Productivity Trends in Indian Industry: Concerns for the Nineties

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That India is a capital scarce economy was well recognised by our planners at the inception of planning in the early fifties. Yet, the overall framework of planning in India has been one which has placed too much emphasis on capital accumulation and far too little on the efficiency with which capital is actually utilized. The outcome is a dismal performance record of the economy with regard to the total factor productivity index at least up to early eighties. There are firm indications that the situation has taken a turn towards the better after 1982-83, argues this paper.

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Productivity has to be a crucial source of growth in an economy characterized by severe resource constraints. The performance of Indian industry over the first three decades of planning was poor with respect to productivity. The problem engaged the attention of the policy makers during the decade just ended. The Sixth Five Year Plan which was launched in 1980-81 placed major emphasis on improving productivity. Not only was there official recognition of the productivity problem during the eighties but the industry itself has been engaged in some introspection on how to improve productivity. Today, at the start of the nineties there is even greater realisation that as the resources constraint in the economy gets tighter and tighter, it is more urgent than ever before to get the most out of the limited resources by improving productivity.

This article begins by sketching the overall contours of planning for industrialisation in India. This provides the context in which the productivity problem can be addressed. The long term trends in industrial productivity in India are presented with a view to high-lighting the new emerging directions. The empirical findings are then analysed with reference to the evolution of the policy and planning framework. Finally we conclude by addressing the changes in policy and planning that are required if the Indian industry is to achieve significantly better productivity performance than in the past.

The Policy Framework

The overall framework of planning in India has been one which has placed too much emphasis on capital accumulation and far too little on the efficiency with which capital is utilised. This provides the backdrop for the productivity problem that we face in Indian industry.

That India is a capital scarce economy was well recognised by our planners at the inception of planning in the early fifties. Capital accumulation was, therefore,

seen as the critical element in planning for development. The planners repeatedly emphasized the importance of the size of the plan and the allocation of investments to different sectors within the plan. Resource mobilisation assumed an important role in this context. This was the dominant perception of the developing world at that time. The key challenge for development was to transform an economy which saved a relatively small proportion of its income into one which saved a reasonably large proportion. The irony is that india has moved from a savings rate of 10 per cent at the beginning of the fifties to over 23 per cent in the mid-eighties, but the growth rate of the economy has increased from 4 per cent per annum to only 5.5 per cent per annum. This has happened because the planning process has not been geared to ensuring that the plan resources are efficiently utilised.

The basic model of planning underlying the Indian plans has had some fundamental biases against efficient utilisation of the resources in the economy. These biases were spelt out as early as 1970 by Bhagwati and Desai (1970) but have become much larger and more obvious with the passage of time.

Major Shortcomings

The first major shortcoming of the model has been that there has been outright neglect of foreign trade possibilities. The import-substitution orientation in the Indian industrial strategy has been derived from the objective of self-reliance on the assumption of pessimistic export possibilities for India. The functioning of the protective trade regime and the built-in inefficiencies in the process of import substitution are now part of the established record. It is worth noting that the critical assumption of export pessimism which formed the basis for this strategy was warranted neither then nor now.[1] Against mounting empirical evidence, Indian policy makers persisted in export pessimism until for India it became a self-fulfilling prophecy. It is heartening to note that alternative perceptions in this respect are beginning to surface in the more recent period.

A second major problem with the plan model was in planning ahead of demand for capital goods. By now, there is ample evidence to suggest that in planning for a balance between the demand and the supply of capital goods within a highly aggregative input-output framework, little, if any, attention was paid by the Indian planners to forecasting market demands, planning a product-mix to match the demands, and to aspects of design specifications and technological up gradation. Sengupta's (1984) insightful study of the public sector steel performance in India is a testimony to the failures of planning in this respect. The decline in capacity utilisation of the capital goods industries after the mid-sixties, therefore, reflected some deep-seated problems including the incompatibility of the structure of capacities with the evolving structure of demand.

The plan model also extended inadequate attention to the infrastructure sectors, e.g., power, coal and railways. Having first reserved the infrastructure sectors for public investment, not only did the infrastructure sectors typically bear the brunt of downward adjustments in public investments, but the inefficiencies in these sectors were also legendary. These inefficiencies covered the entire spectrum from project formulation to project implementation and finally to operational stages. The inefficiencies of the individual subsectors, e.g., railways, coal and power were compounded by problems of lack of co-ordination among the sectors. It was only as late as the Sixth Plan that in keeping with the thrust on productivity, emphasis was placed on balancing investments to improve the utilisation of existing assets and bring about better co-ordination among the sub-sectors of infrastructure.

Finally, there have been problems associated with plan implementation and with the lack of integration between the plan framework and the economic policies formulated by the different economic ministries. The industrial and trade policy framework as it has evolved over time did not only restrict competition to Indian industry from foreign trade but also restricted competition within the economy. The overall result has been a failure to exploit the tremendous potential for industrial development.

Long Term Trends in Total Productivity

In analysing the long term trends in industrial productivity, labour and capital productivity tell only part of the story. For one thing, the partial productivity indices are dominantly influenced by the process of capital deepening (or increasing capital-labour ratio) which is normally associated with the process of capital accumulation. It is, therefore, necessary to go beyond the partial factor productivities to analyse the total factor productivity growth. This measure takes into account the joint effects of increases in labour and capital. The estimate of total factor productivity growth is derived as the difference between the growth of value added and

1 See Ahluwalia (1989).

the weighted sum of the growth of labour and capital, the weights being the respective factor shares.

The long-term trends in total factor productivity growth for the manufacturing sector reported in here are taken from a research study by the author.[2] These results highlight the problem of poor performance with respect to the efficiency in the use of resources or total factor productivity.

Over the quarter of a century from 1960-61 to 1985-86, the growth in total factor productivity in the manufacturing sector has been negligible. Upto 1982-83, total factor productivity is estimated to have declined at a rate of 0.4 per cent per annum. By contrast, Korea shows a total factor productivity growth of 3.7 per cent per annum during 1960-1977, Turkey of 1.3 per cent per annum during 1963-1976 and even Yugoslavia of 0.5 per cent per annum during 1965-1978. But the long spell of virtual stagnation in Indian industry in this respect was broken after 1982-83. Total factor productivity growth was on an average nearly 4 per cent per annum in the subsequent three years. (Table 1).

Table 1 : Trends in Productivity

	Growth Rates		
	1960-61 to 1985-86	1960-61 to 1982-83	1983-84 to 1985-86
Manufacturing Sector			
Total factor productivity growth (TFPG)	0.1	-0.4	3.9
Mean TFPG for 63 industries	0.2	-0.2	4.1
Trend growth in labour productivity	2.2	1.9	...
Trend growth in capital productivity	-2.5	-2.8	...
Trend growth in capital intensity	4.9	4.8	...

	Share in value added	
	1960-61 to 1985-86	1960-61 to 1982-83
A Disaggregated View		
Industries showing positive trend in labour productivity	59	58
Industries showing positive trend in capital productivity	16	15
Industries showing positive trend in capital labour ratio	96	96

2 Ahluwalia (forthcoming).

The TFPG estimates at a detailed level of disaggregation (for 63 industry groups of manufacturing) over the period from 1960-61 to 1982-83 show that the phenomenon of declining total factor productivity is quite widespread. Industries with negative TFPG estimates (or declining total factor productivity) account for almost two-thirds of the value added in the manufacturing sector.

The trends in labour and capital productivities for manufacturing and its 63 industry groups also drive home the phenomenon of declining efficiency in factor use. As mentioned earlier, because the capital-intensity had increased over time for almost all the industries, labour in most of the industries had more (and presumably better) machines to work with. We should, therefore, expect significant positive trend growth in labour productivity in most of the industries. In fact it is significant to note that as capital intensity increased across the board for almost all of the 63 industries, labour productivity showed significant upward trend for a much smaller group of industries. For most industries, the trend in capital productivity was dominantly downward (Table 1).

It is often asserted that the rising capital-output ratio in manufacturing may just be reflecting the fact that an increasing proportion of investments in manufacturing has been directed to heavy industries or more capital intensive industries. Our results show that the increase in the weight of the capital intensive industries had only a small effect on the capital-output ratio in manufacturing while much of the dominant effect came from the increases in the capital-output ratios of the individual industry groups (Table 2).

Trends in productivity growth were also analysed for the use-based sectors. The two largest use-based

Table 2 : Decomposition of the Change in Capital-Output Ratio in Manufacturing (Sub-periods)

(per cent)

Period	Per cent contribution due to		
	Change in industry group's capital-output ratio	Change in industry group's share in value added	Inter-active effect
1959-60 to 1965-66	88.1	36.8	-24.9
1966-67 to 1975-76	114.6	10.3	-24.8
1976-77 to 1982-83	140.4	25.2	-65.5
1976-77 to 1985-86	187.8	14.2	-102.0

Note : Based on 63 industries.

sectors, i.e., intermediate goods and consumer non-durables, experienced declines in total factor productivity, on average, over the period from 1960-61 to 1982-83. The other two sectors, i.e., capital goods and consumer durables, on the other hand, recorded increases.

The intermediate goods sector, like the consumer goods sectors, recorded improvement in its TFPG performance after 1982-83, but it remained by far the worst performer compared to the other use-based sectors. This finding is worrisome because the effect is not limited to the intermediate industries alone but is transmitted to other industries through the network of intermediate deliveries. The productivity performance of the intermediate goods sector assumes special significance in view of the rising intermediate input intensity of Indian industry. Even when the period from 1960-61 to 1985-86 is considered, the intermediate goods sector still shows a negative total factor productivity growth of the order of nearly 1 per cent per annum, the improvement after 1982-83 notwithstanding.

The analysis of the trends in labour and capital productivity in the use-based sectors reveals the same pattern as that in the more disaggregated analysis presented earlier. The phenomenon of sharply increasing capital intensity over time, more slowly increasing productivity and declining capital productivity is very much there.

Both in the detailed disaggregated analysis of total factor productivity growth and that for the use-based sectors of manufacturing, there is evidence of a break in the secular downward trend in the total factor productivity growth in manufacturing after 1982-83. The only exception is the capital goods sector. For the other use-based sectors and for manufacturing as a whole, there is a distinct upward shift in the TFPG after 1982-83 when tests for such a shift are made within the framework of time series estimates of Cobb-Douglas production function.[3] Another emerging development worth noting is that of a slowdown in employment in manufacturing in the more recent period. The analysis of pooled estimates of Translog production functions for the use-based sectors also shows that there is evidence of a change from a capital-saving bias to a labour-saving bias in technical progress for the consumer durables and the consumer non-durables sectors in the eighties.

Factors Affecting Productivity

The major factors affecting the productivity performance of Indian Industry are the degree of competition in the industry, both domestic and foreign, infrastructure availability, and overall growth prospectus for the economy. It is only when a competitive industrial environment is created that technical progress, skill development and other efficiency-raising avenues are explored and exploited to reduce the costs and improve the quality of the product. A competitive industrial environment, however, is not sufficient from the efficiency point of view if there are significant supply-side bottlenecks, e.g., infrastructure availability, or demand constraints because of limited growth prospects for the economy. Within this framework, how do we explain the poor productivity performance of Indian industry from 1960-61 to 1982-83 and the subsequent pick-up ?

There are a number of studies documenting the evolution of the industrial policy framework and the trade policy framework in India from about the mid-fifties to the mid-seventies and tracing their perverse effect on industrial growth and productivity. It is not necessary to go into the detailed aspects of the policy framework here but present only a summary assessment. The policy framework sought to channel investments in such a manner that the scarce resources were allocated along socially desirable directions. In practice the system was characterised by undue conservatism and administrative delays. In course of time, an increasing disjunction arose between the analytical perceptions within the plans and the actual policy regime. The system became more and more regulatory and less and less developmental. The ineffectiveness of the policy regime led to the development of a parallel economy. The reasons for such a policy framework may lie in the realm of political economy but the effects on the industrial economy are there for us all to see.

By the mid-seventies, there was realisation that something had gone wrong with the policy framework. The period of the second half of the seventies can best be characterised as a period of official reflection. A number of official committees were set up to review different aspects of industrial and trade policies and infrastructure performance.[4] Some procedural changes and some loosening of controls began in the late seventies, and the process gained momentum in the eighties.[5]

3. Ahluwalia (forthcoming).

4. Alexander Committee (1978), Dagli Committee (1979), Tandon Committee (1980), Pande Committee (1980), Rajadhyaksha Committee (1980).

5. Narasimham Committee (1985), Hussain Committee (1984).

From a situation in which industrial licensing controlled both entry into an industry and expansion of capacity and a multiplicity of regulations sought to affect the location and scale of an industrial operation, not to speak of the multiple distortions caused by a quantitative foreign trade regime, we have come a long way. The most important changes have related to reducing the barriers to entry, simplifying procedures and moderating somewhat the degree of protection available to Indian industry. Recognising the need for technological upgradation, policies have also sought to provide a thrust to the modernisation of the capital stock in Indian industry. Large business houses have been allowed to play a larger role in industrial development. These policies and a flexible stance on the exchange rate are beginning to show their effect on better export performance.

A second dimension along which planning and policy changed in the eighties was in recognising the importance of infrastructure for industrial development. As is well known the inefficiencies in the infrastructure sectors in India have covered the entire spectrum from project formulation to project implementation and finally to operational stages. Problems in railways, coal and power were compounded by the problems of lack of coordination in planning for these sectors. By the end of the seventies, the neglect in terms of investment and inefficiencies in the use of the capital stock in these sectors had become far too excessive.

The Sixth Plan placed its central emphasis on infrastructure and arrested the trend of declining efficiency. In keeping with its thrust on productivity the Sixth Plan emphasised balancing investments to improve the utilisation of existing assets and bring about better co-ordination among the subsectors of infrastructure. This approach has been sustained in the Seventh Plan. From its low of 44.6 per cent in 1980-81, the plant load factor (a measure of capacity utilisation in the thermal power plants) has increased steadily to reach a level of 56.5 per cent in 1987-88, a little above its earlier peak achievement of 56 per cent in 1976-77.

Trade policy has also been subjected to significant rationalisation and some liberalisation in the last ten years. While there has been considerable liberalisation in respect of raw material and component imports, for capital goods the policy has been dominated by the "indigenous angle" with blatent neglect of cost and quality considerations. There have been some changes in this respect in the second half of the eighties. The 1985-1988 trade policy focussed on the liberalisation of the import of capital goods with a view to facilitating the process of technological upgradation of Indian industry. The liberalisation was also linked with the thrust on exports and the scope of such liberalized access to machinery and equipment for export industries was widened further in the trade policy of 1988-1991. However, the overall trade regime remains highly protective.

The decade of the eighties has therefore seen some easing of controls, some liberalisation and better infrastructure planning. This has resulted in unprecedented growth rates of 8 per cent per annum in industry and improvement in industrial productivity. Of late, exports have also picked up. However, there have also been some aspects of industrial growth which are causing concern. Employment in the industrial sector has stagnated, while import-intensity of exports has also perhaps increased. Improvement in total factor productivity growth seems to be associated with stagnation in employment and only moderate increases in investment. It is against this background that we address the tasks ahead for the policy makers and economic actors in the industrial arena so that they can bring about industrial resurgence in the nineties.

Concerns in the Nineties

There are at least two very important reasons why productivity must be at the centre of our concerns in the nineties. If the nation's coffers are being eroded and the resource constraint is becoming even more stringent than ever before, then the only means to growth is to get more out of the limited resources. This calls for a focussed attention on productivity improvement. A second important reason stems from the balance of payments considerations. There is an urgent need to reduce our trade deficit. But should this be done through a squeeze on imports or a push in exports so that we can balance our trade at a higher level of exports and imports ? Clearly, the exports is the more dynamic and more sustainable route. This in turn is only possible if Indian industry is made internationally competitive through significant improvement in its productivity.

It is worth digressing to correct the record on a popular misconception, i.e., that our current balance of payments problems are due to too much imports. The facts of the matter are that total imports as a proportion of GDP in India are lower today than in 1980-81. It is also true that India's import ratio is among the lowest in the world. Can imports be realisticaly squeezed any further? Would the consequence not be to bring about recession

in the economy? The need of the hour is a thrust on exports. This in turn requires a major thrust on international competitiveness and improvement in productivity. Positive reinforcement can be expected in that the emphasis on exports will inject an external audit on costs and quality in the industrial sector.

A number of steps need to be taken on several fronts if productivity improvement is to be sustained in the nineties. As mentioned earlier, a process of reform of the industrial and trade policy framework has been set in motion over the last ten-twelve years. This process needs to be strengthened further.

An important step in the direction of industrial policy reform would be the removal of the barriers to exit in Indian industry. While considerable progress has been made in reducing the barriers to entry, it is still not possible for a sick non-viable firm to close down. In a situation where industrial sickness is widespread, barriers to exit create formidable obstacles in the way of industrial restructuring. The problem is not limited to the backlog of sick industrial units. As the government eases the restrications on entry, there will be a rush to invest and mistakes will be made. It is very important to ensure that the exit option is open to those who have made mistakes, otherwise there will be units which may be born sick. It is important to recognise that a healthy industrial sector rquires that the sick and unviable industrial units are allowed to die with dignity.

A second important area of policy reform relates to that of the public sector. A number of studies (official as well as non-official) have gone into the reasons for the poor performanc of the public sector as a whole, though there are some important individual exceptions. Perhaps the most obvious shortcoming is that the public sector has failed to contribute to public savings in the manner that was excpected of it. It has also failed to deliver on the rapidly growing infrastructure needs of industrialisation. For from providing leadership to the private sector, the public sector has been bogged down in a high-cost-low-quality trap which is the result of the multiple pulls from the vested interests of the politicians, the bureaucracy and the ideologues.

The time has come to go beyond the old slogans of "more autonomy" and "adequate accountability" for the public sector and ask if it is necessary for the public sector to be spreading itself thin in so many directions. Public sector in India today is extensive enough to include industries such as bread, footwear, leather goods, films, lenses, contraceptives, textiles, cars , scooters, bicycles, and telveision sets, in addition to the industries in the infrastructure sectors and strategic sectors. There is an urgent need to shed responsibility in many of these areas.

In infrastructure sectors, while it is true that the decade ofthe eighties showed much better performance than the decade of the seventies, much more is possible and certainly much more is needed if the industrial growth rate is to be sustained at the high levels of 9 to 10 per cent per annum. It is worth inducting the private sector in some of the infrastructure sectors to help release the critical bottlenecks for growth. More generally, competition must be encouraged both within the public sector and vis-a-vis the private sector.

If domestic competition is necessary, so is a gradual opening to foreign competition. It is only when the Indian policy makers aim at balancing India's foreign trade at higher and higher levels of imports and exports by strenthening the competitive status of India in the world markets that the vast industrial potential in the Indian economy can be tapped. Whether or not one projects buoyant or flourshing world trade conditions in the nineties, Indian strategy to push exports need not be confined to the average growth in world trade. Considering her very small share in world exports, India can aim to raise its export share by improving its competitiveness. It is heartening to note in this context that the "elasticity pessimism" for Indian exports, if it ever had any basis, has been strongly challenged by a number of empirical studies that have been done in recent years.[6] The constraints on Indian exports have been more of our own making rather than oflack of demand.

Along with the industrial and trade policy framework, the exchange rate policy will also have to play an imaginative role in bringing about the new industrial order with a thrust on exports. The financial system will have to play a positive role, while trading houses will also be necessary to reckon with the needs for marketing.

In striving for modernisation to improve productivity, the need for technological upgradation is clearly recognised. However, the costs are not always clearly understood. As the government facilitates the process of technological upgradation by providing incentives for modernisation and allowing foreign collaborations for technological upgradation, this process will make stringent demands on the quantity and quality of infrastructure, it will entail high capital costs and it will

6 Lucas (1986), Bhalla (1989)

tend to be labour saving. This trade-off at the micro level between productivity growth and employment growth need not imply a trade-off at the aggregate level if the rate of growth of investment is accelerated.

As far as increasing employment in the industrial sector is concerned, to some extent this can be done through promoting and encouraging labour-intensive industries. But the policy makers must not adopt an attitude that for every industry, the technology should be relatively labour intesive. Even to promote and encourage labour-intensive industries, labour laws need to be modernised so that industry does not fight shy of facing large pools of organised labour. As it is, industry is moving towards the use of contract labour to avoid the problems of dealing with trade unions. In such a context the slow growth of employment reflects the situation where not all employment is recorded on the payroll.

There are, however, limits to how far the unemployment problem can be solved within the industrial sector. It is therefore extremely important to plan for creating employment opportunities in other sectors, e.g., the rural sector and the services sector (housing, computer software etc.). Service sectors such as trade, transport and financial services not only generate employment but provide useful infrastructure for the industrial sector. The employment generating capacity of the industrial sector should be seen in the broader context of its multiplier effect through the development of these service sectors.

Looking ahead into the nineties and beyond, there is no getting away from the emphasis on industrial productivity in the Indian economy. Both in bringing about greater integration with the rest of the world and in providing dynamism to the development process in the economy, rapid growth in industrial productivity has a crucial role to play.

The analysis in the paper of the factors affecting industrial producitivity has, by no means, been comprehensive. For example, some important factors which have influence on productivity at a micro level, e.g., the management factor and the human resource development factor, have not been included in the analysis. The analysis has focussed on the policy instruments which affect the degree of competition in the economy and critical constraints on the supply side, e.g., infrastructure and technological inputs.

The experience of the eighties has given Indian industry the self-confidence that with the right policies, our industrial sector is capable of generating a growth rate of 8 to 9 per cent per annum. This, however, is still short of the potential. The direction of policy reform outlined in this paper should work towards raising the growth of output and productivity and reducing the gap between the actual and the potential in the nineties.

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Corporate Strategy for the 8th Plan

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In this paper the author argues that the 8th plan will see a policy shift away from physical controls to promote domestic industries, but at the same time there will be a check on excessive liberalisation, so as to avoid imports in non-priority sectors. There will also be a reassertion of strategies designed to reduce rural-urban imbalances. Corporate strategy will have to orient itself towards developing cheaper goods for the domestic market, while moving away from highly import - intensive, non-priority sectors.

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National five year plans have been a recognised factor in the external environment of Indian enterprises. The nature of such national planning has been undergoing changes in India. The recent fundamental shift in the erstwhile centrally planned economies of Eastern Europe has reopened certain questions. These are relevant as India is currently working on her 8th Plan. In this paper we shall examine the changing interface between national and corporate planning, likely 8th Plan outlook ; and the strategy options for Indian business.

Planning Linkages

In the immediate post-war decades there was an interesting dichotomy in planning. In those societies which had national planning by the government, there was very little enterprise level long range planning, as in the communist world of that time. On the other hand, in those societies which shunned governmental planning, there was vigorous enterprise level LRP. As a hybrid welfare state, Britain tried a National Plan in 1966, but gave up soon. In the last two decades, there have been interesting changes in both National and Corporate Planning as well as at the interface between the two.

National Planning

The most dramatic change here is that in most of the communist world, central planning is being given up. There is a return to market forces. The disappointment with national planning appears to be very deep. It is seen to have led to a host of ills - lack of initiative, innovation, quality, service and growth. The enterprises are being given more autonomy. The process which began in Yugoslavia, extended to Hungary and now, is the new article of faith. Advocates of a strategy of "unbalanced" development based on dynamic supply-demand imbalances and response, seem to have been vindicated. (Hirschman, 1959).

In those countries, which are fundamentally market economies, but still do have some government planning, like Sweden and France, the planning has been described as "indicative". It has the following general features :

i) The state does not administratively direct resource allocation into some sectors and restrict their inflow into some other sectors.

ii) There is very little public manufacturing investment. Productive activity is generally left to the market. Even infrastructures like power, transport and communication are not state owned.

iii) There is, however, a "public sector"., but this is more in the nature of defence, education, health, pensions, unemployment benefits and similar "transfer" expenditure.

iv) The government publishes long-term forecasts of the economy, its sectors, and international linkages. These forecasts cover the parameters of GNP, including growth, inflation, exchange rate etc.

Corporate Planning

Planning at the enterprise level has also undergone changes:

i) Formal Long Range Planning Systems, typically for five years, began in the early 1960's and spread to more enterprises in the US, Europe and elsewhere, including India. This was a reaction to the limitations of the annual budget as an instrument of managerial planning and control.

ii) Within such FLRP, it was realised after some rounds that it should be more of a Strategic Plan, rather than a lot of numbers.

iii) The 1973 oil crisis, was recognised as a "discontinuity" going beyond, normal environmental "change". So, it was argued that Corporate Planning was no longer useful. There was also an emphasis on Strategic Management, in place of Strategic Planning. The idea was to pick up weak signals from the budget variance analysis and from the environment, amplify and respond to them.

iv) The fundamental rationale for enterprise level LRP has remained valid. This arises from the increasing national and international competition, growing market opportunities, new technologies, internal and external human aspirations.

v) Planning systems have developed some robustness to cope with the second oil shock of 1980, the worldwide stock market crashes of 1987, the mini-crash of 1989, detente and other such significant environmental changes.

Changing Interface

The interface between national and corporate level planning has gone through interesting attitudinal changes:

i) In the market economies, at the beginning, enterprise top managements were very hostile to the idea of any kind of governmental planning. They feared restrictions, political and bureaucratic interference, corruption and delays. Even in India in the 1950s there was a view held by many entrepreneurs and industry associations that national planning and heavy public sector investment may not be an efficient growth path.

ii) In the centrally planned economies, the planning commissions and ministries were suspicious of enterprise autonomy. The enterprises were no more than implementing agencies.

iii) Today enterprises in market economies appreciate the value of some indicative planning by the government. Also, the Japanese and French examples are seen to indicate the value of long term joint planning and action by government and industry on technological development and international business.

iv) All planned economies are also realising the need for enterprise autonomy and accountability for innovation, growth and financial solvency.

v) The mixed economies are paying more heed to older prescriptions, like improving policy regimes for exports and links with the world economy (Bhagwati, 1966).

