where Storyboarding comes handy.

Laid out in two distinct sections, the material is a step by step guide. The first section explains what a Storyboard is and what it can do. The second section outlines problem solving through Storyboarding with several examples and illustrations.

Problem solving is an organised procedure for addressing problems, opportunities or issues. It is possible to approach an issue on adhoc basic and with serendipity, however the author emphasises that as the stakes rise one should rely on an organised method to reduce the risk of failure.

The conventional problem solving techniques essentially involve finding the following: an objective, the facts, the problem, ideas, the solution and the acceptance for the solution put forth

Such a technique helps us focus on our goal and the method inculcates the concept of divergent and convergent thinking.

There is yet another approach put forward by the author that he calls 'The Integrative Approach' which includes:

* Identifying the problem and finding the reason for improvement

* Understanding the problem and the status quo

* Analysis

* Generation of potential actions

* Evaluation and selection of suitable actions

* Implementing the solution

* Appraising the whole task undertaken

In this manner, with th use of storyboards one could communicate for appropriate 'Impact'. Here use of the multimedia elements like 'Text + Graphics' would be a boon.

The author in his compendium then describes various quality improvement tools like the Check Sheet/Pareto Chart, Flow Charting, Run Charts and Cause and effect Diagrams. He has tried to explain the basic reasons why we should strive for strategic improvement with generous examples for business scenarios.

Finally the author in the various appendices provides Storyboard examples applicable to Healthcare and Education. He also provides a comparison of problem

solving structures followed by a description of the various tools.

On the whole the book is a 'must read' for all individuals who wish to make their mark in their chosen profession. The author has put in a tremendous effort to introduce Storyboarding concepts in a concise and skillful manner.

A practitioner alone could experience the benefits of employing Storyboarding in his vocation and bring quality efforts to life. 'Show Me' shows you just that.

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**Productivity in Spinning by** *T.V. Ratnam, Indira Doraiswamy, S. Seshadri & R. Rajamanickam,* **The South India Textile Research Association (SITRA), Coimbatore-641 014, p. 177, Rs. 240.**

Indian textile industry is the oldest and the largest industry in the Indian subcontinent. Though the sector's predominance in terms of output, employment and exports in the Indian industrial economy remains unquestionable, the incidence of industrial sickness and closures is alarmingly high in this sector. Improvement in productivity has been suggested in many circles to overcome the problem of sickness and closures.

The book under review offers a detailed and systematic mechanism on how to measure, monitor and improve productivity at process levels in spinning mills. It is a comprehensive compilation of nearly four decades of SITRA's pioneering work in productivity measurement and improvement in spinning mills. It is divided in 12 chapters. It starts with a general overview of the concept of productivity and its related aspects. The methodology for the purpose of measurement and assessment of productivity for both labour and machines is next developed. The book also gives a set of productivity norms developed by SITRA for different processes of spinning. Then it illustrates how to calculate productivity parameters and assess the performance of the operatives engaged (labour), ring spinning production and spindle shifts worked (spindle utilisation) on monthly basis for the different spinning processes viz., mixing & blow rooms, cards, drawings, fly frames, ring frames and ring spinning.

By taking a case study of a mill having 30 thousand spindles and producing 6 counts in the range of 20s and 8, the book shows the step by step approach which mills can adopt to measure and improve productivity of labour and machine. It provides the basis for working out the ideal labour size for various combinations of spinning processes and producing various counts Next comes a detailed analysis on how a mill can improve productivity in the processes viz., draw frames & fly frames, ring frames, conventional cone winding and reeling respectively. Modernisation and labour training aspects for productivity improvement and covered. Finally, the book presents a brief account of the productivity growth of SITRA member mills since 1957 and projects the modernisation and productivity levels for 2000 A.D.

It has been established by SITRA's study that if a mill is to stay profitable even during recession, it should achieve at least 75 per cent of the productivity standard of SITRA. On the other hand, a mill would become sick, if its productivity falls short of the standard by 50 per cent or more. In about 40 per cent of the mills, the labour productivity was found to be less than the norm by 33 per cent to 60 per cent, which by itself explains why the incidence of industrial sickness and closures is very high in the textile mills. This underlines the constant need on the part of mills to improve productivity for their continued survival and growth in the competitive environment.

As the spinning mills are also highly energy intensive and material intensive, inclusion of suitable methods of productivity measurement and improvement for these factors of production would have also been quite useful. Furthermore, combining all the inputs and developing a suitable multi-factor productivity measurement for the spinning mills would have been relevant to assess and monitor productivity at the mill level. These are some areas suggested for wider coverage but are, however, not limitations of the book.

Replete with exhaustive formulae for deriving the different measures of productivity, productivity cost difference and returns from modernisation and numerous illustrative examples, the book becomes easy to follow in practice. Needless to say the book could be of great use to mill managements and textile technology teachers and students.

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**Buying & Supplying Quality by** *Richard T. Weber & Ross H. Johnson,* **Tata McGraw Hill Pub. Co. Ltd. New Delhi,1996, p. 272, Rs. 350.**

It all began with the realignment of economic forces the inevitable had happened; the consumer emerged

all-powerful; "caveat emptor" became a distant memory; focus on quality and quality systems took the centre stage. And a lot of dust was kicked up by various management gurus on how to appease the new menace in the guise of a fussy and demanding customer. They vented out with common sense prescience that the quality systems devoid of capable men is a lifeless thing. It is the men who control and operate it, and how they do it, underlines its performance and more importantly, its effectiveness.