8th Plan Outlook

The 8th Five Year Plan of India is in the process of formulation. The process and contents will be influenced by several factors - the manifestos and programmes of the ruling National Front and their allies; as well as the historical trends in planning in India and the world. We shall examine the 8th Plan outlook in this section, and derive some implications for corporate strategy in the next section.

Planning Trends

Indian Planning has gone through the following stages of development :

i) The First Plan, 1951-56, was a rudimentary exercise, basically putting together a few projects, mostly already in the pipeline. At the enterprise level, even annual budgeting was not well established.

ii) The Second Plan, 1956-61, had a conceptual basis, later known as the Mahalanobis model, derived from the Harrod-Domar equation relating rate of savings and capital output ratio to GNP growth.

iii) The Second Plan ran into a foreign exchange crisis. There was an attempt at salvaging a "Core" plan, and also at more import substitution.

iv) The Third Plan, 1961-65, was affected by the Chinese War of 1962 and the Pakistan War of 1965.

v) The period 1966-69 saw a devaluation of the rupee and a series of annual plans. Political and economic uncertainties were compounded.

vi) The Fourth Plan, 1969-74 could build on some foundations like the green revolution and core sector output. It also included a stress on export promotion. But this period also saw more restrictive legislation and procedures, particularly the MRTP and FERA. The 1971 Bangladesh War expenditure also caused some distortions.

vii) The Fifth Plan, 1974-79, was affected by the Emergency and change of government in 1977. A new industrial policy in 1977 was the first significant review and change of the 1956 policy. It stressed the small scale and rural sectors.

viii) Since 1980, the Indian planning and policy regime has been moving more towards "indicative" planning. Severe criticism had been building up due to distortions in planning and procedural delays, adding to inefficient use of capital and human resources. Planning did not seem to make any difference to the sluggish rate of growth of 3.5% p.a. (Ahluwalia, 1985). The Economic Administrative Reforms Commission advocated a move from "physical" to "fiscal" controls, quality and price decontrol, and long term fiscal and trade policies.

ix) The cumulative growth and deregulation has created a more positive and optimistic outlook in industry. There have been booms in consumer products, durables and capital markets. More companies are setting up LRP systems, and pursuing strategies of product/market development and diversification, both through green site projects and acquisition. There has been an improvement in the performance of the infrastructure. This and a rise in demand have led to better capacity utilization. (CMIE, 1987)

Key Issues

The following appear to be some of the key issues confronting the country and the government as we approach the 8th Plan :

i) The first major concern is employment. The economy has demonstrated growth at a higher rate. But the benefits of growth are seen to have accrued to a relatively small proportion of the population. Employment has not grown commensurately.

ii) While there has been a decline in death rates and improvement in life expectancy, food deficiency and malnutrition continue to cause relatively high infant mortality and early mortality (Goryacheva, 1988)

iii) There is a fear that India may be approaching an external debt trap. While exports have been growing fast, they have been import intensive. Imports have not only increased, but have affected many domestic industries adversely.

iv) There is concern about deceleration of growth in the current year, 1989-90. Is this a short term correction ? Or does it indicate that the recent policies are not sustainable ?

v) Another concern is about rising prices. The seasonal price decline in essentials like tea, gur, vegetables and cooking oils has not beenadequate.

vi) There are continuing sectoral and regional imbalances in agricultural, industry and services. They are now socially less acceptable, and create public unrest.

vii) The internal debt is also mounting due to various reasons, like high administrative expenditure, deficit financing and a plateau in savings rate.

viii) Both direct energy imports and imports of exploration and generation equipment and services cause a severe drain on the foreign exchange. The pressure for energy conservation is increasing. (Kothari, 1987).

ix) The costs of economic growth are becoming more visible in terms of their impact on the environment and ecology. (Bandopadhyay et.al., 1985)

x) Added to the above domestic issues, are certain international developments. Concessional financing has gone down during the eighties. The opening up of East European economies will further reduce access to funds and, perhaps even markets.

Policy Indications

It will be some months before an officially approved 8th Plan document will be available. As of now, even an agreed government policy approach to the 8th Plan has not been announced. However, some indications of the range of policies are available from the following:

a) The draft of the 8th Plan Approach Paper (Planning Commission, 1990).

b) The report of the Economic Advisory Council (EAC, 1989).

c) Public debates in the press and elsewhere.

Let us consider some likely indications.

The Planning Commission's Approach Paper is highly qualitative. It advocates against a preoccupation with targets and numbers. It emphasizes the need for restructuring economic priorities and patterns of spending in favour of the poor. It also officially admits the possibility of internal and external debt traps. Including non-resident deposits, the external debt is estimated at 65 billion U.S. dollars. It advocates reduction of foreign commercial borrowings and better use of aid. Internally, it calls for greater thrust on rural development, basic needs and employment generation.

The EAC Report has also stressed the provision of gainful employment as an important ingredient of strategy. The Council has also touched on a topic normally avoided in recent years, namely the need to reduce the population growth rate. But this is to be through health education and women's employment. It has suggested diversification of agriculture for raising cereal and non-cereal output in all regions with different agro-climatic conditions, and especially in the backward areas. With reference to industrial strategy, the Council had advocated a shift to wage goods in preference to consumer durables.

Within the government itself, there are differences in perceptions and policy prescriptions. There are advocates of continuity in some of the major policies, – liberalisation, export-orientation and targeting higher growth rates. They seem to be concerned about the dangers of a sudden lurch in policy towards a regime of physical controls, high taxes, capacity restrictions etc.

The following policy indications may be drawn from the above :

i) There will be greater thrust for rural development. "Bharat", as distinct from "India", as some see the duality, will get some more attention. The government has announced a broad commitment to raise resource allocation for the rural sector from 44% to 50% of the plan size.

ii) There will be a more selective important policy, stressing essential and relevant technology.

iii) The policy regime may continue to be supportive to value added exports.

iv) There may be an increase in the progressiveness of direct taxation and incidence of indirect taxation on the convenience and luxury goods.

v) Commercial energy may become more expensive. There will be a more determined attempt to enforce energy conservation.

vi) The government's reversal of the sequence of equity and growth, may also mean the political will to protect environment and ecology, even at the cost of some growth. (NEERI, 1988). The poor suffer more from environmental degradation.

vii) The planning process will be more decentralised, with the involvement of local government, people and voluntary action groups (Subramaniam, 1988).

viii) The philosophy of involving people, will be extended, through legislation, to workers' participation in management.

ix) There will be stress on probity in politics, administration and industry.

x) One dark cloud is the possibility of a rise in defence expenditure.

Corporate Strategy

The formulation of the corporate strategy for a firm would typically involve the following steps :

a) Identification of opportunities and threats to that firm in the environment.

b) Analysis of the strengths and weaknesses of the firm in relation to those opportunities and threats.

c) Arriving at a creative match of the two.

Here, we can indicate the broad nature of the likely threats and opportunities for the industrial sector generally in the 8th Plan period, 1990-91. A more specific, situational analysis will need to be done for each company.

Threats

The following appear to be the likely perceptions of threat by industry:

i) There may be a slowing down of the process of liberalisation of the 1980s. There could even be a reversal in some areas.

ii) Goods based on a high import content may face import restrictions, or higher duties. Non-essential imports may be banned.

iii) Production processes based on expensive imported equipment and know-how would also be likely to face restrictions.

iv) Capital-intensive, labour-displacing investments would be discouraged, even if more productive.

v) Consumer durables, luxury items and goods targeted at urban consumers are likely to attract more indirect taxes.

vi) There may be a slight deceleration in the industrial growth rate in the medium term.

vii) There will be less political support for issues like productivity, computerisation, voluntary separation, relocation, takeovers etc.

Opportunities

For some time now, foreign investors seem to have been more optimistic about the future of the Indian economy than have domestic companies. The underlying strengths of the Indian economy will continue to provide opportunities to industry:

i) The excesses of liberalisation, particularly in imports and the creation of excess capacities, may be corrected.

ii) Similarly, steps towards reducing external and internal debts, deficits and prices will provide a stabler environment.

iii) The ruling party may be able to strike a better balance in economic policies, with two major partners having different ideological preferences.

iv) With higher rural plan investment, there will be more asset creation and purchasing power in the rural areas.

v) Indigenisation and technology development are likely to be better rewarded.

vi) Value added export efforts will continue to receive government support, perhaps in a larger measure.

vii) More balanced regional agricultural development will create more demand for essentials, in the first instance, and convenience goods in due course.

viii) Professional management, with respect for law and systems, will be rewarded.

Strategy Options

To meet the above opportunities and threats, firms need to choose an appropriate mix from a variety of strategic options:

i) Identify the non-essential, luxury imports, likely to be under threat, and move quickly for import substitution.

ii) Similarly, identify the domestically made, urban-oriented goods and develop lower priced, basic versions of the same for new rural markets, on a selective basis.

iii) Enhance resource allocation to product and process design and development, particularly with an eye on export markets.

iv) Conserve items like energy and materials with a higher import element.

v) Expand rural marketing and distribution channels, both to reach customers and to stimulate self-employment.

vi) Similarly, develop semi-urban and rural vendors, so as to catalyse employment, get cheaper supplies and raise purchasing power.

vii) Invest in human resources to prevent obsolescence and to be more competitive in the domestic and export markets.

viii) Voluntarily develop structures for worker participation and industrial harmony, in advance of legislation.

Action Ideas

We have already mentioned that while the 8th Plan indicates certain broad opportunities and threats for industry, each enterprise can benefit from a specific

strategic management exercise for the 8th Plan. Towards this, top managements and in-house planners may consider the following action ideas:

i) Sometime between April to September 1990, organise a Top Management Workshop to consider the strategic environment of the 8th Plan, and formulate the company's business and functional strategies for the period 1990-95. The budget will provide some further pointers on the government's priorities and policy preferences.

ii) With the broad guidelines emanating from the top management workshop, set up a Corporate Task Force to draft the company's plan for 1990-95 in the light of 8th Plan implications.

iii) If it is large multi-divisional and/or multi-location company, also organise Divisional and/or Functional Planning workshops, to develop their proposals to top management on goals and strategies.

iv) Debate the Divisional and Functional Draft Plans in a Corporate Planning Conference, and integrate them into a synergistic plan, in tune with the new policy regime.

v) Examine the Organization Structure and its adequacy or otherwise to cope with the new plans. Restructure, as necessary.

vi) Carry out an audit of the management systems for forecasting, planning, decision-making, information generation, analysis, dissemination and control. Take steps to make them contemporary, so as to successfully implement the new plans.

vii) Increase the stress on human resources development for the direct, as well as, the extended stakeholders.

The 8th Plan may represent a paradigm shift in Indian Planning. Its core features may be as follows :

a) It will try to retain some of the benefits of the Harrod-Domar model, as adapted by Mahalanobis, but avoid the clumsy rigidities of physical controls.

b) It will also try to retain the benefits of liberalisation, but avoid the wastages of non-essential imports and insensitive growth.

c) Above all, it will try to re-orient the priorities towards agriculture, rural development and fuller employment, which will expand the market for industrial goods.

For industry, this could be another step forwards from 1956, 1977 and 1985. Those firms which take note of this paradigm shift and position themselves strategically will be better able to serve their stakeholders.

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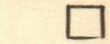

Regional *Vs.* National Priorities: Issues from Kerala's Experience

M.A.Oommen

Planning has been given the go-by in India in recent times. In this paper it is assumed that the role and respectability planning enjoyed during the Nehru-Mahalanobis era will be restored and planning refashioned to give a new sense of direction to the nation marching towards the 21st century. The change of guard at the Centre has offered a fresh opportunity to think anew on the questions of national goals, regional needs and the entire criteria and strategy of resource allocation within the multi-level planning framework of the Indian federal polity. Planning and development efforts in India have not only not solved the conflicts between the national and regional priorities, but accentuated them. The purpose of this paper is to throw some light on this wider issue based on the experience of Kerala. The focus is to raise issues in an effort to seek answers.

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State priorities and National goals

While keeping within the guidelines laid down by the Planning Commission, Kerala has assigned a high priority to social and economic overheads like health, education, roads etc., besides striving to realise in actual fact (not as rhetoric) such national goals as land reforms, family planning and the like. Undoubtedly this has been due to historical and social compulsions. Though with varying degrees of success and emphasis, both the Left as well as Right governments of the state have responded to these compulsions. This has yielded good dividends. Kerala is clearly head and shoulders above all the other states in terms of physical quality of life indicators like life expectancy, infant mortality rate and literacy. The life expectancy of the state is above 70 years and that of females is 73 years, which compares well with those of the advanced countries of the world. For every 3.5 sq. km there is one medical institution in Kerala. Taking both private and public sectors, there are 325 hospital beds for one lakh population.

Kerala is fast heading towards hundred percent literacy. Article 45 of the Constitution says : 'The State shall endeavour to provide, within a period of ten years from the commencement of this Constitution, for free and compulsory education for all children until they complete the age of fourteen years." Kerala is the only state in India that has implemented this directive fully. Kerala's educational structure is pyramid like, contrary to the inverted pyramid we observe in the rest of the country. Again in contrast to the other parts, Kerala has a high enrolment rate and a high retention ratio. It is doubtful whether even after the end of the 12th Five Year Plan, the rest of India will reach the literacy rate (especially female literacy rate) and infant mortality rate reached by Kerala today. Almost the same may be said about the health status of the people of Kerala.

Not only in improving the quality of life, but also in implementing the national population policy and family

planning, Kerala is ahead of other states. Kerala's mortality rate of 6.4 per 1000, compares well with that of many advanced countries of the world. In fact, with falling fertility rate (22 per 1000) Kerala is passing through a kind of demographic transition. Her population growth rate today is below 1.7 percent per annum, as against 2.2 for the country as a whole and is projected to fall to 1.5 percent by the end of the Eighth Five Year Plan. It has been hypothesised by several scholars including those from the World Bank that this demographic transition of Kerala has been due in no small measure to the greater degree of social justice and equity in Kerala's political economy achieved largely through such measures as land reforms, agrarian labour welfare measures etc., (Ratcliffe, 1978; Zachariah, 1984). Indeed land reforms in Kerala have been acknowledged as "the most drastic of any (land reform legislation) passed by any state legislature in India" (Mencher, 1976)

The financial fallout of some of these achievements is difficult to ignore. For example, the liabilities created by the pension payments of the state are extremely high. The amount of pension payment for Government and employees and teachers of schools and colleges is estimated to be around Rs. 245 crores. This is about 12 per cent of the revenue receipts of the state as against less than 4 per cent in most other states. The total expenditure (both revenue and capital account) of the state for education and health services alone is over 52 per cent.

Another noteworthy achievement of Kerala is the public distribution system that reaches out to the remotest villages of the State offering essential commodities including foodgrains at reasonable prices. It covers 95 per cent of the households. M.L. Dantwala once said that providing food at lower prices to the people is "instant socialism". (Mellor and Desai, 1986, 203).

In terms of several social and infrastructural amenities available to the villagers, Kerala stands head and shoulders above all other states in India as is well documented by the First Economic Census of CSO conducted in 1977-78. Out of 22 facilities surveyed, Kerala stands first in regard to 17 items and even Punjab the richest state is first only in regard to railways and drinking water. (Government of India, 1985). In all probability Kerala's position might have improved further than in 1977-78. While Kerala's unique record of achievement is partly due to the rural-urban continuum and settlement pattern of this small state, the ready availability of schools, hospitals, fair price shops, cooperative societies, banks, metalled roads and the like within less than 2 km. radius has helped to improve the quality of rural life of the people.

Thus Kerala has made remarkable progress in realising the directive principles of state policy despite a per capita income which has all along been below the national average. Several national policies such as those for health, general education, rural development and the like meant for 2000 AD and after, however, important and relevant from the national point of view, are irrelevant for Kerala.

Should Kerala Reverse her Priorities ?

A natural question that arises at this stage is whether Kerala should reverse her priorities ? To answer this question a brief review of the growth performance of the economy is attempted.

The growth performance of the economy during the last two decades, particularly after 1975, has been extremely poor. Agricultural production has been declining at an annual rate of 0.54 per cent during 1970-85. During the period 1960-61 through 1974-75 agricultural production of Kerala grew at an annual rate of 3.2 per cent as against 2.19 percent for the country as a whole. However, during the decade from 1975-76 to 1985-86, Kerala registered a negative growth while it was well over 2 per cent for all-India. A scientific study of the spatial pattern of agricultural development in the country has shown that in terms of production and productivity growth Kerala's performance has been one of the worst in the country (Bhalla and Tyagi, 1989). The decline in regard to forests and fisheries has been still sharper with (–) 5 percent and (–) 2 percent respectively per annum during the period. In 1952-53 the forest coverage of Kerala which was nearly 33 percent of the total geographical area has declined to a low 9 per cent today. Equally disturbing is the story of fish landings which have declined to a low 18 per cent of the total fish landings of the country from well over 40 per cent in 1966.

During the decade 1974-75 to 1984-85, the average annual growth rate of Kerala's manufacturing sector was only 2.39 per cent as against 4.72 per cent for all-India, 6.7 percent for Tamil Nadu, 6.8 percent for Karnataka and 5.4 percent for Andhra Pradesh. Due to a severe set-back in power supply since 1985, the manufacturing sector could register only 1.4 percent growth rate in real terms as against 6 percent in the country as a whole. Though the construction sector has registered significant

progress (thanks to the housing boom caused largely by the Gulf migrants' demand) the share of the secondary sector as a whole has declined from 22.1 per cent of SDP in 1980-81 to 19.6 percent in 1987-88.

Kerala's real SDP (at 1970-71 prices) grew at an annual rate of 2.3 percent and per capita income at less than 0.40 percent during the period 1970-71 through 1986-87. The share of Kerala's SDP in India's national income in real terms has declined from 3.28 percent in 1980-81 to 2.63 percent in 1987-88. This is obviously because Kerala's rate of growth lagged way behind the rest of the country. The per capita income of Kerala works out to Rs. 509 in 1970-71 as against Rs.559 for all-India with an absolute difference of Rs. 50. The corresponding figures in 1985-86 is Rs. 635 and Rs. 798 respectively with an absolute difference of Rs. 163. The situation would have been much worse, but for the declining population growth rate. The progressively widening distance of Kerala from the national average is clearly against the avowed goal of rectifying regional imbalances.[1]

Rectifying the regional imbalances may have to receive a high priority in the Eighth Five Year Plan. Based on the projections of the Eighth Plan Approach paper of the Government of India (produced by the previous Government) India's per capita income is estimated to be Rs. 3900 and is projected to reach around Rs. 4795 by the end of 1995. From Kerala's projected 1989-90 per capita income of Rs. 3100 (the projected gap being Rs. 800 at current prices) to reach upto Rs. 4795 by 1995 an estimated massive investment of the order of Rs. 38000 crores, both by the public and private sector is needed (Ramachandran, 1989, 8–10). The questionable nature of the assumptions and the margin of error in the projection may not detain us as the purpose is to drive home the yawning gap and the massive investment that is called for.

The vulnerability of the situation is considerably heightened by the growing open unemployment in the state. Kerala, with only 3.5 percent of the labour force of India, occupying 1.2 percent of the geographical area of the sub-continent accounts for over 11 percent of the total unemployed in the country. The percentage of unemployed to total persons of age 5 years and above in rural areas reckoned in terms of three measures of unemployment viz., usual status, current weekly status and current day's status as revealed by the 27th round (1972-73), 32nd round (1977-78) and 38th round (1983) of the National Sample Survey shows that Kerala has the highest incidence of unemployment among the states in India. The latest estimates (1987) based on a survey conducted by the Department of Economics and Statistics, Government of Kerala put the figure of open unemployment at 27.81 lakh persons and underemployed (those who getwork for less than 183 days in a year) at 15.52 lakh which together form about 40 percent of the labour force and 15 percent of the total population. (Government of Kerala, 1988). The fact that the number of work seekers has increased more than elevenfold, from 2.93 lakh at the end of December, 1970 to 34 lakhs at the end of December, 1989 do not speak well of the planning process, both by the Centre and the state.

This alarming situation is brought to sharper relief when we realise that the organised private sector has not only refused to provide any additional employment but threw many out of employment. By the end of December 1986 organised private sector provided employment to 5.19 lakh persons. But this declined to 5.10 lakh by the end of March 1988. True, the public sector employment during the corresponding period has increased from 5.76 lakhs to 5.86 lakhs. The future, however, look bleak. The central investment in Kerala which was 3.28 percent of the total in 1974 has come down to 1.62 percent in 1987. The cry of central "neglect" thus may have to be seen in the development context of the State.[2]

The state government is passing through a serious fiscal crisis and the chances of their making a visible dent on the unemployment situation through the public sector outlay seems to be difficult. Private sector definitely, has to play a major role. But there are certain national issues which are important and which need be mentioned in this context.

First, industrial location cannot be left to market forces in India. Presumably a redefinition of industrial policy may be considered especially in view of the liberalisation trends of the 1980's.

1. The co-efficient of variation of per capita income of 15 major States which was 19.07 for the three year average ending 1962-63 rose to 27.92 when we take 1970-71 to 1972-73 average and to 35.61 for the three year average ending 1982-83. This is a clear indication of the widening regional imbalances over time.

2. Though Kerala raises about Rs.1100 crores by way of export trade per annum and earns another Rs.1000 crores of free Foreign Exchange (*i.e.* without any expenditure on subsidies, tax rebates etc.,) they are not raised here, as such an approach will not be in strict conformity with the national resource idea within the federal polity.

Second is the issue of wages. The wage rates of unskilled labour in Kerala are very much out of tune with those of her neighbours. This can influence the location of labour-intensive industries as well as small-scale industries which do not require highly skilled labour. The issue of a national wage-salary policy may have to engage the attention of the National Development Council, the Planning Commission and indeed the new government at the Centre.

Third, there is currently a sort of competitive bid in announcing concessions for attracting industries (tax rebates, power, water, land subsidies etc.,) among the different state governments. This has nullified the net benefit that may arise as a result of these concessions. The poor states suffer by way of revenue loss. This is another fiscal federal issue that should engage the attention of the Union and State Governments.

Resource Allocation Strategies : Some Issues

Under the mixed economy type of planning which India has adopted, national goals are sought to be achieved through the public sector outlays and by providing a sense of direction to private sector through a kind of carrot and stick approach. The banks, IFC, IDBI, ICICI, NABARD, Rural Electrical Corporation and a host of public owned institutions are also expected to cater to the realisation of the national priorities and goals. As the volume of funds handled by them is very substantial they can significantly influence the national development pattern.[3]

The critical role of public sector plan outlays needs no elaboration. The Gadgil formula (as modified in 1980) and the centrally sponsored schemes have been the most important instruments in the allocation of resources in the country meant to ensure the realisation of the national goals.

Sharp vertical imbalance in the division of resources and responsibilities between the Union and the states is built into the Indian Constitution. The economic rationale (nowhere made explicit officially) for this clearly is not to build an over-centralised *Centre,* but an impartial umpire engaged in overseeing the implementation of national goals and priorities. That the Finance Commissions which in a way have a statutory responsibility to match resources and functions have so far failed in ensuring the realisation of national goals and priorities is fairly well documented.

3. How far these institutions have contributed to the rectification (or widening) of the regional imbalances is a matter to be empirically researched out. It is left out of this discussion.

The Finance Commissions have come to concentrate on the devolution of non-plan assistance. Admittedly a "gap filling approach" cannot deliver the goods. Whether a normative approach will be helpful or not depends upon the type of norms adopted and the whole strategy of plan allocations including discretionary grants. Though there are several media through which inter-regional flow of funds take place we may mention only the plan assistance and centrally sponsored schemes. Of course, we do realise that any corrective measures could be neutralised if the institutional funding is also not done to avoid built-in biases in favour of richer states.

The size of a state plan is determined by the state's own resources and Central Assistance. Borrowed funds apart, for all practical purposes the states' resources virtually depend on balances from current revenue. Inter alia, it depends also on the Finance Commission awards. For a state whose pension liabilities are over 12 per cent of revenue receipts and the salary payments more than its tax revenues much could not be expected by way of a revenue surplus. In fact during the last eight years the balance from current revenue has been negative and this trend has been continuing with increasing magnitudes.

Central assistance for the plans is provided by way of loans and grants. The ratio of grants to loans is uniformly fixed at 30:70 for all states with the exception of the special problem states like Jammu & Kashmir, Meghalaya, Nagaland etc., for whom dispensation is on the basis of extra ordinary criteria. Such arbitrary allocations have virtually reduced the shareable resources for other states whose central assistance has been based on the Gadgil formula. According to this formula Central assistance for a state is determined in terms of (*a*) 60 per cent on the basis of population (*b*) 20 percent on the basis of per capita income below national average (*c*) 10 percent on the basis of tax effort and (*d*) 10 percent to take account of special problems.

The Finance Commission awards which are based on tax devolutions and grants impose no repayment liabilities on the State. On the other hand, 70 percent of Central assistance for plans has to be repaid with interest. The excessive use of loans (though Article 293 of the Constitution under which this is done provides for only a marginal role, loans have become an overriding tool of budgetary transfers) imposes severe strains on states like Kerala with a poor resource base. The interest liabilities of the Government of Kerala which was only Rs. 57 crores in 1981-82 rose to Rs. 288 crores in 1989-

90, more than a 400 percent increase. As a proportion of the total revenue receipts, this liability which was only 6.7 percent in 1981-82 rose to nearly 14 percent in 1989-90. The servicing of debt will not be heavy for a rich state, but it can cut deep into the potential revenue surpluses which is a major parameter determining the plan size of any state. The issue here is a general one. A few questions immediately come up: should the 70:30 loan-grant ratio be changed? If so in what manner ? Should states falling within defined "backward" or "forward" (states like Kerala which have gone several miles ahead in realising important national goals) brackets be given a different loan-grant proportion ? Kerala requires a maintenance grant or what may be called "national goal effort grant" to sustain the status quo, leave alone the question of improving the quality of services like health, education etc.,

Admittedly, there is a strong case for making a loan as productive as possible, at least in improving the taxable capacity of the community. The Annual Plan exercise at Delhi that has been followed has no independent machinery to evaluate the economic rate of return (and in certain cases the internal rate of return, IRR) of major schemes. It is a matter for debate and decision whether an independent National Loan Corporation, (probably attached to RBI) with a soft-loan window to help states like Kerala be instituted or not. This is important, now that the establishment of an Inter-State Council and a statutory Planning Commission is well underway.

The entire scheme of Central assistance to State Plan needs to be put on a more rational and equitable basis. The Gadgil formula can be modified or abandoned in favour of a more objective criteria. The overall weightage of 60 percent given in favour of population in the Gadgil formula is at best only a neutral criterion. Further, in view of the falling population growth rate of Kerala compared to other states, the per capita income may lose its objectivity as a measure of backwardness. Given the widening inter-state disparity in per capita state domestic product and the growing unemployment from plan to plan as well as the poor progress in physical quality of life indicators like literacy rate, infant mortality rate etc., in most states, a question that needs to be debated is whether the Gadgil formula should be abandoned in favour of a normative approach approved by the National Development Council. A Planning Commission deriving authority from the Constitution probably needs some such criteria in order to set plan priorities consistent with national priorities.

No one can gainsay the need to reduce the element of arbitrariness in the transfer of all funds to the states. In the telling words of Ashok Mitra : "The so-called discretionary transfers sanctioned by Article 282, now threaten to constitute as much as two-thirds of the total. This is where the prejudices and predilections of the Union Government have come into full play, converting the supposedly companionship relationship of a federal polity into almost a masterservitor one". (Mitra"s "Foreword" to Gulati and George, 1988). While Mitra's figure may be exaggerated, his references merit attention and action. The discretionary element is probably most pronounced in regard to the so-called centrally sponsored schemes. Today there are about 300 such schemes ranging from agricultural films to family planning involving a sum of over Rs.16,000 crores per annum. Apparently they are meant to attract the states into national priorities. But never have they been done that way. Attracted by the bait of the grant, the states divert their plan funds which could be at the expense of the state's own priorities. This results in the creation of certain infrastructure and staff or rather "scaffoldings" which are perpetuated ever after the 'mission' is completed.

Under the new dispensation, the whole issue of national and regional priorities needs re-examination. Arbitrariness and adhocism in the allocation of national resources will have to be avoided. Planning in India is to be viewed as a national endeavour in which the states and their Union participate with a purpose. Conflicts are bound to come. The resolution of the conflict depends upon the rules of the game laid down and the readiness in observing them with mutual trust and confidence.

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Industrial Policy for the 1990s

U. Sankar

This paper examines the relative roles of public sector and large, small, cottage and village industries in the private sector in the light of the changed economic conditions, our own development experience, experiences of other countries, both socialist and free market economies, and recent developments in the fields of industrial organisation and development economies,

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The initial conditions in early 1950s for rapid planned development were not favourable. Our savings rate was very low (around 5 %). Our (arable) land-man ratio was low and agricultural production was highly unstable due to the vagaries of the monsoon. Our industrial base was poor and biased in favour of consumer goods industries. The markets for products and inputs were generally imperfect and the institutions needed for the transformation of financial savings into productive assets and for spreading, transferring and sharing of risks were not developed. It was felt that the private sector would be unwilling to undertake huge investments in basic and heavy industries and infrastructures because of long gestation periods and high risks.

Nehru was instrumental in choosing a mixed economy framework and laying the foundations for economic planning. The Directive Principles of State Policy, enumerated in the Constitution of India and the adoption of a socialist pattern of society by Parliament in 1954 provided the general guidelines for social and economic policies. The Industrial Policy Resolutions of 1948 and 1956 specified the spheres of activities of the public sector and large, small, cottage and village industries in the private sector and the policies towards industrial houses, foreign concerns, capital, labour etc. The Industries (Development and Regulation) Act 1951, the Essential Commodities Act 1955 and the Monopoly and Restrictive Trade Practices Act provided the powers necessary for regulation of the private sector. Industrial licensing was used as an instrument for allocating investible funds according to plan priorities. Price and distribution controls for essential commodities were used to achieve social and economic goals.

Nehru and Mahalanobis advocated a heavy-industry oriented strategy to maximize long-term growth in real national income. They were aware that this strategy would yield lower growth rates and generate less employment in the early years of development but it was

preferred (to the Gandhian strategy of decentralized development with stress on labour-intensive techniques) because it would make India technologically self-reliant and provide opportunities to develop our technical skills by imbibing the scientific spirit. It was also anticipated that a high rate of growth of income (5 % per annum) would produce the 'trickling down effect', after some time lag. The planners relied upon small scale, cottage and village industries for employment generation during the transitional period.

The anticipated high average annual growth rate of 5% did not materialise. The average annual compound rate of growth during 1950-51 – 1980-81 was only 3.5% and the per capita growth rate was only 1.3%. In every plan period, the achieved rate of industrial growth was lower than the targeted rate. The targeted rates were above 10% for the second and third plans but the actual rates were only 7.25% during the Second Plan and 8% during the Third Plan. During the fourth and fifty plan periods the average annual growth rate was only 4.8%. A number of scholars (Raj, 1976; Shetty, 1978; Chakrawarti, 1987; Ahluwalia, 1985) have examined the reasons for the slowdown in industrial growth. The factors mentioned for the slowdown in industrial growth during the late sixties and early seventies include neglect of the agricultural sector, particularly lower allocation of funds for irrigation, reduction in the shares of public investment in infrastructures and capital goods industries, a sheltered industrial environment resulting from import substitution, cost-plus pricing and other regulatory policies and a poor performance of the public sector and organized industrial sector in employment generation.

Since 1975 there has been a gradual shift in industrial policies in favour of economic liberalism. These changes are manifested in the delicensing of a number of industries, regularization of unauthorized capacity installed by large industrial houses and foreign companies, automatic increases in capacities upto certain specified levels, exemptions from the MRTP Act for export-oriented units etc.

The Industrial Policy Statement issued by the Janata Government contained special provisions for the development of small-scale and village industries. The list of industries exclusively reserved for the small scale sector was expanded from 180 to 807 by May 1978. The government favoured units with an investment of upto Rs.one lakh and situated in villages and towns with a population not exceeding 50,000. District industrial centres were set up in each district to serve as the focal point of development for small scale and cottage industries. Large business houses were required to rely on internal resources for financing new projects or for the expansion of existing ones instead of relying heavily on public financial institutions.

The Industrial Policy Statement, July, 1980, emphasized optimum utilisation of capacity, correction of regional imbalances through preferential treatment for new units located in backward areas, automatic increases in capacity of almost 50% in 5 years and stimuli for setting up 100% export-oriented units.

It is clear that the objectives of India's industrial policy and the weights attached to each objective have been changing over time. The Sixth Five Year Plan stated that 'Industrial policy cannot be static and will have to respond to changes in the economic scene. The framework of rules and regulations relevant to the nascent stage of development are not necessarily appropriate to the complex industrial structures which have since been built up' (p. 261)

The process of liberalization continued during the 1980s. Many price and distribution controls were dismantled. Import controls were relaxed for modernization of industry and for export-oriented units. Many new units with foreign collaborations were set up in many consumer durable industries. Large industrial houses were permitted to enter the core sectors such as fertilizers, petrochemicals and oil refining. More importantly, the capital market received a big boost by increasing the number of stock exchanges, creation of new financial instruments and institutional measures for promoting financial intermediation. These liberal industrial policies and faster rate of agricultural growth helped the country to achieve an average annual rate of growth in GDP of 5% during the 80's. The average annual rate of industrial growth had been 8%. Despite the high rate of industrial growth, the rate of labour absorption in the non-agricultural sector has been low and there appears to be no significant reduction in the percentage of people below the poverty line. The pattern of industrial growth is also criticised because of the increasing share of durable consumption goods, particularly luxury goods, in the output basket. It is argued that these goods have high import intensities and that the methods of production are capital intensive. There is also a concern that, in view of the low rate of employment generation and skewed distribution of income, this type of growth pattern is not sustainable.

The National Front Government is advocating 50% of plan outlay for agricultural and rural development. It favours a decentralized planning strategy and envisages an employment oriented industrial policy. It is expected that the new programmes for development of small-scale, cottage and villages industries would form an integral part of the Eighth Plan. The proposed strategy is expected to achieve balanced regional growth, dispersal of industries in villages and small towns and improvement in the distribution of household income.

The initial conditions for launching the Eighth Plan and design of economic policies for the 1990s are different. Our gross savings rate is about 22 percent, one of the highest observed rates for a developing country. We have a diversified industrial base. We rank third in scientific manpower and possess the capabilities for undertaking the production of any basic/heavy industry product. Our capital market has been experiencing buoyancy and many private units have come forward to establish large units in the core sector. The economy has become more open and the need for market orientation to achieve cost reduction is being stressed. Some weak spots of our development experience have been the rising incremental capital-output ratios, low rates of employment generation in the organized sectors and the poor physical and financial performance of many of our public enterprises.

This paper examines the relative roles of public sector and large, small, cottage and village industries in the private sector and policies towards them in the light of changed economic conditions, our own development experience, experiences of other countries, both socialist and free market economies, and recent developments in the fields of industrial organization and development economics.

Role of Public Sector and its Management

The IPR of 1948 identified arms and ammunitions, atomic energy and rail transport for central government ownership and reserved all new undertakings in coal, mineral oil, iron and steel and the manufacture of aircraft and telecommunication equipment for the public sector. The IPR of 1956 stressed that the realisation of the objectives of the socialist pattern of society and planned rapid development required that all industries of basic and strategic importance, public utility services and other industries which required investment on a scale which only the State could provide must be in the public sector. During the late sixties and early seventies, it was envisaged that the public sector must capture the 'commanding heights' of the economy. 14 major commercial banks, coal mines and sick textile mills were nationalized. Later the public sector was also expected to provide the necessary counter-poise to the private sector for supply management as needed from time to time in periods of crises in the vital sectors of the economy.

Now the public enterprises function in a wide range of activities, covering fields as varied as manufacturing, generation and distribution of electricity, gas and water supply, construction, transport and communication, banking, finance and insurance, trade and even social services. Some of them operate in a monopoly environment; energy producing enterprises, railways, airlines, etc. Others operate in semi-monopolistic, oligopoly environments. By 1986-87 the total capital stock in departmental and non-departmental enterprises (both central and state governments) was Rs.2,80,000 crores. The gross rate of return (gross of taxes but net of depreciation) in 1986-87 was less than 1.5% (Kelkar, 1989).

One could raise objections to the evaluation of the performance of public sector enterprises in terms of any single measure, such as the rate of return (Sankar, 1983). The public enterprises were expected to pursue multiple goals such as the promotion of self-reliance, employment generation, development of backward areas, generation of internal funds, nursing sick units, developing the small scale sector through anciliarisation and the role of a model employer. Unfortunately, neither the central nor the state governments nor the enterprises themselves had attached any weight to the different goals or provided any ranking of the objectives in specific cases. The enterprises were expected to maximize social gains, but no serious attempt was made to derive pricing and other policies, from the objectives, technology, market and other environmental conditions (Sankar, 1989).

India is a capital-scarce economy. The Planning Commission recommends a minimum financial rate of return of 12% for approval of large projects. Reviewing the financial performances of the state public enterprises, various Finance Commissions reiterated the need for ensuring minimum rates of return on investments in different state enterprises. The concept of a minimum rate of return on invested capital is evident in socialist planning and is also implicit in the Nehru-Mahalanobis strategy of planning. Most of the administered prices are computed after allowing for prescribed rates of return on allowed capital. Then, why are the

observed rates of return on invested capital in many enterprises very low and sometimes even negative ? Based on the Hungarian experience, Kornai notes that, in the case of state enterprises, there are many areas of flexibility and bargaining that soften the budget constraint : taxation, credit, prices and subsidies (Kornai, 1975). He argues that, in more than one area, an enterprise can bargain with government agencies for exceptions and favourable terms, and in so doing can escape the financial consequences of inefficiency. Hence financial deficits are not real constraints as they can be redefined, reduced, or written off through reshaping the terms of taxation, credit, prices and subsidies. Kelkar cites the 'agency problem' as one of the reasons for inefficiency. The vertical relationship between public enterprises and state agencies facilitate non-economic bargaining between the two in terms of sources of power and influence. In sales of electricity and irrigation water some beneficiary groups have been successful in exerting political pressures to keep the prices to these groups below the costs of services.

There is an urgent need for hardening the budget constraint. Kelkar suggests that we should bring efficiency and profits to the 'centre court' in thinking of the public sector. If the conditions for contestability hold, the threat of potential entry can help in achieving economic efficiency. If the contestability conditions are not met (e.g. due to high fixed/sunken costs or/and economies of scale and scope) then "minimizing" competition is necessary. Economic efficiency can be achieved by price reforms, providing autonomy for the enterprises and creating incentives for better performance and penalties for failures in achieving the targets.

The problem arises when goals other than efficiency such as equity and development of backward regions assume special importance. One possibility is that the costs of pursuing goals other than efficiency should be borne by the government, as a social burden. If the government is unwilling to bear the social burden and hardens the budget constraint then cross subsidization becomes inevitable. Cross-subsidization is now widespread in postal, telephone, railway and electricity tariffs.

In certain utility services e.g. electricity supply and city/municipal water supply, not only is the financial performance poor but also the quality of service is poor. Large power consumers can face power cuts by resorting to captive power generation. Similarly high income households can meet their water needs, when the public delivery system fails or is undependable by relying on their own wells or by investing in storage facilities. In both cases, the worst hit are the relatively poorer sections of users. In view of the externalities and economies of scale, greater public investments in power generation and water supply would not only ensure fairness in distribution but also make supplies available to all sections at lower social costs.

Distressed by the mounting losses in enterprises and the lack of political will in making hard decisions such as setting prices equal to long-run marginal costs or retrenching surplus labour, some politicians, business and consumer groups are advocating some form of privatization or private entry into some of the markets. Private entry will occur only in those markets where the prevailing prices are equal to or above long-run marginal costs. In the case of electricity supply, the structure of tariff in many states is such that the LT tariff (particularly agricultural and domestic) are below the long-run marginal costs while the EHT and HT tariff for industries are higher than the corresponding LRMCs. In such a situation a private entrant would have an incentive to set up a power plant in an industrial centre to meet the needs of EHT and HT consumers. The state electricity boards would lose the profit-generating markets and be burdened with serving costlier markets. This phenomenon is known as 'cream-skimming'. This type of problem could be avoided by a stipulation that the new entrant must produce power and sell it only to the utility for distribution. The question then is whether the private entrant will have any incentive to undertake this venture, and if so, on what terms ?

There is some justification for operating public enterprises in utility services, energy industries, mining, rail transport, highly risky activities and activities involving non-market externalities. Whether or not the public sector should be assigned the roles of nursing sick units taken over from the private sector, or serving as a counterpoise to the private sector or acting as a countervailing force, should be examined carefully in the light of our past experience, administrative constraints and our political economy setting.

Some Policies Towards the Private Sector

Our experience in implementing industrial licensing, price and distribution controls, credit allocation and import permit policies have taught us some valuable lessons. It is now obvious that these types of direct regulation of the economic system by administrative controls and guidelines impose heavy costs on consumers and producers. The sheltered conditions have re-

duced the competitive pressures and weakened the motivation on the part of both private and public managers to pursue cost-minimising policies. Further these controls are mainly responsible for widespread corruption and the generation of black money (Dagli Committee Report, 1979). Relaxation of direct controls, particularly exemptions from industrial licensing for certain industries, or raising the limit (in terms of capital invested) also create problems. Private entrepreneurs have incentives to undertake investments in activities and supply those goods for which the demand conditions are favourable. The problem is that, with a skewed distribution of income and in a situation where many basic needs are not met, the market determined basket of outputs may differ from an optimal basket of outputs from the society's point of view. These policies contribute to the flow of private investment in the production of socially less urgent but profitable activities. Even during our tight control regime we could not prevent these types of investments and when we did we found the emergence of smuggling, black market etc. Therefore, a second-best solution might be to rely on indirect controls, such as high import duties for the import of capital goods which go into the production of luxury goods, or/ and higher excise duties on luxury goods, rather than an outright ban on the production of these goods.

In many developed market economies, we observe increasing industrial concentration in many manufacturing industries. The reasons for the concentration are :

(*a*) economies of scale (requiring a minimum size for achieving cost efficiency),

(*b*) economies of scope (in the case of multi-product firms),

(*c*) non-market externalities in gathering market information, in learning and R and D activities and

(*d*) comparative advantages of large firms in marketing and raising funds.

Without realizing the importance of these factors, we permitted many new entrants in activities such as automobile manufacturing, two wheelers, cement, electronics, etc. As a result, many of these firms have capacities far below the optimal levels by international standards. It has even been suggested that managerial diseconomies are more important than diseconomies of scale (Ghosh, 1984). In some instances, even the existing capacities are not fully utilized. In industries such as cement, petro-chemicals and fertilizers, the markets cannot support more than one or two entrants every year. As these units require heavy outlays and the type of intertemporal market failure Keynes envisaged is very likely, the government has to play an important role in regulating investments in the core sector.

With liberal licensing policies, particularly with regard to entry for private firms in core industries, concentration of economic power in private hands will increase. Wide distribution of shares among private individuals and the allotment of a significant proportion of equity capital to public financial institutions are being suggested as methods for achieving dispersal of ownership in large public limited private concerns. The 'agency problem' arises because of the separation of ownership from management, the relatively low share of the controlling interests in paid-up capital and the possible nexus between management and nominees of the institutional investors. The problems of adverse selection, moral hazard and contract enforcement could arise and procedures have to be devised for minimizing the undesirable consequences.

In a capital-scarce and labour-surplus economy the methods of production also do matter. Our industrialisation experience reveals increasing trends in capital-output and capital-labour ratios and relatively low rates of employment generation. The fall in the average net value added/net fixed capital stock ration is attributable to increases in costs of generating capacities as well as low rates of utilization of existing capacities (Chakravarti, 1987). Analysing the impact of new liberalisation and new industrial strategy on output and employment, Ajit Singh and Jayati Ghosh have raised questions about the desirability of pursuing export-led growth strategy and recommended a strategy focussing on the domestic market and building up domestic production and employment (Singh and Ghosh, 1988). The policy of selective deregulation and promotion of internal competition will benefit the economy.

It is also desirable that our fiscal, credit and labour policies be changed tc provide the correct signals to producers about the relative factor prices. Even though the nominal cost of capital has increased in recent years, the real cost of capital to industry appears to be low. Considerations such as export promotion and technological upgradation are responsible for giving fiscal incentives for stimulating private investment. Policies such as reduction in corporation income tax rate, accelerated depreciation allowances and investment tax credit do make the cost of capital (relative to the cost of labour) cheaper. Liberal technology import policies, trade union power and constraints on labour retrenchment are some

of the other factors responsible for producers' preferences for capital-intensive methods of production. As a result, the share of wages in net value added shows a declining trend. The internal demands for many manufactured goods are low partly because of the high indirect tax rates. Based on a sample of 417 public limited companies (accounting for half of the paid-up capital of non-government public limited companies in March 1986) financial data from ICICI, Ranjit Sau reports that, for the period 1969-85, the average shares of wages and salaries, gross profits and excise in net value added and excise duties as 0.352, 0.280, 0.368 respectively (Sau, 1989). The share of corporation income tax and excise duties in the value added measure works out to 44%.

The Industrial Policy Resolutions and five year plans have stressed the need for promoting small-scale, cottage and village industries to achieve goals such as employment generation, improvement in income distribution, balanced regional development, and dispersal of ownership to prevent concentration of economic power. CSO gives distribution of factories by size of capital (the undepreciated gross value of plant and machinery installed) and by employment size classes (CSO, 1989). For the year 1985-86, factories with capital upto Rs. 20 lakhs accounted for nearly 89 percent of the total population of registered factories. These factories had 5% of the total fixed capital, but had a share of 36% in employment and 17% in net value added. Table 1 gives the fixed capital / net value added by employment range and size of capital. In general, we find a positive relationship between the capital-net value added ratio and capital size. At the two digit level, this ratio ranges from 0.59 in other manufacturing industries (code 38) to 3.53 in basic metals (code 33) in the manufacturing sector, with the overall average being 1.75. This ratio for group electricity, gas and water supply is 8.18. It may be seen from Table 2 that the share of labour in net value added increases with employment in most capital size groups, eventhough we do not find any clear pattern after aggregation (over columns or rows).

Table 1: Fixed Capital to Net Value Added by Size of Employment and Gross Value of Plant and Machinery in 1985-86

Employment Range (Number)	Capital Range (lakhs of Rupees) < 10	10-20	2—25	25-35	35 +	All factories
1 - 49	0.822	1.813	3.088	2.785	4.094	1.32
50 - 99	0.518	1.008	1.352	1.068	6.182	2.41
100 - 199	0.434	0.661	0.780	0.734	3.010	2.03
200 - 499	0.448	0.368	0.439	0.607	4.182	3.71
500 - 999	0.180	0.461	0.917	0.890	3.431	3.31
1000 - 1999	0.269	1.047	0.184	0.221	3.018	2.99
2000 - 4999	1.254	0.831	–	0.899	1.219	1.22
5000 and above	–	–	–	–	2.777	2.78
All factories	0.711	1.060	1.239	1.083	3.018	2.58

Source : ASI 1985-86 Summary Results For Factory Sector (CSO, 1989)

Table 2: Emoluments to Net Value Added by Size of Employment and Gross Value of Plant and Machinery in 1985-86

Employment Range (Number)	Capital Range (lakhs of Rupees) < 10	10-20	2—25	25-35	35 +	All factories
1 - 49	0.424	0.340	0.454	0.315	0.246	0.40
50 - 99	0.551	0.452	0.441	0.321	0.421	0.47
100 - 199	0.613	0.504	0.461	0.372	0.352	0.42
200 - 499	0.786	0.516	0.506	0.551	0.474	0.50
500 - 999	0.420	0.436	0.920	1.152	0.439	0.44
1000 - 1999	0.584	0.833	0.387	0.651	0.530	0.53
2000 - 4999	1.916	0.918	–	1.527	0.479	0.48
5000 and above	–	–	–	–	0.548	0.55
All factories	0.494	0.446	0.475	0.435	0.475	0.48

Source : ASI 1985-86 Summary Results For Factory Sector (CSO, 1989)

The government has been using direct measures such as reservation of certain activities, exclusively for small units and the creation of institutions for technical assistance, marketing and credit, as well as indirect measures like excise duties on products of large industries and subsidies on products of small, cottage and village industries. Many studies have drawn attention to the poor physical and financial performance of a large proportion of these units in many of these industries. Capacity utilization rates have been low, both due to problems on the supply side (*e.g.* input shortages, technical problems, power cut) and lack of demand. Organized efforts have yielded good results in some regions in

activities such as handloom dairying and a few handicrafts.

It is argued that the programmes for small-scale, cottage and village industries have not been properly integrated in our plans. It is suggested that a decentralized planning strategy, with thrust on agro-based rural industries, would provide the necessary stimuli for the growth of these industries. It may be said that the social costs of pursuing this type of strategy may be less than the private costs. The questions are how to make these units viable, at what cost and for how long ? In devising action-oriented programmes, both technical and pecuniary external diseconomies facing these units must be clearly identified. The technical diseconomies arise in purchases of inputs, getting credit and the marketing of these products.Policies such as the strengthening of industrial service centres, improving market institutions and extending credit facilities at reasonable rates can help these units overcome some of the problems arising out of diseconomies of scale.

Development of agro-based industries in rural areas will be helpful in increasing rural employment and income and hence reduce the social costs of rural-urban migration. One problem with an agro-based industrialisation strategy is that fluctuations in agricultural supplies due to weather and other factors will affect the supplies of raw materials to these industries. Policies such as extension of irrigation facilities, provision of dependable supply of water by conjunctive use of ground water, development of drought-prone varieties, buffer stock programmes for agricultural raw materials, etc. can help in stabilizing the supplies.

It is desirable that the government involve voluntary agencies, cooperatives and other forms of producer organizations for the development of these industries. These organizations can play useful roles in internalizing externalities, diseminating technical and market information, development of managerial skills and other promotional activities.

The experiences of highly developed economies show that construction, trade and service sectors provide greater opportunities for employment generation than manufacturing. Activities such as housing, repairs and services and road construction are labour-intensive. In framing and implementing employment-oriented industrial policies the social costs of implementing programmes in different sectors should be ascertained so that conscious decisions can be made on the nature and extent of trade-offs between output and employment.

Concluding Remarks

In formulating industrial policies in a mixed economy we must recognize both the limits and strength of markets, as well as the limits and strengths of government interventions. The following observation of Sen (1987) is highly relevant: 'Markets as institutions have many advantages and quite prominent disadvantages, and the judicious choice of markets in some spheres but not in others is a good subject for instrumental analysis enlightened by professional investigation'.