Now, it is time we considered a few things seriously. One; Quality cannot be built on the ravings of arm-chair intellectuals alone. Two: Practical bottlenecks in implementing quality initiatives can no longer be ignored. After all, a few decades of widespread (though disconcerted) experience in this area ought to teach us a few dos and don'ts.

Yet, literature available on the subject continues to harp on generalities. Quality as a company-wide responsibility is good; but how to build it into individual functions is the issue. M/s Weber and Johnson have attempted to address one such missing link through their book on "Buying and Supplying Quality". The authors have chosen, and very rightly so, the procurement function, which serves as the entry point of every process. It is evident from the title that the authors would have liked to weave in, quality improvement initiatives in the manufacturing function as well. Unfortunately, the scope of treatment has dwelled more on the purchasing aspects, relegating production to the background. What could have been an advantage has been rendered a disability, since these functions constitute different sections of the quality-chain and simultaneously addressing issues from both perspectives becomes difficult.

Chapters on Strategy for obtaining quality from suppliers, Product requirements, Supplier evaluation and selection, Legal aspects, Evidence of conformance, Inspection and testing and, Working relationships with the supplier, mete out a fair treatment to the central theme. The rest of the chapters, introduced desultorily, deal with the basic principles of producing quality and could have fared equally well in the form of appendices since, in the present sequence, the reader is left wondering whether the authors are referring to the buyer or supplier. Considering even this lack of continuity and cohesiveness of subject matter, the book is justified in exploring the finer nuances of a procurement function. Quality in procurement as a strategic business goal has finally arrived. Can others be far behind?

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# INDIAN JOURNAL OF INDUSTRIAL RELATIONS

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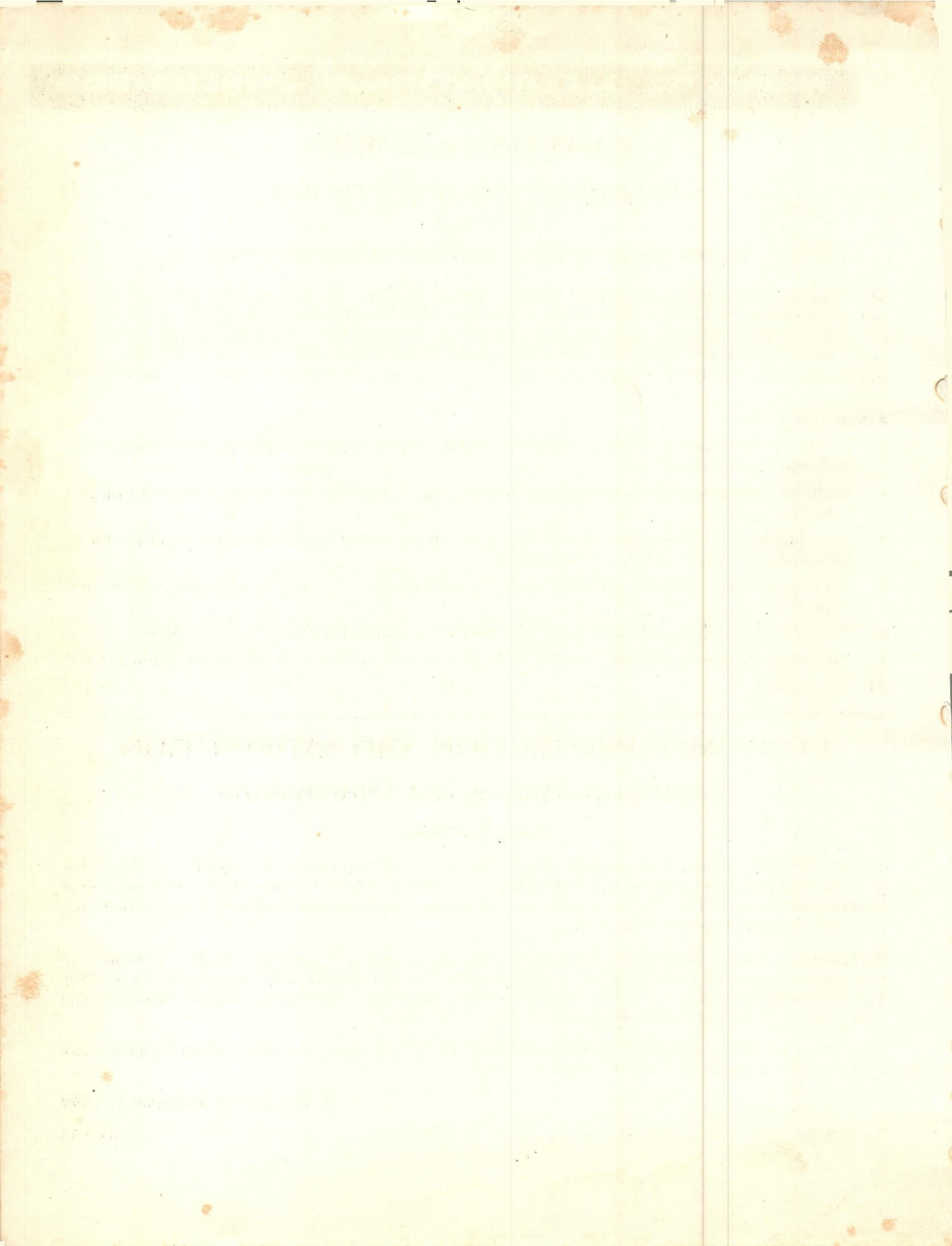*Indian Express, December 1, 1994*

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