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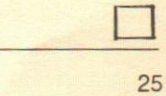

India in the Twentyfirst Century : Some Danger Signals

B. B. Vohra

Even though India's progress in certain fields, particularly in infrastructure and industrial development, has been impressive it will cease to have much relevance if the country continues to be overshadowed by an excessive population growth, widespread poverty, mass illiteracy and unemployment, insufficient food production and collapsing ecological system. Were we to strive for parity with China in food grains availability, our last harvest should have been 250 million tonnes instead of 170 million tonnes. We have no option but to ensure that every acre of land is put to the best possible use and that it is not allowed to undergo any kind of degradation. We set our sights so low that we have landed ourselves in to the ecological crisis which has overwhelmed us today; argues this paper.

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What kind of India will there be in 2000 A.D. and what are the major problems the country is likely to face in the 21st Century ?

A great deal of thought was given to these questions in the mid-seventies when the Ford Foundation commissioned the "Second India Studies". The title of these studies was meant to convey the message that by the end of the century, India's population would have doubled from what it was in the early seventies and that this development would inevitably create new problems for which the country should be prepared.

One has to be careful about the perils of futurology, for there is really no knowing what entirely unforeseen developments may occur at any time in the future. Nevertheless, there are certain unmistakable trends which clearly indicate the direction in which a country is moving. In the case of India, the most worrisome features revealed by the "Second India Studies" relate to the high rate of population growth, its failure to deal effectively with problems of rural development, proverty and social justice and the rather disappointing performance of its agricultural sector. Unfortunately all these negative factors are still very much a part of the India scene and bode ill for the country's future. In addition, there has been another development of great significance, namely the damage suffered by the country's life-support systems by the continued degradation of its land resources. Although this damage had been taking place in an insidious manner for decades, the fact that it was not mentioned by the "Second India Studies" only shows that ecological awareness had still to strike root in the mid-seventies.

It is felt that for the purpose of assessing India's future prospects, it will be enough if only these four core factors are taken into consideration. Even though progress in certain other fields - particularly of infrastructural and industrial development - has been impressive, it will cease to have much relevance if the country continues to be over-shadowed by problems created by an excessive population, widespread poverty,

insufficient food production and a collapsing ecological system.

As far as the problem of population is concerned, the "Second India Studies" envisaged three distinct scenarios for the year 2000 - a 'low' of 926 m, a 'medium' of 999 m and a 'high' of 1035 m. However, according to a recent report of the Population Reference Bureau in Washington, India's population has already reached 835 m, is increasing at around 2.3 per cent per annum and will reach 1042 m by the year 2000. In other words, we are likely to have 70 m more mouths to feed in 2000 A.D. than the 972 m that were estimated when India's 7th Plan was drawn up in 1985. This is a most sobering prospect indeed and points to a grim future for the country which, incidentally, is all set to ultimately become the world's most populous nation, with a population of some 1700 m, around the middle of the next century.

As regards proverty and lack of social justice, these problems are still very much with us. India still has some 30 per cent to 40 per cent of its people below the poverty line. This is a very serious matter because such a situation is, to put it mildly, not conducive to the achievement of the political, economic and social stability that a developing country needs so badly. What is however not generally realised is that our failure to deal effectively with problems of poverty and social justice has had a most unfortunate effect on the agricultural sector, and has landed us into a vicious circle from which it will be difficult to escape.

The ruling elites of all countries find it difficult to tackle problems of poverty and in many cases try and sweep them out of sight. India is no exception to this rule - if anything, it exhibits, thanks to the caste system and the Karma theory, a greater tolerance of, and indeed callousness towards, problems of deprivation and social injustice. This perhaps explains why the country's food production targets are based on estimates of the effective demand for foodgrains under the prevailing distribution system rather than of the minimum nutritional requirements of the entire population. These targets are naturally pitched low because they take no account of the requirements of those 300 odd millions of the populations who do not possess adequate purchasing power to buy all the food that they need.

If is often forgotten that India's claim to have achieved self-sufficiency in foodgrains is based on this so-called "realistic" view of its food requirements. It speaks volumes for our rather cynical approach to the entire problem of hunger and poverty in the country that this myth should have been eagerly accepted by our ruling elite who are in no mood to shoulder the awesome responsibility of feeding the entire population at an acceptable level of nutrition. It is, however, a great pity that the claim of having achieved self-sufficiency should have been also accepted by aid-giving countries and agencies and thereby invested up with a credibility it did not deserve.

Be that as it may, the point to note is that the myth of self-sufficiency has rendered a grievous disservice to Indian agriculture by creating an entirely unjustified sense of complacency with regard to its capabilities and achievements. For there can obviously be nothing seriously wrong with the agriculture of a country which can feed itself without having to depend on imports. It is the smugness born out of such thinking which has led to the adoption of low food targets and therefore to the perpetuation of the poverty syndrome.

A true indication of India's agricultural situation can only be provided by comparing its level of productivity with that of China. So completely have we convinced ourselves of our wonderful achievements in agriculture that the record harvest of 170 million tonnes which we gathered in 1988-89 has been hailed as a great event, even though it represents a gross availability of only around 200 kg per capita per annum. China's foodgrains production, on the other hand, is upwards of 300 mt according to U.S. sources - its own claims are much higher, and thus represents a per capita availability of nearly 300 kg per annum. However, even more important is the fact that the Chinese have less than 100 mh of land under agriculture as against around 143 mh of ours.

Complacency on the food front has also contributed effectively to another most serious development - the neglect of our land resources and consequently their unchecked degradation. A simple arithmetical exercise will show that were we to strive for parity with China in the matter of per capita foodgrains availability, our last harvest should have been not 170 mt but around 250 mt. Had we aimed at anything like such a parity, we would have had no option but to ensure that every acre of our land was put to the best possible use and that it was not allowed to suffer from any kind of degradation. It was precisely because we set our sights low that we have landed ourselves in the ecological crisis which has overwhelmed us today.

The dimensions of this crisis are truly frightening and merit discussion because coming, as it does, on top of our failure to keep population growth under check and to tackle problems of poverty and hunger, it will be the outcome of this crisis which will determine whether India will enter the 21st century as a limping giant or as a viable and self-respecting country. It was as far back as in 1980 that the Sixth Plan document reported that out of the total area of some 266 mh which have any potential for biotic production, as many as 175 mh or two-thirds were

suffering from degradation to a greater or lesser degree. At least around 90 mh or nearly half of the degraded area had been damaged to such an extent that it has been since officially classified as "wastelands". In other words, only around one-third of the country's area which had any relevance for agricultural, forest or pasture production was in good health, another one-third was sick to a greater or lesser degree and the remaining one-third had for all practical purposes gone out of production. This is a shocking state of affairs indeed.

The present situation must be even worse because while, on the one hand, we have not done very much in the intervening years to halt the process of degradation, on the other hand the pressures of animal and human populations on the land have grown steadily at over 2 per cent per annum. However, thanks once again to the curse of complacency, we have not felt any need for systematically monitoring the health of our irreplaceable land resources, let alone for drawing up long-term policies for their improved mangement. We are thus living in a paradise of our own making, and have convinced ourselves that there is nothing really seriously wrong with the ecological situation when in fact it may have already deteriorated to the point that the land may be incapable of sustaining a billion people in 2000 A.D.

What does the 21st century hold for such a country ? If present trends continue unchecked, the country will have little to look forward to. The question next arises as to what chances there are of India being able to reorder her policies and priorities quickly and energetically enough to be able to ward off the disaster that threatens her. These chances appear to be very bleak indeed, basically because there is as yet no real awareness of the threat.

Thus, although population control is perhaps the most important issue of all, it seldom finds mention in the media and does not figure in political debates between political parties. It is almost as if the problem did not exist and if it did, was of no great significance. Similarly, the question of whether our food production is sufficient for our needs is even less in the news, so complete is our convication that we have achieved self-sufficiency in this field.

The problem of poverty does get talked about but mostly in the context of electoral tactics. A campaign to eradicate poverty was announced about twenty years ago as part of an election campaign but no coherent strategy to achieve the objective has been worked out to date. Large sums of money have been channeled into rural areas for poverty alleviation programmes in the form of loans and grants to individuals but only a small percentage of these funds actually reached the intended beneficiaries - only about one rupee out of every six, according to the Prime Minister. Poverty alleviation programmes have not been effectively linked with programmes for greater food production and better resource management and have therefore proved to be largely infructuous.

As far as better resource management is concerned, even the concept has yet to find acceptance. Although it was as far back as 1973 that the then Prime Minister approved of a proposal to take up the challenge of improved land management in a serious manner and to create the organizational infrastructures necessary for such a task, these ideas never found willing aceptance among a "resource illiterate" establishment and have yet to acquire a practical shape. As a result, the situation in this field is still chaotic and the country is not even properly informed of the economic and ecological damage it is suffering as a result of the neglect of its basic resources.

We spend thousand of crores of rupees each year on big irrigation projects but without ensuring that waters impounded at such high cost are properly utilized. Our pre-occuptation with big dam projects is almost pathological and makes us neglect the real challenge in the field of water management which is the conservation of water as soil moisture and ground water through better land management and effective afforestation. There are still no effective checks on freely grazing animals and therefore on the untold damages they cause to the natural regeneration of the land. We are thus pursuing policies which are directly responsible for droughts as well as floods, for the premature siltation of irreplaceable reservoirs, and for the loss of incalculable quantities of top soil and sweet water to the sea. The list of our defaults is almost endless.

In these circumstances, it is futile to hope for any dramatic change in India's existing policies and priorities, which are quite obviously tilted in favour of industrial, military and urban development rather than rural development and proverty alleviation. The only hope for the country lies in the possibility that it will perceive, while there is yet time, that its biggest responsibility is to narrow the growing gap between the needs of a large and rapidly increasing population on the one hand and on the other, the shrinking capacity of a rapidly eroding productive base to meet these demands. But mere perception will not do—such a responsibility must also be discharged before the point of no return is reached. This is exactly where the seeds of a major tragedy lie.

Indian Agriculture : Performance and Projections

S.S.Khanna and M. V. Pavate

This paper attempts to trace the agricultural scenario for the coming years and suggests that a strategy designed to bring all cultivable area under production, by concerted efforts at wasteland development, will be required to meet the increasing demands for agricultural produce. There has to be a greater emphasis on the development of improved seeds, as well as the evolution of an adequate support system for farmers in the form of markets, remunerative prices and science and technology back-up.

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Indian agriculture has exhibited a remarkable degree of resilience during the last four decades. The country has achieved self-sufficiency in foodgrains from a base level of 53 mt. to a production level of 170.25 mt. in 1988-89. The annual rate of growth in agriculture since Independence has been about 2.8 per cent while during the pre-independence era, it was only 0.37 per cent. During the 80s the growth rate has been around 3 per cent per annum. Another silver lining in the over all phenomena of agricultural production is the output change due to increased productivity.

Foodgrains Production

The performance of foodgrains was slightly better in the first year of the Seventh Plan which showed about 95 per cent of the achievement of the target as compared to 90 per cent and about 83 per cent of the targets set for 1986-87 and 1987-88. The short fall in achievements of targets during the second and third years of the Seventh Plan was of the order of 15.92 million and 27.69 million tonnes, respectively. Crop production was badly affected in almost all the states during these years due to unfavourable weather conditions, particularly the drought in 1987-88.

In the last two years of the current plan, the Special Rice Production Programme(SRPP) has been launched with the determination to maintain the overall growth rate stipulated for agriculture in the current plan. In order to faciliate the farmers in the SRPP states to participate in the programme in a big way, several measures were introduced to assist them. These include reduction in prices of nitrogenous fertilisers, reductions in the interest rates of agricultural loans, establishing hundreds of new input distribution and procurement centres etc. Against the target of 166.57 million tonnes of foodgrains during the season (1988-89), the achievement has been 170.25 mt. and it is likely to be between 170-173 mt. in the current year, (1989-90) (Table 1)

Table 1 : Targets and Achievements of Agricultural Production during Seventh Plan

(Million tonnes)

Crop	1985-86		1986-87		1987-88		1988-89		1989-90	
	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement	Target	Likely Achievement
1	2	3	4	5	6	7	8	9	10	11
1. Rice	63.50	63.83	65.00	60.56	64.65	56.86	67.95	70.67	72.50	70.5-71.2
2. Wheat	49.20	47.05	49.00	44.32	50.51	46.17	52.32	53.99	54.00	52.5-53.8
3. Coarse cereals	33.00	26.20	32.00	26.83	32-32.5	26.36	33.00	31.89	33.75	33.0-33.5
4. Pulses	13.50	13.36	14.00	11.71	14-14.5	10.96	13.30	13.70	14.75	14.0-14.5
5. Total Foodgrains	159.20	150.44	160.00	143.42	160-163	140.35	166.57	170.25	175.00	170.0-173.0
6. Oilseeds	13.60	10.83	14.80	11.27	14.15	12.65	15.66	17.89	16.50	16.9
7. Cotton*	8.50-8.60	8.73	8.80	6.91	8.30	6.38	9.78	8.69	10.00	9.5
8. Jute & Mesta @	8.65	12.65	8.50	8.62	8.60	6.78	9.20	7.70	9.50	7.85
9. Sugarcane	191.00	170.65	185-190	186.09	180-185	196.74	195.00	204.63	212.00	205.0

** Bale of 170 Kgs.*
@ Bale of 180 kgs.

Oilseeds

During the Seventh Plan, the production of oilseeds is targetted to increase from the assumed base of 13 million tonnes in 1984-85 to 18 million tonnes by 1989-90. This implies a growth rate of 6.72 per cent per annum. After the mid-term appraisal, however, the final year target has been indicated as 16-18 million tonnes to be achieved by 1989-90. The production of oilseeds in 1988-89 has been 17.89 m. tonnes against the target of 15.66 m. tonnes and it is expected that the production would not be less than 27 m. tonnes in the current year (1989-90).

Sugarcane

Sugarcane production has moved up significantly from the level of 154.25 million tonnes in 1980-81 to 182.48 million tonnes in 1986-87. The annual growth rate of sugarcane production based on a triennium average for this period was 2.20 per cent while sugarcane productivity recorded a growth rate of 1.38 per cent. The sugarcane production, however, made a quantum jump of 11.83 million tonnes in 1986-87 over the preceding year. During 1988-89, the production has been 204.63 mt. against the target of 195 mt. and in the current year the production is not expected to be less than 205 mt.

Cotton

During the period 1980-81 to 1986-87 the annual growth rate of cotton production was 1.47 per cent while productivity showed a significant improvement registering a growth rate of 4.48 per cent. The production of cotton maintained a steady growth during 1984-85 and 1985-86 and thereafter it showed a downward trend in 1986-87 and 1987-88 due to bad weather conditions and pest attack diseases. During 1988-89 the production had reached the level of 8.69 m. bales (of 120 kgs) and it is expected that in the final year of the Seventh Plan it would be around 9.5 m. bales

Jute & Mesta

The first year of the plan i.e. 1985-86 recorded a new peak production of 12.65 million bales of 180 kgs each as against the previous peak of 8.37 million bales in 1981-82 indicating a big jump of 4.28 million bales. The production fell to 8.6 million bales in 1986-87 and is expected to further decline to 7.0 million bales in 1987-88. The production during 1988-89 has been 7.70 m. bales (of 180 kgs) and it is expected that it would exceed the last year's level.

High Yielding Varieties Programme

The expansion of area under HYVs of cereals continues to be one of the main planks of the strategy for increasing foodgrains production in the country. The

achievement in the coverage of area of HYVs in the first three years of the Seventh Plan fell short of the targets set for these years. The achievements/likely achievements in the first three years of the current Plan would be 55.42, 56.18 and 54.10 million hectares respectively. The downward trend indicated by the decreasing coverage by HYV is mainly attributed to the continued dry spell over large areas. During 1988-89, the achievement has been 62.57 m.ha. and it is expected that this would reach 65 m. ha. in the current year.

Fertilisers

The fertilizer consumption in the country has been showing a steady increase in recent years. The consumption in terms of nutrients (NPK) increased from 8.4 million tonnes in 1984-85 to 8.74 million tonnes in 1985-86 and was stationary at 8.4 million tonnes in 1986-87. However, the anticipated consumption during 1987-88 is likely to be only 9.01 million tonnes against the target of 10.30 million tonnes. During 1988-89 it is expected that the target of 10.20 million tonnes has been exceeded to reach the level of 11.04 m. tonnes and it would be around 12.43 m.t. in the current year.

Plant Protection

Consumption of plant protection chemicals (technical grade) increased from 52,000 tonnes in 1985-86 to 72,000 tonnes in 1986-87 and was only 49,000 tonnes in 1987-88, and rose to 55,000 tonnes in 1988-89. The current year target is 85,000 tonnes.

Irrigation

In the Seventh Plan, the target of additional area for utilisation of irrigation potential has been fixed at 10.90 million hectares which work out to an annual average of 2.18 million hectares. in the first two years of the Seventh Plan, the aggregated achievement is estimated to be of the order of 3.83 million hectares of additional area covering an annual increase of 1.91 million ha. The achievement in 1987-88 and 1988-89 has been 1.94 and 2.08 m. ha. respectively. The target for the current year has been 1.37 m. ha.

Cooperative Credit

The progress in the disbursement of short-term, medium term and long term cooperative credit has so far been much below the plan expectations. The Seventh Five Year Plan has envisaged an increase in total disbursement of cooperative short, medium and long term credit from an assumed base level of Rs.3250 crores in 1984-85 to Rs. 7070 crores by the terminal year of the Seventh Plan i.e. 1989-90, as against the targets of Rs. 3684 crores, Rs. 3915 crores and Rs. 4558 crores for 1985-86, 1986-87 and 1987-88 respectively. The achievements for the last two years of the Plan are expected to be Rs. 5442 crores and Rs.5779 crores.

Imbalances In Agricultural Growth

The agricultural growth has however been characterised by certain imbalances :

a. Although assured irrigation has increased greatly, the reduction in the amplitude of fluctuations in agricultural output due to weather aberrations still exists.

b. Low foodgrain producing areas have a high potential in output but have not been well managed and exploited.

c. The rural employment situation has become a matter of serious concern particularly in view of the declining employment potential of agricultural growth in better developed regions. Inspite of the reasonably good performance in agricultural production the incomes of large sections of the agricultural population are very low and therefore the capacity to invest in the adoption of modern science and technology is meagre.

d. Even though the per capita availability of foodgrains has improved slightly over the years it is still far from being considered satisfactory, particularly in view of the unabated rapid growth of population.

However it is a fact that the consumption pattern is undergoing changes and the quality of life is getting better. The aspirations of the people are higher and they are eager to take advantage of the developments in science and technology in other parts of the world. Keeping these considerations in view the country has to tackle many pressing problems on a priority basis. Some of these are listed below :

- Productive employment has to be generated for an additional 15 to 17 million people every year.
- For overcoming regional disparities in socio-economic conditions need based special programmes using the systems approach have to be chalked out,

- Better Management of natural resources, land, water energy and minerals is needed keeping the ecological and environmental security in view.
- Declining land holding size poses problems for sustainable agriculture.
- It is necessary to increase agricultural production and productivity in potential areas in an integrated manner so that the foodgrains production increases from the present level of 3.7 million tonnes to an average of 7 million tonnes per annum.

Projections for 2000 AD

Medium and long-term (perspective) planning becomes the *sine qua non* for a country which has adopted the path of planned development. This is necessary in order to differentiate between projects with short gestation periods and those with long term durations, and to plan investments accordingly. In the absence of a proper long-term perspective there is the danger that short term and even medium term plans may reflect an excessive preoccupation with pressing contemporary events, thereby relegating the task of structural reforms to the background. In the process, the available growth potential may not be fully realised. Because of the discontinuities and the long time lag between investments and output, the need for perspective planning is particularly strong in the development of infrastructure like power, transport and communications, scientific research, technical education as well as in sectors like major and medium irrigation, coal and steel where there are large gestation lags often extending beyond the period of any single five year plan.

An attempt has been made to estimate the projections for 2000 A.D in respect of foodgrains and commercial crops. Although the targets fixed for agricultural crops for the Seventh Plan could not be achieved during the first three years, a Special Foodgrains Production Programme was launched to achieve the target of not less than 173-175 million tonnes during the last year of the Seventh Five Year Plan.

Assuming the average production of 172 m. tonnes as the base and assuming a growth rate of 4 per cent during 1990-91 to 1994-95 and 3.5 per cent during the last five years of this century, a foodgrains production of the level of 210 m. tonnes and 250 m. tonnes is expected by 1994-95 and 2000 A.D. respectively. (Table 2.)

Table 2 : Crop Production in 1988-89 and Projections for 1989-90, 1994-95, and 2000 A.D. (million tonnes)

	1988-89 Act.Ach.	1989-90 Target	1994-95 Projections	2000 A.D. Projections
1. Foodgrains				
a. Rice	70.67	72.50	88.0	106.0
b. Wheat	53.99	54.00	67.0	80.0
c. Coarse Grains	31.89	33.75	37.0	42.0
d. Pulses	13.70	14.75	18.0	22.0
Total	170.25	175.00	210.0	250.0
2. Oilseeds	17.89	16.50	22.5	27.5
3. Sugarcane	204.63	212.00	270.00	320.0

Strategies For The 8th Plan : The Thrust Programmes

The following thrust programmes for augmenting the foodgrains and oilseed production will be continued in the 8th Plan :

a. The **Special Rice Production Programme (SRPP)** scheme is under implementation in 439 selected blocks: Assam (37), Bihar (118), Eastern Madhya Pradesh (40), Orissa (63), Eastern U.P. (102), West Bengal (70) and Tripura (9). The scheme has been extended to Tripura since 1988-89. Under the programme emphasis is laid on the spread of improved rice production technology through the organisation of field demonstrations etc. Besides, inputs like seeds, fertilisers, improved farm implements, plant protection equipments and pesticides are made available to resource poor farmers at subsidised cost.

b. The strategy adopted under **Special Foodgrains Production Programme (SFPP)** is as follows :

i) increased fertiliser use by 20 kgs. of nutrients per ha.;

ii) use of improved high yielding varieties of seeds;

iii) better management of weeds and timely control of pests and diseases; iv) harnessing ground-water through tubewells; v) completing on farm development work in command areas and completing the irrigation projects in advanced stages of implementation and efficient use of stored water; vi) bonus/incentives for production/ procurement of foodgrains; and vii) increased flow of short-term and long-term credit.

c. The Centrally Sponsored Scheme of **National Pulses Development Programme (NPDP)** was launched in the year 1986-87. In this programme, thrust is given to crop and area specific schemes with regard to major pulses like gram, arhar, peas, lentil, moong and urad. This programme is primarily a district oriented mission and is intended to achieve the increased level of productivity within a time frame. It also provides scope for increasing the area under pulses.

d. The **National Oilseeds Development Project (NODP)** was started in 1984-85 and is in operation in 180 districts of 17 states on a 50 : 50 basis between the Centre and the states. In addition to NODP, the Government of India has sanctioned the Oilseeds Production Thrust Project with 100 per cent central assistance in 14 states. It is currently being implemented in 240 districts of 17 states. The project covers development of 4 major oilseeds, namely groundnut, rape seed/mustard, soyabean and sunflower which account for 85 per cent of the total production of oilseeds. The project lays more emphasis on seeds production on a large scale, extensive plant protection measures, transfer of technology through demonstrations, supply of improved farm implements, application of sulpher in groundnut and rape seed/mustard for augmenting the seed yield and oil content.

e. The objective of the **Technology Mission on Oilseeds (TMO)** is to reach a production of the order of 16 to 18 million tonnes of oilseeds in 1989-90 up from the average annual production of 11.4 million tonnes during the Sixth Plan (1975-80). The basic approach is to increase the per hectare productivity of oilseeds although there is also a great deal of scope for increasing production through an increase in acreage under oilseeds under rainfed conditions. Oilseeds production has also responded very well to dryland farming technology.

f. In 1983-84 a Centrally Sponsored Scheme known as **Special Assistance to Small and Marginal Farmers** for increasing Agricultural Production in all the blocks of the country was introduced. Considering the importance of the programme, the scheme has been continued during the Seventh Plan. The important components of this scheme are development of minor irrigation, distribution of minikits of seeds and land development.

g. Rainfed areas account for 70.3 per cent of the net sown area in the country, of which more than 2/3rds fall in the low to medium rainfall region (upto 1125 mm). The bulk of crops like coarse cereals, pulses, oilseeds and cotton are grown under rainfed conditions, Accordingly in the Seventh Plan, high priority has been accorded to the development of dryland/rainfed farming with a view to raising productivity and achieving other objectives like reductions in poverty, unemployment and regional disparities. The main focus of the development strategy is to minimise risk to farmers through land improvement measures designed to conserve soil moisture. This helps in the introduction of suitable crops/cropping systems including dryland horticulture and economic utility plantation and in providing farmers with area specific technologies, inputs and services. The emphasis is on an area development approach taking Watershed as the unit of development.

Irrigation Potential Utilisation

Even after the full exploitation of all the available irrigation potential about 50 per cent of the cultivated area will depend on rainfall. As of now the rainfed areas constitute over 70 per cent of crop lands and contribute about 43 per cent of foodgrains production. The improvement of productivity of the rainfed areas has thus a close bearing on the well being of a large mass of the population. It is estimated that the gross cropped area that can ultimately be irrigated has been assessed to be 113 million hectares as against the possible total cropped area of 200 million hectares on full development of irrigation potential. It is therefore necessary to develop the entire irrigation potential of 113 million hectares by the year 2010.

In dryland areas programmes of soil and water conservation should be fully utilised for efficient use of water and its management. In the areas having good quality water and abundant acquifar, programmes of minor irrigation should be launched immediately to utilise water through shallow tubewells dug wells etc.

Fertilizers

The requirement of foodgrains by the year 2000 has been estimated around 250 million tonnes. The achievement of this target will be made possible by increased use of fertilisers both under irrigated and

rainfed areas and by improvement in technology. The requirement of fertilisers by the year 2000 has been estimated at around 24 million tonnes (nutrient basis) and that of irrigation around 100 million hectares.

High Yielding Varieties

It has already been seen that the coverage under high yielding varieties is not uniform in all the states. The advantages that acrue at the global level for better germplasm utilisation and effective breeding programmes should be undertaken. Some of the problems which need attention are :

i) A number of plant diseases like blast and bacterial leaf blight and pests like brown plant hopper have become common phenomena retarding progress. Suitable disease resistant varieties need be evolved.

ii) The replacement of seeds of high yielding varieties is necessary after every three or four years in order to maintain high levels of productivity. To achieve this objective it is necessary to step up the production of certified seeds and to make systematic arrangements for their distribution.

Price Policy

The instrument of support prices to influence cropping patterns needs to be utilised effectively in the coming years. Remunerative prices to the farmers and provision of all inputs for agriculture at a fair price has to be guaranteed. Prices need to be fixed on the basis on the real cost of farming by the Commission for Agricultural Costs and Prices, before the sowing season. The support prices should be adjusted for inflation from the date of announcement to the time of marketing. Labour cost utilised should be the actual wages, if higher than the legal minimum wages. Emphasis needs be laid on managerial or entrepreneurial labour in the family labour input while calculating cost of cultivation and fixing support prices.

Agricultural Research

The agricultural research system, which forms the bedrock of agricultural development, will need to change its orientation radically. The research efforts in agricultural sciences, particularly its applied aspect, appear so far to have been heavily biased towards achieving the technical maxima. This has been at the cost of taking adequate account of the financial or economic feasibility of the technologies developed. Physical input output relationships, rather than financial costs and returns, have been the prime area of concern of agricultural scientists. This has resulted in a large corpus of research findings which have only little or fortuitous relevance for the farm community. It should be necessary to emphasise in this context that one element of real costs which is vitally relevant to the Indian situation where small and marginal farmers predominate, is the risk element.

Agricultural research has made significant contribution in achieving the "Green Revolution" in the North Western parts of the country and in enhancing yield levels in wheat and rice in many parts of the country. There is, however, a wide gap between the technology available for the rainfed/dryland region and the technology adopted by the farmers in these regions. As a result the production in these regions swings far too widely, depending upon the seasonal conditions. A major thrust in the next decade would be on delivering acceptable technology to the farmers which would increase and stabilise agricultural production in the dryland region.

Another area demanding immediate attention in the next decade would be the research effort in oilseeds crops, with the objective of achieving self sufficiency in oilseeds production in the near future. The Government of India has launched the National Oilseeds Development Project and also the Technology Mission on Oilseeds and Oilseeds Production Thrust Project.

Policy Issues for the VIIIth Plan
Land and Water Resources Management

(*i*) A massive land/water development programme comprising soil conservation, land levelling, reclamation of usar/salt affected and other degraded lands is required so as to increase the area by about 5 million ha. in the 8th Plan.

(*ii*) A water management and operation strategy focussing on the full utilisation of benefit from major and medium irrigation projects is required.

(*iii*) A plan for the improvement of water delivery systems, timely completion of major and medium multi purpose projects, programmes for drainage and flood control with the highest priority to ground water exploitation, development and conjuctive use is necessary.

(*iv*) Development of optimal land use and cropping pattern plans for different ecological zones of the country is also essential, backed by appropriate technology, extension, input supply infrastructures marketing and agro processing.

Agricultural Production

(i) Weather forecasting should be such that the farmers can take advantage of weather forecast released for each region and it should be broadcasted through All India Radio/Doordarshan in advance.

(ii) Priorities need to be given to the development of a seed plan in the Eighth Plan assigning to each agricultural university the quantity of breeder/ foundation seed required for further multiplication by the State Department of Agriculture/National Seeds Corpn./State Seeds Corpns./Private Agencies and others. The availability of seed of the desired quality, type and quantity is to be made well in advance of the sowing season and be accessible to farmers within 5 to 8 Kms.

(iii) The input supply system should be made available for each agro ecological zone based on the soil type and the crop seasons in the area. The quality control of these inputs must be regulated.

(iv) Horticulture and vegetable production must be encouraged around big cities; for this the availability of seeds and other required inputs at reasonable cost should be ensured. The technological back up has also to be ensured. Of course the required marketing and processing facilities are also to be dovetailed.

(v) During the coming years an effort should be made to see that a farmer is able to get the maximum benefit from his land. For this it has also to be ensured that the appropriate marketing facilities exist for the farmer to get remunerative prices for his produce. By way of government intervention and also by granting support prices to certain produce it is to be ensured that no stress sale takes place. The farmer should be able to get support price taking into account the labour cost, managerial/entrepreneur cost etc.

(vi) A master plan for providing a network of warehouses and godowns in public and cooperative sectors for the entire country has to be drawn so as to ensure that no distress sale takes place and the farmer is also able to safely store the produce.

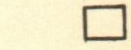
Conclusions

Agricultural programmes in our country are generally not subject to adequate evaluation and monitoring. Multiplicity of agencies in many cases has created more confusion. It is therefore necessary that the agricultural planning machinery be well equipped with the most modern tools. This would provide timely feed back to the relevant executive decision-making bodies for formulating future plans. Quality consciousness, cost reduction, long term sustainability and better utilisation of products are other areas of policy and programme fronts.

The future agricultural plans should be such that we are able to produce 88 MT rice, 67 MT wheat, 37 MT coarse grains, 18 MT pulses, 22.5 MT oilseeds and 270 MT of sugarcane by 1994-95. By the end of this century we should be able produce 106 MT tonnes of rice, 80 MT tonnes of wheat, 42 MT of coarse grains. 22 MT of pulses, 27 MT of oilseeds and 320 MT of sugarcane. Unless we achieve these suggested targets the food requirements of our population will not be met.

Agricultural Research and Education

The agricultural research in the country is largely carried out through 43 central institutes, four national bureaus, 20 research centres, nine project directorates of ICAR and 26 state agricultural universities. Although the agricultural research network in the country has developed to the desired level, so as to adequately serve the needs of each region/sub region, modernisation of the research system has been lagging behind. The research system has also not been given the required autonomy, flexibility and financial support. There is a need to selectively strengthen research institutions in terms of equipment, library facilities, building facilities, manpower development etc. through financial support and international collaboration.



Extension Strategies for Enhancing Productivity in Irrigated Agriculture

S. P. Singh and C. Prasad

Irrigation is an important factor in the removal of climatic constraints on increase in agricultural production and for alliviating the economic conditions of farmers. The decline in the utilization of created irrigation potential, low irrigation efficiency, escalating cost of irrigation projects, low rates of return, long gestation periods, rapid deterioration of land and many associated ecological hazards in the case of medium and major irrigation projects make irrigation not an unmixed blessing. This calls for a revolution in the concept, attitudes, strategies and policies in irrigation management. Keeping this in view the strategies for effective water use efficiency and productivity in irrigated lands are discussed in this paper.

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It is estimated that the population of India will be 961 million by the year 2000, 1234 million by the year 2025 and above 1500 million by the year 2050, when India will be the most populous country in the world.

This increasing population pressure is putting more stress on land for its various requirements, the most important being foodgrains which meet nearly 80% of the calorie requirements of human diet in the country. The progress in foodgrains production in the country during the preceding 40 years from about 50 million tonnes in 1950-51 to a record of 172 million tonnes in 1988-89 is commendable. Though it has no parallel example in the world, the progress has been offset by the increase in population pressure. It is, therefore, imperative that the rate of increase in agricultural production be further enhanced to meet the ever increasing food demands.

The possibilities of extending cultivation to new areas are very limited as all possible lands including marginal ones have already been brought under plough. Any effort at stretching cultivation further will be a disastrous step as it will disturb the fragile eco-system. Therefore, the only possible way to step up production is by accelerating the productivity of land over space and time. At present the productivity of irrigated lands in the country is far below the potential already exhibited by National Demonstrations. Further, only limited technology has so far percolated down to the end-users. Thus, the emphasis has to be on a quick transfer of new technologies to farmers.

Present Irrigation Scenario

Irrigation is considered a basic input into agriculture and this priority has been reflected in the five year plans. Prior to the initiation of the First Five Year Plan, for

example the irrigation potential in the country was 22.6 m. ha of which 9.7 m ha was through major and medium irrigation projects.

This area increased nearly threefold by the end of the Sixth Five Year Plan. The annual rate of growth of irrigation potential during Sixth Five Year Plan was 2.26 mha, which is one of the highest in the world. It is proposed that in the Seventh Five Year Plan, the total irrigation potential be increased to 80.41 m ha : 34.31 m ha through major and medium irrigation projects and 46 m ha through minor irrigation projects (Tables 1 and 2).

Table 1 : Irrigation potential created and utilized and the cost incurred in different major and medium irrigation projects since 1951.

Period	Irrigation potential (Cumulative m ha) Created	Utilized	Out lay (Rs. in crores)	Number of projects Taken up	Completed
Pre Plan	9.71	–	–	–	–
First Plan (1951-56)	12.19	10.99	380	24	1
Second Plan (1956-61)	14.33	13.05	380	47	5
Third Plan (1961-66)	16.57	15.18	581	74	14
Annual Plans (1966-69)	18.10	16.75	434	85	15
Fourth Plan (1969-74)	20.70	18.69	1237	118	24
Fifth Plan (1974-78)	20.72	21.16	2442	191	28
Annual Plans (1978-80)	26.61	22.65	2056	205	29
Sixth Plan (1980-85)	30.10	25.33	7549.78	246	65
Seventh Plan (1985-90)*	34.71	29.24	11555.56	–	–

* *Target*

Source : Annual Reports of Ministry of Water Resources.

The available estimates indicate that the maximum amount of exploitable irrigation potential in India is 113.5 m ha. Out of this about 58.5 m ha is from major and medium irrigation sources and 55.0 m ha through minor irrigation (40 m ha from ground water and 15 mha from surface water). This potential when fully harnessed, will be sufficient to irrigate only half of the net cultivated area (155.50 m ha cultivable area anticipated by 2025 A.D.)

Table 2 : Physical and financial achivements and the perspective for minor irrigation development.

A. Physical (million hectares)

Item	Ultimate feasible	VI Plan Achievement upto 84-85	Level of total achievement	Achievement upto 1987-88 VII Plan target	
Ground water	40	5.7	27.7	7.1	3.90
Surface water	15	1.8	9.8	1.5	0.87
Total	55	7.5	37.5	8.6	4.77

B. Financial (Rs. in crores)

Item	VII Plan Expenditure Approved	Anticipated	VII Plan Expenditure Approved
State Plan outlay	1741.30	1914.34	2669.99
Central Sector	70.00	64.92	135.00
Institutional Finance	1700.00	1437.56	3500.00
Total	3511.30	3416.82	6304.99

Source : Annual Reports of Ministry of Water Resources

The details of area irrigated through different sources in the country are given in Table - 3, which indicates that out of the total net irrigated area in the country 48.4 per cent is irrigated through wells (27.7 through tubewells and 20.7 through other wells); 38.0 per cent through canals ; 7.3 per cent through tanks; and the remaining 6.3 per cent through other sources. The cropwise gross irrigated area shows that 71 per cent of the irrigated area is under cereals and millets, 91 per cent of which is taken by rice and wheat crops only; almost in equal share. The pulses and commercial food crops share only 3.69 and 11.18 per cent of the total gross irrigated cropped area. This way all food crops account for 85.9 per cent of the irrigated area under all crops leaving only 14.1 per cent area for non-food crops; 5.72 per cent under oilseeds and 8.38 per cent under other non-food crops.

In the development of irrigation potential, a considerable amount of funds have been spent in different irrigation projects. The total expenditure on major and medium irrigation projects upto the sixth plan period, was of the order of Rs. 14,897 crores (Table 1). In addition, Rs. 3,416.8 crores have been spent on minor

Table 3 : Net area irrigated by different sources-statewise (1985-86)

(Area in 1000 hectares)

Zone/State	Canal	Tank	Well		Other sources area	Total net irrigated
			Tube wells	Others		
EAST						
Assam	362	–	–	–	210	572
Bihar	973	121	933	113	668	2808
Orissa	853	234	226	360	–	1673
West Bengal	717	263	689	23	219	1911
Manipur	–	–	–	–	65	6
Meghalaya	–	–	–	–	50	50
Mizoram	–	–	–	–	8	
Nagaland	–	–	–	–	51	5
Sikkim	–	–	–	–	16	16
Tripura	–	–	–	–	29	2
Arunachal Pradesh	–	–	–	–	22	22
NORTH						
Haryana	1181	1	1038	9	7	2236
Himachal Pradesh	7	1	4	–	85	96
J&K	289	3	2	2	14	310
Punjab	1412	–	2229	45	4	369
U.P.	3330	142	5467	614	316	9879
Delhi	5	–	31	11	–	4
SOUTH						
Andra Pradesh	1783	786	183	673	113	3538
Karnataka	735	242	42	439	217	1675
Kerala	100	44	38	–	114	296
Tamil Nadu	774	672	88	942	25	2501
Pondicherry	9	1	14	–	–	2
WEST						
Gujarat	489	41	305	1432	4	227
Madhya Pradesh	1296	145	84	1213	249	298
Maharashtra	410	281	–	1063	127	1881
Rajasthan	1154	84	170	1681	20	310
Goa, Daman & Diu	–	–	–	–	13	1
All India	15879	3070	11544	8621	2646	41760

Source : Directorate of Economics and Statistics, Department of Agriculture and Cooperatiion, Ministry of Agriculture.

irrigation projects during this period (Table 2). In the Seventh Five Year Plan, a sum of Rs. 11,556.66 crores has been allocated for major and medium irrigation projects and a sum of Rs. 6,304.99 crores for minor irrigation projects. In addition, Rs. 1,671 crores have been allocated for Command Area Development (CAD) programmes for the development of infrastrcuctural facilities during this plan period. This shows that irrigation potential is being created at staggering costs. According to official estimates, the cost of creation of irrigation potential was around Rs. 1200 per gross hectare in the first Plan which has risen to over Rs. 20,000 per gross hectare in the Sixth Plan and at present is around Rs. 40,000. For its utilization, fairly high amounts have to be spent on the creation of the necessary infrastructure which will increase the cost of irrigation further.

Rising costs have also resulted in a sharp increase in the losses incurred by big irrigation projects as a whole. At the time of independence, irrigation works were able to cover their interest and maintenance charges. However, they soon began to incur losses which rose to about Rs. 400 crores per annum in the early 1980's and to Rs. 800 crores in the mid-80's today the losses are in the neighbourhood of Rs. 100 crores (Vohra, 1989)

There has remained an appreciable gap between the irrigation potential 'created' and 'utilized' in different irrigation projects. This gap at the end of 1984-85 has been estimated at 7.5 mha; 5.2 mha in the major and medium irrigation projects and 2.3 mha in minor irrigation projects. The disheartening feature is that this utilization of created potential in the Seventh Plan Period has been projected to increase to 10.2 mha by 1989-90. Despite the expression of serious concern by all, the gap is swelling with time and threaten to negate efforts at increased agricultural production. Why ?

Systems Approach in Irrigation Management

The water is a limited resource, besides

being costly. This calls for a more efficient use of the available irrigation water. Like many other areas, there is a need to have a systems approach in irrigation management. The problems of irrigation management in different projects are highly variable on account of their geographical locations, administrative set-up, and socio-economic conditions. Hence, there is no fixed perception for improving the management of existing irrigation systems. There is a complete dearth of micro-level irrigation systems management studies in the country and hence the present irrigation systems management is done on a purely ad-hoc basis.

Improved Irrigation Technology

The State Agricultural Universities as well as other State and central institutes have been working for a considerable period to develop new technologies for the proper use of irrigation water. The Important components of this technology are as under :

Method of Irrigation : The present methods of surface irrigation in almost all the irrigation commands are highly inefficient. Unless the efficiency of water application is raised, total utilization of irrigation potential will not be possible. Properly designed surface irrigation methods like border strip, furrow, check basin etc. can achieve a irrigation efficiency as high as 70% over the conventional method. The sprinkler and drip irrigation methods, on the contrary, give a fairly high rate of application efficiency. At Hissar, sprinkler irrigation increased the irrigated area by 35 per cent and the crop intensity by 100 per cent. Drip irrigation, suitable for all row crops, especially wide spaced crops, saves irrigation water by 50-70 per cent and increases the yield of different crops by 10-70 per cent. The irrigation Biwail method is widely used in United States, Australia and Europe. This advanced technology has been available in India as well. In Maharashtra, about 400 hectares of sugarcane have been provided with this method which saves about 50-70 per cent of water used and also increases yield by 50-100 per cent, as is evident from the data summarised in Table 4 (Sivanappan, 1988). The Government subsidises the use of sprinkers, drip and biwall irrigation systems, by small farmers.

Irrigation Scheduling : Timely and adequate supply of irrigation water to crops is crucial for efficient 'on farm' water management. A great deal of research has been done on irrigation scheduling in important field crops particularly in wheat and rice, crops accounting for about 63 per cent of the gross irrigated area under all crops.

Table 4: Irrigation efficiency of various systems

(in percentages)

Irrigation Efficiences	Surface irrigation	Sprinkler irrigation	Methodsl Drip Biwall irrigation
Conveyance efficiency	60-70 (Well irrigation)	100	100
Application efficiency	60-70	70-80	90
Surface water/moisture evaporation	30-40	30-40	25
Over all efficiency	30-35	40-60	75-80

The most responsive growth stages to moisture stress in different crops have been identified and the optimum irrigation schedules have also been formulated.

A good amount of irrigation water could be saved by missing irrigation at the less sensitive crop growth stage. For example in wheat tillering, jointing and hard dough stages are less sensitive than crown root initiation, enthesis and milk stages. The studies also indicate that the response of gram to irrigation was high (about 50%) in the central south Indian vertisoils and the absolute grain yield with 2-3 irrigations was about 25 q/ha. On the other hand, the crop in north-western India, requires only one irrigation around six weeks, after sowing, in order to obtain a higher yield. Likewise mustard also requires not more than two irrigations in alluvial soils in North India.

The optimum time of irrigation is also an important factor affecting the efficiency of irrigation water use. Though considerable efforts in this direction have been made, it is still far from an exact science. The agronomic results have to be combined with experience for getting better results.

Depth of Irrigation : Another aspect of irrigation scheduling is the depth of irrigation. In command areas of public irrigation systems, there is virtually no discipline regarding the depth of water application. In Maharashtra and Gujarat, irrigation as deep as 30-35 cm in sugarcane is not uncommon. Similarly in the Ram Ganga Command area where hardly two irrigations are allowed during the rabi season, the depth of irrigation adopted by the farmers has been as much as 15 cm. This is a fallacy and besides loss of precious irrigation water, there is a loss of soil nutrients and an aggravation of the problem of water logging . There is a need to decide the depth of irrigation suitable for each soil type and crop.

Impact of Improved Technology : The effect of improved irrigation management technology on the use of irrigation water and also on crop yield has been studied on farmers' fields in micro-level water studies in some command areas under the aegies of the Coordinated Project for Research on Water Management of the ICAR. These studies have given very encouraging results and these are presented in the following paragraphs.

In the command of lower Bhawani Sagar Irrigation Project in Tamil Nadu, there was a saving of about 100 ha cm in irrigation water with about 14 per cent increase in grain yield or rice as a result of improved water management technology. Likewise, in the case of groundnut, the water saving was extremely good (182 ha cm) and the yield improved by about 50 per cent. Similarly, at Hissar, under the Bhakra Canal System, improved water management technology increased the grain yields of wheat, gram and raya by 65, 98 and 32 per cent, respectively. In deep black soils in the Mula irrigation project command, the increase in yield of wheat, sorghum and gram varied from 30 to 57 per cent. The amount of water saving was about 10 per cent in wheat and sorghum whereas in gram, the water saving was of the order of 40 per cent. Similarly, at Chalakudy in Kerala, the rice yield increased by 170 per cent with abut 45 per cent saving of irrigation water due to improved water management technology over control (Randawa and Rajput, 1986).

Extension Strategies for Irrigation Management

Irrigation mitigates the impact of irregular, uneven and inadequate or wide fluctuations in rainfall from year to year and thus stabilizes production. There is a mistaken belief that water by itself will do miracles and that with the construction of engineering works, the duty of Government planners and administrators is over. It is now realized that water alone is not enough and that without the use of appropriate technologies for soil and water management and other inputs, the returns from irrigation are too low. A study by the International Rice Research Institute (IRRI) in the Philippines indicated that out of a yield of 6.1 t/ha, hardly 1.4 t/ha increase could be attributed to irrigation (Kanwar, 1979).

Sarma and Roy (1979) critically analysed the additional production due to various factors in India between 1960-62 to 1975-79 and came to the conclusion that the co-efficient of increase due to irrigation in India is rather low and the contribution of fertilizers is the highest as is evident from the following data :

Input	Additional food Production (m tonnes)
Irrigation	6.24
Fertilizers	19.90
Area	3.70
Shift in cropping system	3.69

From the above, it is evident that the irrigation facility being created in the country is highly cost intensive. The thrust henceforth should be on proper management of all inputs, including irrigation water, and for this the following transfer of technology strategies are suggested for the efficient use of irrigation water for high agricultural productivity.

Organisation Strategies

Water is released in different irrigation systems on a roster basis decided with reference to the cropping systems in practice at the time of planning the irrigation system. Even after decades, the roster does not take the new technological advances and actual water needs of crop cultivars into consideration. Further, the old cropping systems/patterns that existed at the time of project preparation have been changed with the advancement in knowledge. All these points are not taken into consideration while deciding the roster. This is because the engineers controlling irrigation systems are not aware of the new technological developments. Education and training of the irrigation engineers, to apprise them of the new agricultural technologies, is therefore essential. For this, better linkages between the irrigation engineers and agricultural technologists are needed. Besides, more and more agricultural engineers need to be inducted into the system.

It is a general experience that farmers, though in a position to afford the use of inputs, are not able to do so because the inputs are not available in the right quantities, of the right quality and at the right time and locality, resulting in a low efficiency of irrigation water. Water use efficiency is increased by fertilizer application. Therefore, efforts must be made for the timely availability of all inputs such as improved seeds, fortilizers etc. to the farmers synchronizing with the timely availability of irrigation water. This would require advance planning and active plans, methods not in use as yet.

Technological Strategies

Most of the recommendations being made for irrigating different crops are based on the information

available from a very few locations, which are not always appropriate to the local needs. Therefore, there is need for detailed soil mapping so that recommendations can be made for different agro-climatic zones. Similarly the most efficient cropping systems in terms of efficient water use and the efficient management of inputs in relation to irrigation water availability need to be identified for different zones. In other words it may be mentioned that there is need for a systems approach and micro planning in irrigation management. These approaches will help in a more judicious use of available irrigation water.

At present the first-line extension programmes, i.e. National Demonstrations, Lab to Land, Operational Research Projects and Krishi Vigyan Kendras are being taken up by SAUs, ICAR Research Institutes and a few reputed voluntary organizations. In all these programmes, the emphasis is on a package or practices for different crops, in which irrigation is only a minor component. In the light of the recent advances in irrigation management technology, there is a need to have more emphasis on increasing the efficiency of irrigation water. For example, it is necessary to encourage extensive irrigation in water shortage areas . This shows that for each area, crop planning should be done more meticulously, to economise on water use. The results of the Operational Research Project on water management indicates that the introduction of one or two crops like maize, wheat pulses, oilseeds and potato in the areas of traditionally three rice crops a year in Eastern and Southern India not only reduced the water requirements of the system by also increased net profits (Rajput and Agrawal, 1983).

At present, the irrigation practices being adopted by the farmers are based on their past experiences of uncertain availability of irrigation water. Therefore, their present method of irrigation is inefficient, regarding the time, depth and mode of irrigation. The available research information clearly indicates that the irrigation efficiency can be considerably increased by adopting new techniques. Therefore, there is need to popularise new and efficient irrigation management technologies in the farming community.

In irrigated agricultural research, the main emphasis has so far been on 'on-station' trials. Therefore, it has not been possible to assess the farmers reaction towards new technologies developed at the research stations. This calls for more 'on farm' testing of new technologies in the line so that the new findings can be validated at farmers' fields, farmers' reaction towards these technologies can be gauged and also to know the constraints in the adoption of these new technologies. It is not enough to do on-farm trial/testing; involvement of farmers is also important. In view of this, it is proposed that the Operational Research Project approach be given priority in the coming Five Year Plan. Proper validation of new technology and constraint analysis, to provide scientific feed-back to the technology generating institutions persons, will then be possible.

It is observed that nearly three-fourth of the farm holdings are held by small and marginal farmers (< 2.0 ha). These farmers are using traditional farm implements since they are resource poor. In recent years, a number of improved and energy efficient implements have been developed for different field operations such as soil turning ploughs and harrows, seed cum—fertilizer drills, etc. But these are beyond the reach of the poor farmers owing to the high cost of new implements. Therefore, it is suggested that small and marginal farmers be provided with low-cost and energy efficient improved implements as a "community input" as in the Lab to Land project of the ICAR.

Infrastructural Issues

Adequate land development including field lay-out of irrigation and drainage channels and land levelling are the basic requirements for the efficient use of water. The land levelling is a major deficiency in major and medium irrigation projects. After the establishment of the Command Area Development Agency (CADA) in the mid seventies, land levelling work has been speedened up in the irrigation command areas but the allocation of funds for the purpose is not commensurate with the quantum and importance of the programme. Vohra (1986) has drawn attention to the mismatch in fund allocation in the Seventh Five Year Plan of India for the creation of additional irrigation potential through engineering works and the utilization of potential through CADA. The ratio is 7:1. Another disturbing feature is that the quality and pace of work are not satisfactory. Further, this is a capital intensive item and the quantum of work involved is huge. This is an area which needs to be taken up on a priority basis so that there is efficient utilization of created irrigation potential.

Upto the Sixth Five Year Plan period, field channels have been constructed in an area of 8.1 mha and 'warabandi' was implemented in an area of 1.6 mha. Further, positive improvements like land levelling and warabandi have taken place in 45 projects where

utilization is now matching the potential created. In addition, the gap in utilization and created potentials has been reduced substantially in another 16 projects. The Seventh Five Year Plan fund allocation for the CADA programmes is highly inadequate in view of the size of the problem.

Most of the canals and channels, specially of the older irrigation systems are unlined and their maintenance is also not upto the desired level. Therefore, the losses of irrigation water from such irrigation systems are fairly high; in some systems the loss exceeds even 50 per cent. A study by the Central Water and Power Commission in 1967 revealed that 71% of the water was lost in canals, 7 per cent in distributories, 22 per cent in water courses, and 27 per cent in the field. All these conveyance losses result in increasing the ground water table in the area leading to maladies such as salinity, water stagnation etc. Serious problems of water logging and salanization have been reported from many irrigation projects like Chambal in Rajasthan and Madhya Pradesh, Tava in Madhya Pradesh, Jayakwadi in Maharashtra, Tungabhadra in Karnataka and Gandak and Kosi in Bihar. According to some estimates, India has already lost about 6 mha of crop land due to water logging and salanigation and large areas are going out of cultivation due to these problems in many new irrigation projects (Vohra, 1982). Perhaps the worst example is provided by the Sarda Sahayak Project in Uttar Pradesh. According to a recent study, the extension of this project at an expenditure of Rs. 384 crores has added 4 lakh hectares of irrigated area but with a loss of 5 lakh hectares of irrigated areas to water logging, a net loss of 1 lakh hectare and a net negative effect on food production (Vohra, 1989)

Though some efforts are being made to reduce these losses, they are not commensurate with the quantum of work involved. The lining of irrigation systems involves considerably high capital investment. Further, there is a need to provide adequate drainage in all irrigation systems. Another possible way to reduce this loss of irrigation water is recycling of underground water, wherever possible. This aspect also needs emphasis in the coming plans.

The SAUs and ICAR Research Institutes claim that they have developed new and more efficient irrigation water management technologies, particularly regarding systems and methods of irrigation water conveyance and application. These technologies are not followed even in their research farms. This raises doubts regarding the efficacy and economic viability of the new irrigation technologies in the minds of farmers. The latest irrigation technologies should be practised on research and demonstration farms of SAUs and ICAR Research Institutes; this will also be a training ground for extension workers and farmers.

Training

Since the new irrigation water management technologies have not been given due importance in the past, the extension personnel as well as the Subject Matter Specialists of training centres are not fully aware of the recent developments in this line. Hence, there is an urgent need to organise training programmes for these categories of officials also so that they can carry the correct message to the end users i.e. farmers. The SAUs and the Water Technology Centres and I.A.R.I., New Delhi and T.N.A.U., Coimbatore can contribute considerably in this regard. VALMI's may also develop capability to this effect.

As mentioned earlier, the new irrigation management technologies have not been effectively taken to the farmers. Therefore more training programmes for the farmers in recent irrigation water management technologies need to be conducted. The Krishi Vigyan Kendras (KVKs) and other training Institutions can develop special courses for this purpose.

A high percentage of children in the rural areas drop out at the school level. If these future farmers are properly trained in the efficient use of irrigation water. they can absorb the message more effectively and practise on their farms.

The KVKs could conduct special training courses for school drop-outs on new irrigation management practices and modern cropping patterns.

Use of Mass Media

In the past very few attempts have been made to use the mass media to popularize new irrigation water management technologies. Emphasis should also be given to the publication of folders, leaflets etc. Written in simple regional languages for distribution among farmers so that they can understand new technologies better. Appropriate documentary and video-films as well as low-cost visuals should be developed and used in the training programmes and farm advisory services by the State extension functionaries. At present, visuals are almost

non-existent in extension work and more so in areas like irrigation management.

People's Participation

Farmers are the end users of irrigation water below the outlet. It would be difficult to have effective irrigation systems management in the absence of participation. In some foreign countries like South Korea, Pakistan and Egypt, their well established farmers' cooperatives take on the responsibility for water distribution below the outlet. But in India, the experience regarding farmers' participation has not been encouraging till now, except for a few water cooperatives in Gujarat and Maharastra and Farming Pipe committees in Andhra Pradesh. This is probably due to the pressure of a large number of farmers an outcome of the small farm holding size. The water cooperatives or committees should look after both the maintenance of the canals and channels to reduce conveyance losses of water as well as help in educating farmers in new technolgies for efficient use of irrigation water in the fields. At the village level the formation of Village Resource Development Societies will also be very helpful. Finally, there should be more social science research on organized farmers' participation in irrigation management, starting from the outlet committees to minors and distributories. There is an urgent need for community/group action in irrigation management. The village panchayats can play a decisive role in this regard.

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Impact of Commercial Energy Shifts on Income & Employment

A.P. Bhatnagar B.S. Panesar

The study identifies the important commercial energy sources used in four sectors of the national economy, (Agriculture, Industry, Transport, others) and studies the function of relationship with the National domestic product (NDP) and employment . The implication of a commercial energy shift between industry and agriculture has been analysed with particular reference to NDP and employment gains. The results show that to increase the NDP at the national level, the industry sector has to be allotted more with a corresponding decrease in the share of electricity to agriculture in the projected values for the years 1990, 1995 and 2000.

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Energy planning has two aspects viz. supply management and demand management. Appropriate energy policies can be framed only after a careful and simultanious consideration of both of them. The most efficient system shall be able to integrate the supply options/constraints and demand pattern of energy for various sectors of the national economy. For achieving social justice and equitable distributive order, energy allocation can play an important role.

It is well established now that an all round development of a nation depends on energy. The developed countries enjoying higher quality of life have a very high consumption of energy per capita whereas it is very low in developing countries.

The research done at the School of Energy, Punjab Agricultural University shows that a direct relationship exists between commercial energy and agricultural production. It needs a four fold increase in energy to double the crop production, in India. In U.S., the yield of paddy is about 1.62 times high based on an energy input of about 1.88 times more than in India. In the case of maize the corresponding multiplying factors are found to be 2.45 and 6.69.

The present study, aims to arrive at an optimum mix of energy for various sectors in India for the future. The study was undertaken in the context of three levels of agricultural development represented in ascending order by the states of Bihar, Uttar Pradesh and Punjab and the two important sectors of agriculture and industry.

Methods and Materials

Data in respect of commercial energy (Petroleum products, coal, electricity) consumption, NDP and employment in various sectors was collected from various sources and re-arranged. The information was developed under four sectors namely, Agriculture, Industry, Transport and others.

Four models were studied for the trend patterns and projections for the commercial energy consumption. Functional relationship of NDP and employment with electricity consumption was established by formulating seven different models. Finally an optimization model was constructed to examine the shift of energy and its implications.

Current Trend Pattern

Four different models viz. sigmoid growth, exponential decline, rapid growth and constant growth, were considered while the values of unknown parameters were determined. The best fitting model/models were used for analysing the trend pattern and for arriving at the future projections.

Electricity Consumption

The four models fitted well. The sigmoid growth model was considered best as a major part of the electricity generation comes from the hydel, a renewable source. The sectoral consumption of electricity as projected is given in Table 1.

Consumption of Petroleum Products and Coal

Discussions on these products have not been attempted in this paper, either for want of insufficient data or because some of these not being used at all in the agriculture sector. Coal is also not considered for similar reasons.

Table 1 : Projected Consumption of Electricity during 1990, 1995 and 2000 and Actual Consumption in 1985. (million kwh)

Region	Year	Agriculture	Industry	Transport	Others	Total
India	1985	23422	74270	3082	22225	122999
	1990	31788	84995	3647	32423	152853
	1995	37946	100599	4283	48778	191606
	2000	41802	116823	4944	72019	235590
Punjab	1985	2364	3025	0	967	6356
	1990	5239	3529	0	1386	10156
	1995	7469	3822	0	2148	13440
	2000	9382	4056	0	3276	16715
U.P.	1985	3737	5168	576	2139	11620
	1990	5657	5466	654	2815	14593
	1995	6712	5915	707	4197	17532
	2000	7356	6281	733	6154	20526
Bihar	1985	780	4067	324	22225	5599
	1990	1670	4361	767	377	7177
	1995	3197	4698	931	454	9282
	2000	5721	4936	1107	537	12302

Net Domestic Product

The NDP at constant prices before 1970 was at 1960-61 prices and after 1969-70, at 1970-71 prices. The NDP before 1969-70 was therefore, converted to constant prices of 1970-71.

All the four models were found best fit for time trend of NDP both at constant prices and current prices in the case of data for all India, Punjab and UP. For simplicity and ease of use, the constant growth model was selected in the case of these states. None of the four models however were found suitable for the transport sector in the case of Bihar but all four fitted the remaining three sectors of economy. For simplicity, the constant growth model was selected for the three sectors of agriculture, industry and others.

Employment

The four models were found not fit to represent the employment trends in the case of all India data. All the four models fitted well in the case of Punjab and Bihar. However, the constant growth model was selected for the sake of simplicity to represent the trends. Except for transport sector, the same trend followed in the case of UP also.

NDP and Employment Versus Electricity Consumption

It was considered appropriate to find the functional relationship of the two dependent parameters ; *i.e.* NDP and employment with electricity. Seven functional models were formulated to determine these functional relationships. These are ;

$$Y = \frac{Y_O}{[1+(X/B)^A]} \quad \text{(FM1)}$$

$$Y = Y_o * [1-EXP\{A^* (X-B)\}] \quad \text{(FM2)}$$

$$Y = Y_o * X^A \quad \text{(FM3)}$$

$$Y = Y_o * EXP(A * X) \quad \text{(FM4)}$$

$$Y = Y_o + A * X \quad \text{(FM5)}$$

$$Y_2 = Y_o + A * X \quad \text{(FM6)}$$

$$Y = Y_o + A * X + b * X^2 \quad \text{(FM7)}$$

where

Y = Dependent variable i.e. NDP or Employment
X = Electricity consumption in million kwh
Y_o , A and B are model constants

A computer programme in BASIC was designed to determine the model co-efficients and correlation co-efficient (R) for all the four sectors in the case of data from all India, U.P. and Bihar. In case of Punjab only three sectors i.e. agriculture, industry and others were considered as there was no electricity consumption in the transport sector. The algorithm for the best fit was to minimise the sum of squares of deviations of predicted values from the observed values. The values of Y_0 in case of Functional Models 1 and 2 were determined by hit and trial methods. For other constants in models 1 and 2 and all the constants of the models 3 to 7 were determined by using least squares method.

The models found best fit to express the relationships of electricity consumption with NDP at constant prices and employment are :

All India		
Agriculture	FM7, FM3	FM7, FM3
Industry	FM2, FM7	MF7, FM3
Transport	FM7, FM2	FM7
Others	FM7, FM3	FM7, FM4
Punjab		
Agriculture	FM1, FM3	FM7, FM3
Industry	FM2, FM7	FM7, FM3
Transport		
Others	FM7, FM1	FM7, FM3
U.P.		
Agriculture	FM6, FM7	FM7, FM6
Industry	FM7, FM4	FM4*, FM7*
Transport	FM7, FM4	FM7*
Others	FM7, FM2	FM7, FM1
Bihar		
Agriculture	FM7, FM4	FM7*, FM4*
Industry	FM7*	FM1, FM3
Transport	FM7*, FM6*	FM7*
Others	FM3, FM1	Fm7, FM1

** These models to be used with caution.*

Optimization Model

The main aim of this study was to examine the question of commercial energy shift from industrial sector to agriculture and vice versa in detail with regard to its employment and economic implications. Thus, it was envisaged that the interaction, if any, which needs to be suggested through this study, will not affect the growth of other economic sectors i.e. transport and others, as these are the basic and prime sectors. There is very little that can be done to the other sectors (which comprise hotels, trade, households, banking, public and other similar commercial organisations). Thus, these two sectors were considered to grow as they are now growing.

Another question which was examined in detail was the level to which the shifting of energy can be suggested. The downward shifting demands a reduction in present installed capacities in the industry or present level of agriculture. It is not possible to take a backward step or reduce the current installed capacities in the industry or level of agriculture. Reduction in the level of industrial or agricultural operations would mean low efficiency in energy utilization. Developing nations like India cannot afford this option of low efficiency in energy utilisation. It was thus planned that a minimum of 1985 standards would be maintained in energy availability to a particular sector.

The optimization model was constructed around the central idea of maximising the NDP or employment such that the total amount of electricity remains at the projected levels during the year of decision. As an example, if the decision is to be made for the year 1995, then the total projected consumption of electricity in 1995 was determined for each sector. The total consumption after shift should also remain at the same as those determined above.

The mathematical formulation of the problem

Maximize Z,

$$Z = \text{SUM}\,[S, \{\delta_s (E_s)\}] \qquad (8)$$

where ;

S = Set of

1. agriculture
2. industry
3. transport
4. others sectors

δ_s = Functional relationship for NDP or Employment with E_s

E_s = Electricity consumption of the S'th sector

Z = Objective function (NDP or Employment)

Subject to the following constraints

$$E_1 + E_2 + E_3 + E_4 = EPT \qquad (9)$$

$$E_s < \text{or} = EP_s \quad (10)$$

$$E_s > \text{or} = EB_s \quad (11)$$

$$E_{s1} = EP_{s1} \quad (12)$$

where

S_1 is the set of

1. transport
2. others sectors

EPT is the total projected consumption of electricity

EP_s is the sector-wise projected consumption of electricity

EB_s is the sector-wise base consumption of electricity

The constraint equations 10 and 11 are over all the elements of the set S (i.e. for agriculture, industry, transport and others). The constraint equation 12 is only over set S_1 (i.e. for transport and others). In case of Punjab the set S comprised only agriculture, industry and others. While the set S_1 comprised others only.

The above mathematical formulation was translated into a computer programme in GAMS language. Non-linear programming technique, which is part of the GAMS package was used to optimize the objective function. The projected electricity consumption for the years 1990, 1995 and 2000 were based on Sigmoid Growth Model. The values used in the optimization model are given in Table 1. This Table also gives the values of electricity consumption in the base year i.e. 1985.

Let ;

EO_s = Energy allocated for different sectors at optimum value of the objective function

Then ;

The per cent shift in energy allocation for each sector (PERSHIFT) and improvement in objective function (PERIMOBJ) is given below :

$$PERSHIFT = (EO_s - EP_s) / EP_s \times 100 \quad (13)$$

$$PERIMOBJ = \{Z(EO_s) - Z(EP_s)\} / Z(EP_s) \times 100 \quad (14)$$

where ;

$Z(EO_s)$ = Value of objective function for ES $= EO_s$

$Z(EP_s)$ = Value of objective function for ES $= EP_s$

The per cent energy shift in each sector and per cent improvement in objective function was calculated for each case, and are given in Tables 2, 3, 4 and 5. For each sector, two functional relationships were studied, and these are illustrated as cases I and II.

The maximization of objective function i.e. NDP at constant prices ('70-'71) and employment was carried out for years 1990, 1995 and 2000. The functional relationship for each component of the objective function (i.e. for Agriculture, Industry, Transport and Others) and for both cases (the best fit, and the second best fit) are given in Tables 2 and 4, and 3 and 5 and Cases I and II. These cases were decided, based on the value of correlation co-efficients but their range of application was small as these relationships tended to give an absurd value of employment or NDP as the case may be; in such cases these relationships were replaced with the next best relationships. In most of the sectors and regions, however, the two cases were the best and second best functional relationships.

Table 2 : Effect of Shifting Energy Allocation among Industry and Agriculture on Total Net Domestic product (Ist Case)

Region	Year of shift evalu-ation	Agri-culture	Indus-try	Trans-port	Others	Improve-ment in net domestic product, %
India	1990	-11.2	4.2	0.0	0.0	1.55
		18.5	57.9	2.4	21.2	(68482)
	1995	-25.6	9.7	0.0	0.0	6.49
		14.7	57.6	2.2	25.5	(75301)
	2000	-32.5	12.0	0.0	0.0	14.63
		12.1	54.7	2.1	31.0	(67360)
Punjab	1990	9.6	-14.3	0.0	0.0	0.23
		56.6	29.8	0.0	13.7	(3067)
	1995	-4.9	9.5	0.0	0.0	0.024
		52.9	31.1	0.0	16.0	(2807)
	2000	-18.9	43.8	0.0	0.0	1.31
		45.5	34.9	0.0	19.6	(1057)
U.P.	1990	-33.9	35.1	0.0	0.0	8.54
		25.6	50.6	4.5	19.3	(8845)
	1995	-44.3	50.3	0.0	0.0	17.19
		21.3	50.7	4.0	23.9	(10267)
	2000	-49.2	57.6	0.0	0.0	26.47
		18.2	48.2	3.6	30.0	(10483)
Bihar	1990	56.7	-10.0	0.0	0.0	7.31
		20.3	65.7	8.4	5.6	(4267)
	1995	112.9	-21.0	0.0	0.0	18.79
		28.8	57.4	8.1	5.6	(3368)
	2000	153.0	-29.6	0.0	0.0	30.46
		35.4	51.0	7.9	5.6	(7227)

Notes :

1. *The figures in parenthesis are the total value of net domestic product in Rs. Crores.*
2. *Figures in second rows are % electricity for each sector*

Table 3 : Effect of Shifting Energy Allocation among Industry and Agriculture on Total Net Domestic Product (IInd Case)

Region	Year of shift evalu-ation	Agri-culture	Indus-try	Trans-port	Others	Improve-ment in net domestic product, %
India	1990	-11.2	4.2	0.0	0.0	1.14
		18.5	57.9	2.4	21.2	(49778)
	1995	-25.6	9.7	0.0	0.0	4.84
		14.7	57.6	2.2	25.5	(48155)
	2000	-32.5	12.0	0.0	0.0	6.68
		12.1	54.7	2.1	31.1	(55548)
Punjab	1990	9.6	-14.3	0.0	0.0	0.22
		56.6	29.8	0.0	13.6	(3208)
	1995	-5.2	10.2	0.0	0.0	0.021
		52.7	31.3	0.0	16.0	(3646)
	2000	-20.0	46.2	0.0	0.0	0.366
		44.9	35.5	0.0	19.6	(4039)
U.P.	1990	-33.9	35.1	0.0	0.0	10.77
		25.6	50.6	4.5	19.3	(9029)
	1995	-44.3	50.3	0.0	0.0	26.38
		21.3	50.7	4.0	23.9	(11876)
	2000	-49.2	57.6	0.0	0.0	40.23
		18.2	48.2	3.6	30.0	(15163)
Bihar	1990	56.8	-10.0	0.0	0.0	5.73
		20.3	65.7	8.4	5.6	(4066)
	1995	112.9	-21.0	0.0	0.0	14.53
		28.8	57.4	8.1	5.6	(5048)
	2000	153.0	-29.6	0.0	0.0	25.03
		35.4	51.0	7.9	5.6	(6326)

Notes :

1. *The figures in parenthesis are the total value of net domestic product in Rs. Crores.*
2. *Figures in second rows are % electricity for each sector .*

Results

The results of the optimization study are presented and discussed below :

All India

The results of maximization of NDP at constant ('70-'71) prices with case I, indicated that NDP can be improved to an extent of 1.55%, 6.49% and 14.63% from its projected values in 1990, 1995 and 2000 respectively, by reallocating electricity among agriculture and industry (Table 2). Further the allocation to agriculture should be reduced by 11.2%, 23.6% and 32.5% of the projected values of electricity consumption in 1990, 1995 and 2000 respectively and more electricity should be allocated to industry. This means that, in 1990, the allocation should be 28228 million kwh instead of its projected consumption of 31788 million kwh (Table 3). Similarly, it should be reduced in the years 1995 and 2000. The results of reduction required with case II (Table 3) were exactly the same as in case I. Hence, it can be concluded that, the share of electricity consumption in the agriculture sector has to be cut down if the NDP is to be improved.

The results of maximization of employment with Case I, indicated that the employment can be improved to an extent of 0.55%, 0.007% and 0.313 % from its projected values in 1990, 1995 and 2000 respectively, by reallocating electricity among agriculture and industry (Table 5). These values in percentage terms are very small. The actual values of the objective function are improved by 1.0%, 0.01% and 0.6 millions of people. This means that these many more people can get employment with this modification. It indicated that allocation to industry should be reduced by 5.7% in 1990

Table 4: Effect of Shifting Energy Allocation among Industry and Agriculture on Total Employment (Ist Case)

Region	Year of shift evalu-ation	Agri-culture	Indus-try	Trans-port	Others	Improve-ment in net domestic product, %
India	1990	15.2	-5.7	0.0	0.0	0.55
		24.0	52.4	2.4	21.2	(1739)
	1995	-1.4	0.5	0.0	0.0	0.007
		19.5	52.8	2.2	25.5	(1780)
	2000	-9.1	3.3	0.0	0.0	0.313
		16.4	50.5	2.1	31.0	(1890)
Punjab	1990	-54.9	81.5	0.0	0.0	36.86
		23.3	63.1	0.0	13.7	(48.8)
	1995	-68.4	133.6	0.0	0.0	107.85
		17.6	66.4	0.0	16.0	(73.7)
	2000	-74.8	173.0	0.0	0.0	211.63
		14.1	66.3	0.0	19.6	(102.9)
U.P.	1990	5.3	-5.5	0.0	0.0	0.99
		40.8	35.4	4.5	19.3	(277.8)
	1995	11.1	-12.6	0.0	0.0	2.17
		42.4	29.5	4.0	23.9	(290,.7)
	2000	15.1	-17.7	0.0	0.0	2.97
		41.3	25.2	3.6	30.0	(297.2)
Bihar	1990	56.8	-10.0	0.0	0.0	16.22
		20.3	65.7	8.4	5.6	(208.1)
	1995	112.9	-21.0	0.0	0.0	50.16
		28.8	57.4	8.1	5.6	(282.7)
	2000	153.0	-29.6	0.0	0.0	95.09
		35.4	51.0	7.9	5.6	(387.5)

Notes :

1. The figures in parenthesis are the total employment in lakhs
2. Figures in second rows are % electricity for each sector .

Table 5: Effect of Shifting Energy Allocation among Industry and Agriculture on Total Employment (IInd Case)

Region	Year of shift evalu-ation	Agri-culture	Indus-try	Trans-port	Others	Improve-ment in net domestic product, %
India	1990	17.4	-6.5	0.0	0.0	2.14
		24.4	52.0	2.4	21.2	(1765)
	1995	55.7	-21.0	0.0	0.0	5.85
		30.8	41.5	2.2	25.5	(1906)
	2000	81.5	-30.0	0.0	0.0	7.41
		32.7	34.2	2.1	31.1	(2089)
Punjab	1990	9.6	-14.3	0.0	0.0	0.16
		56.6	29.8	0.0	13.6	(33.7)
	1995	-1.9	3.7	0.0	0.0	0.0002
		54.5	29.5	0.0	16.0	(35.0)
	2000	-14.3	33.0	0.0	0.0	0.16
		48.1	32.3	0.0	19.6	(36.0)
U.P.	1990	5.3	-5.5	0.0	0.0	1.25
		40.8	35.4	4.5	19.3	(282.7)
	1995	11.1	-12.6	0.0	0.0	2.99
		42.5	29.5	4.0	23.9	(301.1)
	2000	15.1	-17.7	0.0	0.0	4.34
		41.3	25.2	3.6	30.0	(313.4)
Bihar	1990	56.8	-10.0	0.0	0.0	8.53
		20.3	65.7	8.4	5.6	(189.6)
	1995	112.9	-21.00	0.0	0.0	21.60
		28.8	57.4	8.1	5.6	(219.1)
	2000	153.0	-29.6	0.0	0.0	36.28
		35.4	51.0	7.9	5.6	(253.1)

Notes :

1. *The figures in parenthesis are the total employment in lakhs*
2. *Figures in second rows are % electricity for each sector .*

and given to agriculture. However, in 1995 and 2000, the allocation to agriculture should be reduced by 1.4% and 9.1% of the respective projected values of electricity consumption and given to industry. This means that, in the initial stages of employment improvement more electricity should be allocated to agriculture. But, the ultimate goal in employment generation will lie in industries and hence after 1995 more emphasis should be given to industries. The results of energy shift with case II (Table 5) were totally different from the result for case I (Table 4). This case indicates a shift of energy allocation from industries to agriculture even in the years 1995 and 2000. The employment improvement suggested by the second case is as follows : 3.8, 11.1 and 15.5 million more will be employed by the above mentioned shift in 1990, 1995 and 2000 respectively. It can be said that to increase employment, agriculture may be allotted an increased share of electricity with a corresponding decrease in industry in 1990. After observing the performance during the year, allotment decision may be taken for the years 1995 and 2000.

Punjab

The results of maximization of NDP at constant ('70-'71) prices with case I, indicated that NDP can be improved to the extent of 0.23%, 0.024% and 1.31% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 2). It indicated that allocation to industry should be reduced by 14.3% of the projected consumption in 1990 and this electricity should be allocated to agriculture. In 1995 and 2000 allocation to agriculture should be reduced by 4.9% and 18.9% of the respective projected values of electricity consumption and this electricity should be allocated to industry. This indicates a shift in priority areas. Upto the year 1994 priority should be given to agriculture but from 1995, the priority should shift to industry in case improvement in NDP is desired. The results of energy shift with Case II (Table 3) were almost the same as in case I. Hence, the model shows that the share of electricity consumption in the agricultural sector has to be cut down from 1995 in case the NDP is to be improved. It must, however, be remembered that there is a need for agro-based industries to come up in a big way in Punjab to utilise the large surpluses of farm produce, by-products and wastes. This will go a long way in increasing the production of value added farm products.

The results of maximization of employment with case I, indicated that the employment can be improved to an extent of 36.86%, 107.85% and 211.63% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 4). The actual values of the objective function are improved by 1.3, 3.8 and 7.0 millions of people. This means that these many more people can get employment with this modification. These figures may seem very large but are reasonable as Punjab has a large number of small scale industries. It indicated that in 1990, 1995 and 2000 the allocation to agriculture should be reduced by 54.9%, 68.4% and 74.8% of the respective projected values of electricity consumption and given to industry. This means that, for more employment generation the emphasis will lie in industries and hence should be given priority. The results of energy shift with case II (Table 5) were slightly different from the result for case I (Table 4). This case indicates a shift of energy allocation from industry to agriculture in the initial year i.e. 1990 but from

1995 onwards the emphasis will rest on industry as the model allocated more electricity to industry from its projected consumption by reducing it in agriculture.

To sum up, the projected electricity consumption share may be maintained on a status quo basis for both agriculture and industry for the years 1990 to 1994. From the year 1995 onwards a fresh decision shall have to be taken as the model favours the industry sector.

U.P.

The results of maximization of NDP at constant ('70-'71) prices with case I, indicated that NDP can be improved to an extent of 8.54%, 17.19 %and 26.47% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 4). It indicated that allocation to agriculture should be reduced by 33.9%, 44.3 %and 49.2% of the respective projected values of electricity consumption in 1990, 1995, 2000 respectively and more electricity should be allocated in industry. The results of reduction required with case II (Table 3) were exactly the same as in case I. Hence it can be concluded that, the growth of electricity consumption in the agricultural sector has to be cut down in case the NDP is to be improved.

The results of maximization of employment with case I, indicated that employment can be improved to an extent of 0.99%, 2.17% and 2.97% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 4). These values in percentage terms are very small but in absolute terms are sizeable. It indicated that allocation to industry should be reduced by 5.5%, 12.6% and 17.7% of the respective projected values of electricity consumption in 1990, 1995 and 2000 respectively and given to agriculture. This means that in U.P. the emphasis will remain on agriculture, to generate more employment. The results of energy shift with case II (Table 5) were exactly same as the results for case I (Table 4). Hence, it can be concluded that the growth of electricity consumption in industry has to be cut down in case the employment situation is to be improved.

Bihar

The results of maximization of NDP at constant ('70-'71) prices with case I, indicated that NDP can be improved to an extent of 7.31%, 18.79% and 30.46% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 2). It indicated that allocation to industry should be reduced by 10.0%, 21.0% and 29.6% of the respective projected values of electricity consumption in 1990, 1995 and 2000 respectively and more electricity should be allocated to agriculture. The results from case II (Table 3) were exactly the same as in case I. Hence, it can be concluded that, the projected share of electricity consumption in industry has to be cut down in case the NDP is to be improved.

The results of the maximization of employment with case I, indicated that employment can be improved to an extent of 16.22%, 50.16% and 95.09% from its projected values in 1990, 1995 and 2000 respectively by reallocating electricity among agriculture and industry (Table 4). This means 2.9, 9.4 and 18.9 million more people can be employed by just reallocating electricity. The results indicated that allocation to industry should be reduced by 10.0%, 21.0% and 29.6% of the respective projected values of electricity consumption in 1990, 1995 and 2000. These shift values are exactly the same as for the NDP maximization. Hence, the suggested interaction is the same for NDP and employment maximization. The results of case II (Table 3) were exactly the same as in case I. Hence, it can be concluded that, the projected electricity consumption in industry sector has to be cut down in case the employment situation is to be improved.

Conclusions

NDP and employment in the country may be influenced by management decisions of allocation of commercial energy (electricity) to competing economic sectors of agriculture and industry.

At the national level it can be brought about by reducing the projected share of electricity consumption in agriculture with a corresponding increase in the share of industry. In Punjab, the projected share of electricity in agriculture may be increased in the year 1990 upto 1994. A decision may have to be taken for the year 1995 and onwards in favour of industry. Uttar Pradesh may follow the same pattern as at the national level. In Bihar, agriculture has to be given priority by allotting an increased share to it with a corresponding decrease in the projected share of electricity in industry.

At the national level,increase in employment may be achieved by increasing the projected share of electricity to agriculture with a corresponding decrease in industry during the year 1990. The allotment decision for the years 1995 and 2000 may be based on the performance

achieved during the years 1990-94. In the case of Punjab, the projected electricity consumption in both agriculture and industry may be maintained on a status quo basis, during the years 1990-´94. In the year 1995 and beyond, a decision may have to be taken in favour of industry based on the performance during the years 1990-´94. In the states of U.P. and Bihar, the agricultural sector may be provided an increased share of electricity with a corresponding decrease in the share of industry during the years to come.

The level of development of agriculture in a state affects the commercial energy (electricity) allotment decision.

In the case of a state having developed agriculture, industry may have to be accorded priority from the year 1995 onwards to improve the NDP and employment situation. The states having partially developed agriculture may have to increase the projected share of electricity consumption in agriculture to increase employment opportunities. To improve NDP, however, these states may have to increase the share of industry in projected electricity consumption. The states engaged in developing agriculture, may have to increase the share of electricity consumption in agriculture both to improve the NDP and to increase employment. Trend pattern rather than actual figures estimated in the study shall be given more importance. Energy allocations during the year 1995 and onwards shall be undertaken based on a careful assessment of performance achieved during 1990-´94. An indepth study is required to take into account all the interplays.

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□

Choice of Technology for Distributive Justice

Jag pal Singh

The developmental policies followed in India have neither raised the efficiency of capital up to the optimum level nor achieved the objective of distributive justice. This happened because of two misleading concepts : firstly, labour productivity has been viewed in relation to the employed persons only, keeping the unemployed persons out of the stream. Secondly the pre-occupation with the saving ratios witnesses a misplaced emphasis. In the case of a welfare state or in the context of underfed people, the best way is to raise the level of productivity of every working person. This would imply a strategic shift from a consumption oriented planning procedure to a resource utilization approach, argues this paper.

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The issue of technological choice is closely related to the level of employment in an economy and also to the distribution pattern of national income among different occupational categories. It also provides direction to the Research and Development (R and D) activities which, in turn, determine the pace and pattern of growth. In India, growth with social justice has been a common objective in almost all the development plans particularly during the seventies and afterwards. Today although the country ranks third in the world in technical and scientific personnel and tenth in the level of gross industrial output, its place in per capita income is amongst the ten lowest nations and the percentage of population below the subsistence level remains between forty and fifty (Kumar, 1988).

The issue of technological choice is being raised in the country since last thirty years; some strongly believe that appropriate technology has the capability to redress the damage. It is often advocated that for bridging the gap between the rural and urban as well as that between the affluent and the poor, the very technology that created it, must be utilised (Kumar, 1988). However the advocates of appropriate technology accept the existing technological duality in the economy. Therefore, there is still a legitimate doubt if the so called appropriate technology would be able to resolve the problem of unemployment, income-disparities and abject poverty. This paper tries to look at the present techno-economic policy frame-work with objective of listing the consequences. It also examines the prevailing concepts of appropriate technology and ascertains their relevance in the Indian context. The paper then attempts to evolve alternative techno-economic criteria in order to achieve the objective of social justice through growth. Illustrative exercises are undertaken towards the application of the proposed parameters for devising an employment plan and also deciding the Research and Development activities in a particular sector.

Present policy framework

History records that almost in every country economic policy has been guided by the philosophy of higher savings, capital intensive techniques and higher labour productivity. India is not an exception to this . That in India we are led by this philosophy is borne by the evidences brought forward by Brahmananda (1982). The present study draws the required information concerning employed labour, capital stock and Net Domestic Product all at 1970-71 prices for different sectors and for four reference years; 1950-51, 1960-61, 1970-71 and 1980-81 from Brahmananda (1982). Table-1 gives the changes in capital stock per employed person in different sectors during 1950-51 - 1980-81. There is a clear evidence of rising capital stock per person employed in some of the major sectors of the economy, (Table 1) Taking all the sectors together capital intensity per employed person has gone up roughly three times; Rs. 3492 in 1950-51 to Rs. 9376 in 1980-81. However, there are substantial differences, across the sectors in regard to not only of the level of capital stock per person employed during the year but also in its growth over the years. Table 2 shows the corresponding productivity during 1950-51 to 1980-81 in different sectors of the economy. Except in the case of real estate, in all the other sectors labour productivity has gone up, by around one and a half times. However as in the case of capital labour ratio, neither the labour productivity level was same across the sectors nor its growth over the years showed any uniform rate. This has not only created variations in sectoral labour productivities but also seemed to have resulted in widening the income-disparities in the economy.

Socio-economic Implications.

According to the law of optimisation and the law of equi-marginal productivity, total factor productivity is maximised only if the use of the scarcest factor of production is efficient. In India, or in all the developing countries for that matter, the scarcest factor is capital, unlike in the case of developed nations where scarcity is experienced in labour supply. Economic policies in developing countries clearly has gone against these laws. As shown in Table 3, the efficiency of capital in almost every sector of the economy appeared to have come down. Taking all the sectors of the economy together, efficiency of capital declined from 0.331 in 1950-51 to 0.227, in 1980-81. Table 3 also reflects the variations in the sectoral efficiency of capital. In 1950-51 the variation was in the range of 0.022 to 8.83 which in

Table 1 : Capital Labour Ratios in Different Sectors of the Economy [Rs.]

Sectors	1950-51	1960-61	1970-71	1980-81
Agriculture	737	931	1325	1979
Forestry	952	2910	6398	7991
Fisheries	1211	3447	5392	836
Mining & Quarrying	2333	3686	9284	32985
Regd. Manufacturing	11397	21314	27242	44094
Unregd. Manufacturing	1219	1521	3613	4778
Elect. Gas Water Supply	59264	104926	127782	199927
Construction	7150	8917	6834	7049
Railways	39165	57874	92373	81024
Non-Railways Trans. and Storage	16442	19065	19570	23895
Road Transport	16651	14342	15665	11075
Air Transport	232307	217894	232500	342456
Communication	11794	16043	20175	37679
Trade, Hotel, Restaurant	7171	8051	8639	9701
Banking and Insurance	19523	13968	9304	8827
Commercial Banking	409531	406495	329960	238752
Life Insurance	240000	301243	383236	436247
Real Estate	2553666	1226956	821921	674555
Public Administration	10380	23192	28221	47022
Other Services	1362	1597	2750	3423
All Sectors	3492	4566	6895.	9376

Table 2 : Output-Labour Ratios in Different Sectors of Economy (Rs.)

Sectors	1950-51	1960-61	1970-71	1980-81
Agriculture	958	1125	1268	1254
Forestry	8412	9925	10914	9006
Fisheries	2304	3051	3907	4070
Mining & Quarrying	1615	2614	3542	4915
Regd. Manufacturing	3027	4565	5696	6752
Unregd. Manufacturing	67	1027	1471	1330
Elect. Gas Water Supply	2132	4729	6186	9379
Construction	4651	6163	5706	5159
Railways	2302	3542	4473	4510
Non-Railways Trans. and Storage	1892	2838	3010	4608
Road Transport	1791	2410	3633	3680
Air Transport	5384	8947	17142	27894
Communication	3230	4285	4780	8839
Trade, Hotel, Restaurant	1945	3046	4297	3718
Banking and Insurance	10748	12762	11479	14633
Commercial Banking	9062	8376	8760	9076
Life Insurance	16315	20149	21194	36612
Real Estate	71500	43260	33843	29577
Public Administration	1457	2281	3357	5576
Other Services	852	1120	1601	1759
All Sectors	1158	1504	1941	2134

1980-81 narrowed down to between 0.038 and 1.61. It may, thus, be concluded that Indian plans could not fully exploit the developmental potential available in the country and hence the level of total output and growth rates remain very low.

As is evident from Table 4, there arose large scale disparities in Capital-Labour-Ratio (CLR), Output-Labour-Ratio (OLR) and Output-Capital-Ratio (OCR) across the sectors. While disparities in CLR has led to the problem of unemployment and underemployment, differences in OLR has given birth to income-disparities and hence poverty in the society. Disparities in OCR, on the other hand, has led to the problem of exploitation of labour engaged in capital scarce sectors of the economy. Thus, the past policies have neither raised the efficiency of capital upto the optimum level nor achieved the objective of distributive justice. This has happened because of two misleading concepts. Firstly, labour productivity is viewed in relation to employed persons only, keeping the unemployed persons out of the stream. In fact, the policy should have been to raise the Average Labour Productivity, taking into account the total working persons available in the country during the plan period. Secondly, the pre-occupation with savings ratios witnesses a misplaced emphasis. For higher savings larger income-disparities in the society has been advocated as a precondition. In a capitalistic economy, savings can be increased by either suppressing the consumption or by raising level of production per working person or both. In the case of a welfare state or in the context of underfed people, the best way is to raise the level of productivity of every working person. This would imply a strategic

Table 3 : Output Capital Ratios in Different Sectors of the Economy

Sectors	1950-51	1960-61	1970-71	1980-81
Agriculture	1.299	1.208	0.957	0.633
Forestry	8.833	3.410	1.705	1.127
Fisheries	1.901	0.887	0.724	0.486
Mining & Quarrying	0.692	0.709	0.381	0.149
Regd. Manufacturing	0.265	0.209	0.209	0.153
Unregd. Manufacturing	0.550	0.675	0.407	0.278
Elect. Gas Water Supply	0.035	0.045	0.048	0.046
Construction	0.650	0.691	0.835	0.731
Railways	0.058	0.061	0.048	0.055
Non-Railways Trans. and Storage	0.115	0.148	0.153	0.192
Road Transport	0.107	0.168	0.232	0.332
Air Transport	0.023	0.041	0.073	0.081
Communication	0.273	0.267	0.236	0.234
Trade, Hotel, Restaurant	0.271	0.378	0.497	0.383
Banking and Insurance	0.550	0.913	1.233	1.657
Commercial Banking	0.022	0.020	0.026	0.038
Life Insurance	0.067	0.066	0.055	0.083
Real Estate	0.140	0.098	0.118	0.118
Public Administration	0.140	0.035	0.041	0.043
Other Services	0.625	0.701	0.582	0.513
All Sectors	0.331	0.329	0.281	0.227

Table 4 : Variation in CLR, OLR and OCR in Different Years

Item	1950-51			1960-61			1970-71			1980-81		
	Max	Min	Diff	Max	Min	Diff	Max	Min	Diff	Max	Min	Diff
CLR In Rs.	240000.00 Life Insurance	737.00 Agri-culture	239263.00 Commer-cial Banking	406495.0 Agri-culture	931.00 Life Insu rance	4045564.00 Agri-culture	383236.0 Life Insu rance	1325.00 Agri culture	381911.00	436247.0 Life Insu-rance	1979.00 Agri-culture	434268.00
OLR In Rs.	16315.57 Life Insu-rance	670.99 Unregd Manu-factur-ing	15644.58	20149.25 Life Insu-rance	1120.00 Other Service	19029.25	21194.60 Life Insu-rance	1268.96 Agri-culture	19925.64 Life Insu-rance	36612.02 Agri-cul-ture	1254.28	3555.74
OCR	8.833 Fore-stry	0.0221 Comm-ercial Bank-ing	8.8109	3.4102 Fore-stry Bank-ing	0.0206 Comm-ercial Bank-ing	3.3896	1.7056 Fore-stry Insu-irance	0.0265 Comm-ercial Bank-ing	1.6791	1.6577 Comm-ercial Banking	0.038	1.6197

Note : Real Estate Sector has not been included in this Table

shift from consumption oriented planning to a resources utilisation approach. Considerations relating to securing a favourable balance of trade rather than self-sufficiency in terms of product(s) would receive serious attention of the planner. The country should have concentrated on using its resources for the products for which they are cost effective.

Concept of Appropriate Technology

The concept of appropriate technology has been defined differently. The appropriate technology movement has very often, been identified with the use of unsophisticated equipment which favours application of unskilled labour particularly in rural areas. The appropriate technology movement in its broadest sense set out an alternative agenda for economic development. The movement put technology assessment directly on to the policy agenda as a means of showing that there were alternatives to the high technology paradigm which seemed to dominate the thinking of development agencies throughout the world (Clark, 1988).

Appropriate technology is a way of thinking about technological change, recognising that tools and techniques can evolve along different paths towards different ends. It includes the belief that human communities can have a hand in deciding what their future will be like, and that the choice of tools and techniques is an important part of this. It also includes the recognition that technologies can embody cultural biases and sometimes even have political and distributional effects that go far beyond a strict economic evaluation. Appropriate technology, therefore, involves a search for technologies that have for example, beneficial effects on income distribution, human development, environmental quality and the distribution of political power in the context of particular communities and nature (Darrow et al, 1981).

The word appropriate is an adjective which means suitable or proper. Appropriate technology is, therefore, to be understood as a technology that may be suitable or proper in the context of a particular community, area, region or country. It must be so fashioned so as to achieve the objectives for which it is set up. The definition of this technology, therefore, must be related to its performance in the context of a particular situation (Das, 1981). The crucial theme of appropriate technology is technology itself. Technology is the application of science. Science is knowledge. Knowledge is heartless – it is neither violent nor benevolent. Technology, on the other hand, as a mode of application of knowledge, acquires the characteristics of the applicant, and hence has a purpose, form and spirit. The application originates from the need of a society, an inventor is only the agent through whom technology takes shape (Basu, 1983).

The appropriate technology movement is that through which the direction of technological development can be changed, not by abandoning scientific and technical knowledge, but by turning the attention of scientists and engineers to the criteria of smallest, simplicity, capital saving instead of labour saving and non-violence towards people and nature (McRobie, 1984). Earlier appropriate technology was considered as the process of development involving less cost workplace. Now there is the need for a broader view and also a system approach which takes into account the total needs of a community (Dunm, 1983). The appropriateness of a technology, of course, depends on the context in which it is to be used. The technology programme of a Rural Development Centre is concerned principally with small scale appropriate technologies at village level. Area of involvement includes water supply and sanitation, housing, energy and fuel use, village tools, transportation and agricultural technology. Apart from the modicum of official interest in appropriate technology across the region, there are only a handful of projects at the national level. Appropriate technologies, hitherto has been limited to regional activities only (Marjoram, 1983).

Appropriate technology, thus is a technology which suits the means to the ends. Means and ends are relative terms. In case of an appropriate technology, these terms have been used in relation to specific area or section 5 of the society. In other words, the concept of appropriate technology has accepted the technological duality in the economy. And hence, there arises a serious doubt about its effectiveness in alleviating unemployment, income-disparities and poverty on a country wide basis. Harmoneous development of Indian economy is hindered by the existence of a technological duality in the economic structure. This duality is reflected in the co-existence of "both aeroplanes and rikshas, hand ploughs and tractors, the service of ashaman and modern medicines. Joint stock companies and transational corporations exist side by side with the disintegrated rural communities". (Skorow, 1978). From the brief historical analysis of the present position of rural industries and technologies vis-a-vis the modern sector, it is obvious that the question of rural development is essentially related to the problem of technological duality (Nath, 1984). The policy of industrialisation through foreign collaboration has enlarged the extent of 'Schism'.

It has led to a sharp polarisation into a dual society (Reddy, 1973). "Whenever engineers talk about the technologies for rural development, the discussion immediately shifts from cars, computers and nuclear reactors to bullock carts, soak – pits and wood-stoves . ... For any villager the term development is synonymous with urbanisation-metalled roads, high rise building, sleek cars and neon lit streets. Clearly, the identification of technologies for rural development cannot be done in isolation from those being used in urban areas. What is, therefore, needed is a fresh appraisal of our concept of technology and development so that a uniform unbiased perspective of technology valid for both rural and urban development could emerge" (Dhar, 1987).

It is doubtful if appropriate technologies oriented to certain areas or some sections of the society would prove effective in alleviating widespread unemployment, income-disparities and poverty. In order to achieve the distributive justice, the concept of appropriate technology is to be defined in relation to the men and material resources available in the country as a whole. It is necessary that the appropriateness of every technique must be assessed before allowing its use. In the absence of such a mechanism the concept of appropriate technology would have theoretical value only.

Alternative Parameters for Assessing Appropriateness

Technology helps in translating inputs into output. Inputs can be divided into human and material. Material inputs are represented by capital and human inputs by labour. The combination of capital and labour is influenced by technology in use and this combination influences capital and labour productivity. With the help of these relationships, it is possible to evolve the desired techno-economic parameters, which are (1) CLR (2) OCR and (3) OLR. These parameters are related to the means and ends of the country as a whole. Distributive justice in the economy can be ensured only if values of all these ratios in general and value of OLR in particular in respect of every technique are around national averages.

Equality in CLR requires a two dimensional approach. The first is concerned with the allocation of available men and material resources in different sectors of the economy, the second being the distribution of allocated men and material resources among different production units within the same sector. In case of varied geo-climatic conditions and resource endowments, equality in CLR among different production units of the same sector is an impossible task. In this situation, the planners can compromise with a range of CLR for every sector of the economy, different production units within a sector observing different CLRs within the range but the sectoral value of CLR for all sectors of economy should reconcile with each other.

OCR is purely a technological parameter. In the planning process OCR plays the role of a regulator for balancing or widening the variations in CLR and OLR in the economy. In case of full employment, the value of OCR is expected to be one. At this value of OCR, and CLR is always equivialent to OLR which indicates the amount of capital that can substitute one unit of labour in the economy. The technique which gives lower value of OCR would require higher amount of capital per labour for ensuring the quality in OLR. In such cases, the consumers of that product over exploit the national resources for their consumption. There are some units in almost every sector and some sectors in the economy in which, despite the low value of OCR, income per working person is higher than the national average because of very high value of CLR. In such cases, techniques in use work as a channel of exploitation of national resources in favour of those persons who are employed in these units/sectors or who consume these products. The techniques which give the value of OCR more than one are the other side of the coin. The working persons who are engaged in the activities in which such techniques are in use alongwith their dependants are exploited by this technological duality in favour of the earlier categories of persons. To avoid this, it seems necessary that the planners should use this tool to balance the variations in CLR. This condition can be fulfilled by the relationship :

CLR × OCR = National Average Income per Working Person. - - - - - - - - (1)

The above relationship reflects that the product of CLR and OCR may ensure distributive justice in the economy. in fact, product of CLR and OCR may only ensure intra and other inter sectoral equality of income and not the ultimate objective of distributive justice. In order to achieve the distributive justice in the economy in addition to intra and inter sectoral equality of income one has to ensure proper distribution of incomes among different factors of production engaged in one and the same production unit. Distribution of income among different factors of production to a great extent depends upon the pattern of society and the value system which a country

adopts. In short, the planning process has to go through three distributive mechanisms alongwith a mechanism of standardisation of price-mechanism, viz (i) allocation of men and material resources among different sectors of the economy; (ii) distribution of allocated men and material resources among different units engaged/to be engaged in a particular sector and (iii) distribution of incomes among different factors of production engaged in one and the same production unit. Since all these are effected in terms of money, price-mechanism becomes a very important aspect.

Effectiveness of the Proposed Parameters

In order to work out the values or ranges of the proposed techno-economic parameters, information about the magnitude of unemployment during the reference years is required. In India, to arrive at a reliable unemployment rate is a difficult task. To illustrate the application of the proposed parameters, the magnitude of unemployment has been assumed as 5 percent of the employed persons in 1950-51, 15 percent in 1960-61, 25 percent in 1970-71 and 35 percent in 1980-81. On the basis of this assumption magnitude of unemployment alongwith values of CLR, OCR and OLR for all the four reference years has been computed and given in Table 5. The value of OLR does not increase in proportion to the value of CLR which justifies the effectiveness of OCR in planning.

The data given in Table 5 reflect the average values of CLR, OCR and OLR. In fact, an economy observes a range of CLR and OCR instead of constant values. Variation in actual OLR is the result of these ranges and also due to the distribution mechanism or incomes among factors of production. According to Table 4, the value of actual CLR varies from Rs. 2,40,000 to Rs. 737 in 1950-51, Rs. 4,06,495 to Rs. 931 in 1960-61, Rs. 3,83,236 to Rs. 1325 in 1970-71 and Rs. 4,36,247 to Rs. 1979 in 1980-81. Similarly the value of OCR varies from 8.83 to 0.022 in 1950-51, 3.41 to 0.02 in 1960-61 from 1.70 to 0.02 in 1970-71 and from 1.6577 to 0.03 in 1980-81. The acceptable range of CLR can be worked out on the basis of a pre-determined range of OCR and OLR. It may again be emphasised that the range of CLR is an intra-sectoral concept and it has no concern with the inter-sectoral range of CLR. In order to achieve the objective of distributive justice there must be equality in inter-sectoral CLR.

What should be the range of OCR? Growth objective demands that the values of OCR should be as high as possible. On the contrary, improvement in working conditions requires that the value of OCR should be as low as possible. Within these two extreme situations one has to take decision. In the Indian conditions, 0.20 to 1.20 may be as an appropriate range of OCR. With the help of OLR values as shown in Table 5 and the range of OCR, intra-sectoral range of CLR for all the four reference years have been calculated and given in Table 6. The range of OLR comes to Rs. 919 to Rs. 5515 in 1950-51, Rs. 1090 to Rs. 6540 in 1960-61, Rs. 1294 to Rs. 7785 in 1970-71 and Rs. 1316 to Rs. 7900 in 1980-81. Techniques which require capital per unit of labour beyond the pre-determined range is bound to create unemployment and underemployment, poverty and income-disparities in the economy alongwith exploitation of some working persons in favour of others. Licensing policy is expected to clear number of units in each sector of the economy in such a way that the sectoral values of the proposed parameters are around the national averages.

Table 5 : Value of Proposed Parameters

Items	Values of Different Items in Reference Years			
	1950-51	1960.-61	1970-71	1980-81
Labour employed in Lakhs	1471.14	1665.73	1829.55	2304.85
Unemployed labour in Lakhs	73.557	249.85	457.38	806.70
Total labour available in Lakhs	1544.69	1915.59	2286.94	3111.55
Capital stock in Rs. crores	51386.00	76067.00	126156.00	216116.00
Net domestic Product in Rs. crores	17044.00	25065.00	35525.00	49187.00
C L R in Rs.	3326.00	3970.00	5516.00	6945.00
O L R in Rs.	1103.00	1308.00	1553.00	1580.00
O C R	0.33	0.33	0.28	0.22

The effectiveness of the proposed techno-economic parameters is to be examined in the context of removal of poverty, income disparities and unemployment. In any country, income-disparities are the root cause of poverty. Poverty would automatically disappear as employment opportunities are increased. Removal of unemployment is the ultimate yardstick of success. It can be concluded that full employment in the economy is the function of proper inter and intra sectoral allocation of men and material resources. To achieve and further maintain equilibrium and stability in the economy it is desirable to keep the present product-structure intact, which means that there is not much scope of transferring material resources from one sector to another. This

Table 9 : Allocation of Labour and Capital Stock in Different Sectors

Sectors	Allocation of Labour and Capital in Reference Years							
	1950-51		1960-61		1970-71		1980-81	
	Labour in Lakhs	Capital stock in Rs. Crores	Labour in Lakhs	Capital Stock in Rs. Crores	Labour in Lakhs	Capital Stock in Rs. Crores	Labour in Lakhs	Capital Stock Rs. Crores
Agriculture	228.05	7585	279.03	11022	309.69	17083	429.47	29827
Forestry	0.72	24	1.96	78	4.18	231	5.21	362
Fishery	1.53	51	4.71	187	5.72	316	8.55	594
Miningand Quarrying	5.47	182	7.88	313	15.53	857	45.02	3127
Registered Manufacturing	101.74	3384	196.87	7816	249.16	13744	425.19	29530
Unregistered Manufacturing	42.33	1408	46.39	1842	77.70	4286	142.63	9906
Elect-Gas-Water Supply	24.23	806	53.65	2130	119.07	6568	199.49	13855
Construction	33.64	1119	40.45	1606	40.22	2219	41.41	2876
Railways	105.86	3521	141.98	5637	195.43	10780	183.39	12737
Non-railways Transport and Storage	69.75	2320	80.20	3184	98.27	5421	124.89	8674
Road Transport	44.70	1487	51.41	2041	49.14	2710	49.96	3470
Air-Transport	9.07	302	10.42	414	11.80	651	28.10	1952
Communication	6.91	230	11.03	438	16.74	920	25.71	1788
Trade Hotel Restaurant	156.97	5221	157.17	6240	141.40	7800	220.97	15347
Banking and Insurance	8.62	287	9.04	359	9.46	522	11.27	783
Commercial Banking	78.80	2621	119.73	4756	149.54	8249	212.10	14731
Life Insurance	13.71	456	30.30	1211	36.05	1989	34.48	2395
Real Estate	460.67	15322	426.49	16932	457.45	25233	437.07	30355
Public Administration	101.74	3384	196.87	7816	249.16	13744	425.19	29530
Other Services	50.39	1676	51.51	2045	51.35	2833	61.61	4279
All Sectors	1544.90	51386	1915.89	76067	2287.06	126156	3111.17	216116

to be a suitable strategy. For example, manufacturing of seats for railway compartments, spinning function of textile industry, crushing function of sugar industry, pulp-making function of the paper industry etc. can be shifted from the premises of large and medium scale industries to rural areas. This shifting would certainly need some improvement in infrastructural facilities and services in rural areas alongwith Research and Development (R and D) efforts. For improving the infrastructural facilities and services higher amount of human and material resources are needed which can be made available through proper allocation of resources. To meet the R and D require-ments, research institutions should be directed to concentrate on these issues.

The procedure of identification of the fields/aspects/ issues which need R and D efforts has been highlighted with the help of data related to sugar industry. Information of different aspects of two technologies: Large scale sugar mills based on 120 days working and Mini sugar mills based on 110 days working have been given in table 10. Garg (1979) based on his study of the Mini Sugar mills has drawn four major inferences : (i) for producing one tonne of output, Mini Sugar Mills require capital equal only to 42 per cent of that required by a large scale plant; (ii) to create one job in Mini Sugar Mills, only 11 per cent of the capital in large-scale sugar plant is required, (iii) for the same capital 2.37 times more sugar output can be produced by the Mini Sugar Mills, and (iv) 10.3 times more jobs can be created by Mini Sugar Mills for the same outlays as in large scale sugar plant. All these arguments, in fact, are in favour of Mini-scale sugar technology. There are darker sides also e.g. crushing of every hundred quintals of cane in Mini Sugar Mills causes a loss of 2.1 quintals of sugar and as a result, the cost of production per quintal of sugar comes to Rs. 13.30 more when compared to that in large scale plants. Here, the following issues need deeper consideration and subsequent resolution:

(i) Whether the country should bear the material loss in terms of sugar which is of a renewable nature or labour which is perishable along with person's life?

(ii) Whether the accumulation of incomes and wealth in the hands of big farmers and big entrepreneurs is to be

Table 10 : Information about Large and Mini-scale Sugar Technology

Particulars	Large scale sugar technology based on '120' days working	Mini-scale sugar technology based on '110' days working
Capacity at maximum crushing tons/day	100	100
Total capital available for investment Rs. million	60	60
Capital required for installation of one unit in Rs. million	60	1.3
Number of units which can be installed on the basis of above capital investment	1	46
Employment		
a. per unit	—	202
b. total	900	9292
Total sugar output per annum in tonnes	14,550	34,500
Investment per ton of sugar in Rs.	4.123	1,733
Investment per worker in Rs.	66,666	6,000

Source : Mini Sugar Project Proposal and Feasibility Report
By : M.K. Garg, (1979).

allowed or distributive justice is to be achieved through the production process itself?

Acceptable answers perhaps is to minimise the loss of human resources as well as of material resources. Mini Sugar Mills does not ensure both these aspects. In fact Mini Sugar Mill causes material loss at every stage of the production process and, therefore, cumulative loss becomes very significant. Extraction of juice from sugarcane, clarification of juice, evaporation and concentration of juice into masscuite and formation of crystals and their separation from the masscuite to obtain the final product are the main functions involved in sugar production. The material loss can be minimized by performing the last three functions in large scale sugar mills and by raising the juice extraction efficiency of bullock crusher whereas labour loss can be minimised by shifting the first function to the rural areas. This would raise the number of employed persons with the same amount of capital stock and hence the values of CLR and OLR in case of sugar industry may come very near to the national averages. In addition to this, it would also be possible to observe the value of OCR within the desired range. Shifting of crushing function would provide baggasse at village level which can be utilized for pulp making in paper industry. *For this purpose, the R and D institutions have to work for either raising the juice extraction efficiency of bullock crusher or using the juice which is left in baggasse for any other product.*

Conclusion

In a capitalist economy, CLR, OCR and OLR seem to be the most appropriate techno-economic parameters for assessing the suitability of a technique. To ensure the desired results, it is necessary to assess the appropriateness of every technique. In order to apply these parameters in the present situation the best solution is to shift the first function of the production process related to large and medium scale industrial units from urban to rural areas.

In Indian planning, growth with social justice has been the main objective. This objective should be restated as "social-justice through growth". In case of growth with social justice, the preference goes to those techniques which suit mass production. On the contrary, if the social justice through growth is the objective, the preference goes in favour of those techniques which suit production by masses.

In the case of developing countries, the concept of appropriate technology comes into conflict with the present techno-economic policies which accept a technological duality and encourage the R and D institutions for putting their efforts for raising the productivity of employed persons rather for raising efficiency of capital. Income disparities are the inevitable outcome of present policies. To reverse this, we have to change the nature of the concepts of saving and labour productivity and consider the entire economy as a single entity.

This paper peripheraly touches a very important aspect of the planning process i.e. there is a need to change the consumption oriented planning into a resource utilisation scheme. In the case utilisation planning the emphasis is expected to be on minimisation of wastes in terms of men and material resources. Secondly, the concept of product self-efficiency is to be replaced by that of a favourable balance of trade. Distributive justice needs multi-dimensional efforts for proper allocation of men and material resources, choice of appropriate techniques and also proper distribution of incomes among different factors of production.

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Management of Service Quality: A Conceptual Framework

Shams-ur Rahman

The definition and measurement of quality have been made mostly in the context of the manufacturing sectors. Since the characteristics of a service differ sharply from those of a product, our knowledge about product quality cannot easily be applied in defining and measuring service quality. This paper attempts a generalized conceptual framework for service quality

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Most published works on quality control have been developed to manage the quality of manufcturing products. Only over the last decade,has there been a growing interest in the development of systematic knowledge about the management of quality for service systems like banking and finance, hotel and catering, tourism and leisure, insurance companies, retail activities, advertising and education. Chase (1981) sees two reasons for such interest, namely :

1. the rapid growth of services relative to manufacturing in the last decade; ;
2. the pressure on service operations to become cost efficient in their production processes.

Chase's observations are valid particularly for the developed nations. Statistical data show that in 1984 the services sector of the economy accounted for 58% of GNP in the EEC countries, whereas the figure for US was 66%. The percentages are 62 and 55 for Sweden and Finland respectively(Grönroos, 1988). The service sector in developed nations is even more important as far as total employment is concerned. In the UK 67% of those in employment are working in service organisations(Armistead, 1988). This figure is 65% for both Canada and US(Cowell,1984). Although, third world nations are predominantly agricultural countries, service industries are, however, becoming increasingly significant to the economy.

Since the characteristics of a service differ sharply from those of a product, our knowledge about product quality cannot easily be applied in defining and measuring service quality. In order to fully understand the concept behind service quality we have first defined service and quality in section II. In section III we give a description of a conceptual framework for service quality and outline the guidelines for its possible usage in service organisations.

II. Concept of Service, Quality and Service Quality

Starting from the physiocrats (a group of eighteenth century French philosophers), many attempts have been made to define service. To the physiocrats service meant all activities other than agricultural production, whereas Adam Smith considered services as activities that do not end in tangible products(Walters and Bergiel, 1982). A contemporary definition of service is as follows: "A service is any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tied to a physical product" (Kotler, 1982,p.624).

Some attempts have also been made to define service from the process point of view. Since sometime services and products are hard to distinguish (Shostack, 1982), it is problematic to define service from the process point of view. For instance, a car is a product and an airline is a service but transport is common to both and each has product and service elements. Shostack, however suggested that services and products be distinguished on the basis of their tangible elements.

Generally, a service is made up of two systems: an interface and a support (Teboul, 1988), which can be compared with the front and the back office of a bank or the dining room and the kitchen of a restaurant (see fig.1). And deliverying the service means dealing directly with the customers and transforming them from an initial state of non-satisfaction or need into one of contentment.

On the other hand, quality means different things to different people. Garvin,(1984) outlined five viewpoints of quality, namely:

1. Transcent=Beauty;
2. Product=Content;
3. User=Fitness;
4. Value=Cost;
5. Manufacturing=Variability

Maister(1984) and Teboul (1988) considered the user-based viewpoint (The Juran concept of "fitness for use" addresses this viewpoint (Juran, 1980,p.1) of quality for service operations, i.e. quality is the customers perception of the service offer. Since perception is an experimental state of one's mind (Haywood-Farmer, 1988), rather than necessarily being real, a service is therefore, not only 'what' is delivered but also includes 'how' it is delivered. The 'how' of the service is the interactions of the customers with the premises, with the equipment, with the employees and even with the 'other customers(see fig.2) With regards to the gradual disappearance of movie theatres in the USA, Canby's (1982) findings justified this opinion. He pointed out thirteen complaints, including insensitive and undisciplined employees, underlit and out-of-focus projection, ear-splitting sound, and a cumbersome refund procedure in the case of power failure. None of these have anything to do with the quality of films beings shown.

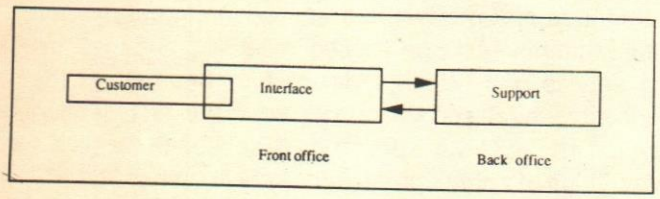

Fig. 1 : Service definition (Teboul, 1988)

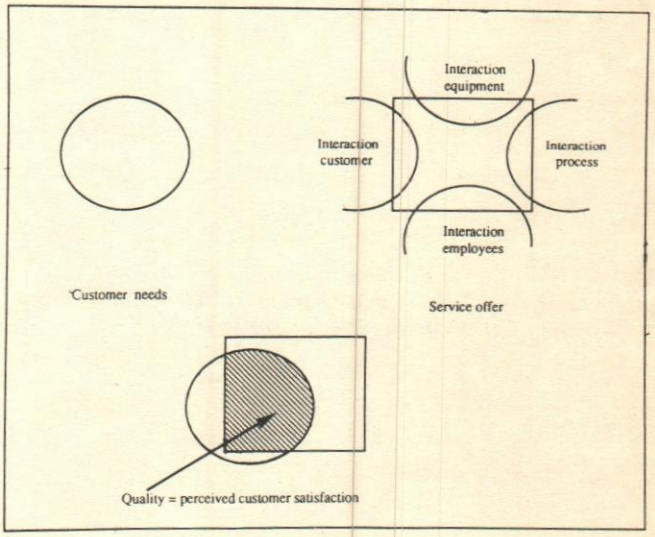

Fig. 2 : Quality as perceived user satisfaction (Teboul, 1988)

According to Gronoos (1982) service quality can be considered in terms of technical quality and functional quality. The technical aspects relate to 'what is delivered,' e.g. meals in a restaurant and bedrooms in hotels. The functional aspects of service relate to how it is delivered, i.e, attitudes and behaviour of employees, inter-relationships of customers and servers, appearance and personality and service-mindedness of service personnel and their accessibility and approachability. Moreover, he emphasised that the 'how' of service delivery is critical to perceptions of service quality. Lehtinen(1983) viewed service in terms of 'process quality' and 'output quality'. Process quality is judged by the customer during the service and output quality is judged by the customer after the service is performed. The barber's conversation and apparent skill during the haircut involve process quality, the apppearance of the hair after the haircut involves output quality.

III. A Conceptual Framework for Service Quality

The sources of quality problem with the manufacturing products are commonly related to workmanship, materials and parts, control system, product design and maintenance of process equipment(Leonard and Sasser, 1983). The primary causes of service quality problems, on the other hand, are quite different from the manufacturing products because of some special characteristics of services. Among such characteristics are (Farsad and Elshennawy, 1989):

1. Intangibility of service.
2. Simultaneous production and consumption of service.
3. Customer involvement in service production.
4. Heterogeniety of service.

These unique characteristics make the process of service quality control less manageable and the level of expected quality less predictable. However, a number of ideas, as to how service companies must organise and function to produce good quality services, have been proposed in various studies related to service quality. These ideas can be categorised into three approaches:

Approach I:

Adaptation of manufacturing techniques for the service sector to encourage efficient use of resources for increase in productivity. Writers advocating this idea tend to model the service system as being similar to manufacturing. The idea has been more subjectively addressed by Levitt (1972, 1976). He proposed the 'production-line' approach and suggested that like manufacturing, the system of division of labour and specialisation could be followed in service industries, to produce speed, quality, cleanliness and low prices. As examples, fast food restaurants such as McDonalds and Burger King were cited. Chase(1978) introduced the concept of separating high and low contact operations and running no-contact or back-office operations along similar lines to a production plant. Dierdonck and Brandt (1988) advocated a `focused-factory` concept for service organisation. The concept of focused-factory is to have different plants, each focused on 'one set of internally consistent non-compromised criteria for success'. All these views attempt to restructure service systems to make them more like manufacturing processes; however, none requires much customer involvement.

Approach II:

Participation of customers in the production process of the service systems and thereby achieving productivity gains. Some of the writers advocating this approach are Fitzsimmons (1985), Zeleny (1978) and Lovelock and Young (1979). Since, in service systems consumers are generally present when the service is performed and witness its production, Fitzsimmons (1985) and Berry (1984) termed them as 'untapped productive resources' and hence, claimed that by shifting some of the services on to the customers, it is possible to increase productivity.

Approach III:

De-industrialisation of services. Writers proposing this idea give great importance to the 'interface' of the service system. Teboul (1988) for example, argued that when the service is industrialised (*i.e.* approach I) the centre of interest is less the service itself than the product delivered with the service. According to him, for the long term positioning of a service organisation, strategies like maintenance and enhancement of the interface are a must.

Since service organisations are highly diverse and cover a wide range of activities, no one particular aforementioned approach fits into all the services. However, an appropriate combination of these approaches can provide a useful framework to study the service quality for any type of service. In the case of approach I, an efficient back-office (support system) is essential,

whereas, in approach III, interface of the service is important. Approach II, however, gives more emphasis to the situational judgement and attitudes and behaviour of the employees, given the fact that in a service system customers are generally present when the service is performed and witness its production.

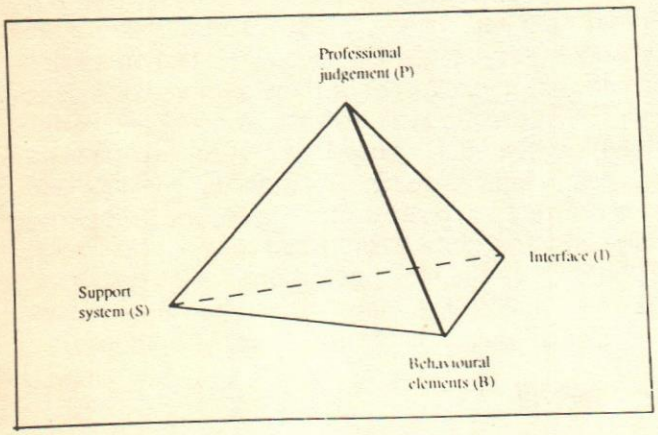

Fig 3: A Conceptual model for service quality

The proposed framework for service quality is essentially based on a combination of these approaches and consists of following features:

1. Interface of the service organisation.
2. Behavioural elements of the employees.
3. Support system of the service organisation.
4. Professional judgement of the servers.

The proposed model is an extension of the service quality model by Haywood-Farmers (1988). In Haywood-Farmer's model the 'interface' of the service system has been included as a component of the physical process along with the support system, *e.g.* production and delivery facilities. By doing so the author has oversimplified the importance of interface in a service organisation. Moreover, the third feature of his model *i.e.*, professional judgement, which includes characteristics like advice, diagnostic ability and motivation to serve, has limited scope without a substantial size of the interface. For example, in the fast food restaurants, the staff have no scope whatsoever to advice the customers in designing their food. Here, showing warmth and friendliness (*i.e.* behavioural elements) by the service providers will serve the purpose. On the other hand, in a Japanese Benihana restaurant (where the size of the kitchen is significantly small compared to the dining area) the staff has sufficient opportunity to advice and mutually design the service. It is, therefore, more justified to have 'professional judgement' as one of the features when interface is also a distinct component of a service quality model.

The proposed model(see fig. 3) has been explained with the help of the three dimensional classification scheme proposed by Haywood-Farmer (1988) (see Fig. 4). The co-ordinates of the scheme represent degree of customisation, degree of contact and interaction between customers and service organisation and degree of labour intensity. It is the responsibility of the service managers to choose an appropriate combination of the model's features on the basis of the organisation's status in terms of service customisation, contact of customers and intensity of labour.

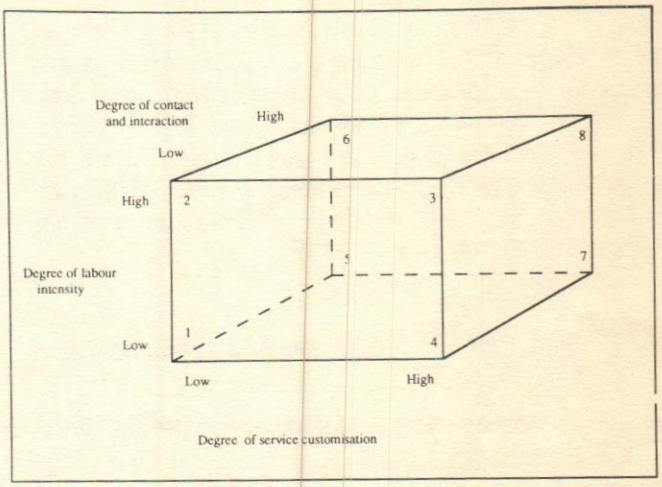

Fig. 4: A Three-Dimensional Classification

The model can be studied in the following manner. There are two extreme octants in Fig. 4 — octant 1 and octant 8. Octant 1 represents services which are low in all the three dimensions. Since, there exists no or low contact between customers and servers in such services, therefore, the server's personal behaviour and interface are relatively unimportant. The focus for quality control should therefore be emphasised on work processes and procedures, *i.e.* near the lower left hand corner of Δ PSB in fig. 3. An example of such services

could be the back room operations at a bank. On the other hand, octant 8 represents the services which are, high in all three dimensions. In such organisations interface, support, behavioural elements and professional judgement are all important. The proper service quality balance would therefore be at the centre of the pyramid PSBI in fig.3.

As one moves towards octants 5-8, the contact and interaction between the customer and the service producing system increases. In services low both in labour intensity and service customisation (octant 5), the support system is important. Special care must be taken to make sure the equipment is reliable and easy for the customer to use. A 'cash-point banking system' is an example of such a service. As high contact and interaction services increase in labour intensity(octant 6, 8), more attention must be given to the attitudes and behaviour of the staff. A service with high contact, high labour intensity but low service customisation (octant 6), will be a combination of support and behavioural elements. The proper quality balance, in this case, will lie between the lower two corners of Δ ISB in fig. 3. A take-away food service is a good example of such an organisation. In the case of a fast food restaurant, like McDonalds, interface is also important.

Octant 2 is high in labour intensity but low both in contact and service customisation. Here personal behaviour, professional judgement and interface will remain quite unimportant. Delivery service of a postal department is an example of such kind of services.

As one moves towards octants 3, 4, 7 and 8 of fig. 4, the degree of customisation increases. In this case the product must be designed to fit the customer's need and hence, the server must advice the customer, decide what the customer wants and decide how best to produce the service. These functions require professional judgement on the part of the server. In labour intensive organisations the server's personal behaviour and interface are important. The emphasis in quality control should therefore be focused on the Δ PBI. Repair and maintenance services, a dentist's chamber and Benihana restaurants are some examples of such services. In low labour intensive services, such as the one related to computer, the professional judgement and support system of the organisation are important.

So far very few efforts have been made to develop models for service quality. Some examples of conceptual models are Grönoos (1984), Leitinen and Laitamaki (1984) and Parasuraman, Zeithaml and Berry (1984). Recently LeBlanc and Nguyen (1989) and Haywood-Farmer (1988) had proposed two different models. The model by LeBlanc and Nguyen (1989) has been directed to service quality in financial institutions. The conceptual model described earlier is essentially an extension of Haywood-Farmer's model.

IV. Summary

The article presents insights into some basic concepts of service and service quality. A number of ideas proposed in different studies on service quality has been categorised into three approaches. Since service organisations are highly diverse, individually no one approach is suitable for all service activities. In this respect, a model comprising four quality attributes such as interface of the organisation, support system, behaviour of the service personnel and professional judgement, has been proposed. Managers must carefully choose and balance the appropriate mix of these quality attributes in order to achieve good service quality.

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Productivity Measurement, Evaluation and Improvement

Vedat Verter and Mehmet A. Eyler

This study is based on the idea of identifying alternative opportunities for productivity improvement via evaluation and analysis of reliable productivity measures. The proposed aggregate measurement model is a hierarchical one which takes into account different layers of the real life system as well as accounting for the relationships between productivity, price recovery and profitability. The authors' case study on an existing production system gave promising results in terms of effectiveness of the measurement model. Main contribution comes from the analytical approach to specification of dominant factors of aggregate productivity and potential factors for productivity improvement.

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Performance measurement is a critical component in the general management process. Reliable measurement systems constitute a sound basis for continuous monitoring and control of organizational performance. This enables the managers to point out the bottlenecks and potential factors of improvement and to evaluate the success of previously implemented projects. A viable categorization of the performance measures designed for organizational systems is as follows :

- Efficiency,
- Effectiveness,
- Productivity,
- Profitability,
- Quality,
- Innovation,
- Quality of work life.

We would like to emphasize the interactions between these measures although each indicates the level of performance of different activities.

Productivity is a measure of performance for the production activity and refers to the amount of output produced per unit of input. It is possible to express this via the following equation:

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} \qquad (1)$$

Here, output stands for a weighted sum of various products,whereas input stands for a weighted sum of various inputs.

Profitability is usually the main concern of the managers of profit maximizing firms. It is a measure of utilization of financial resources. Increases in profitability may be due to price recovery as well as productivity improvements. Price recovery shows the firm's ability to reflect the input cost changes onto output prices. Unless the firm has a monopoly in the market, price recovery is imposed by market conditions and is uncontrollable. We

would like to emphasize that profitability increases based on productivity improvements are much more reliable in the long run than the ones motivated by just increasing the output prices.

Prevailing Approaches

Initial attempts to systematize the determination process of productivity improvement projects were the design of productivity checklists and action based programs (Apple, 1977; Kristokis, 1983; Robbins and Myers, 1983). These methods are primarily based on surrogate measures rather than direct measurement of productivity. The Multi Criteria Performance Productivity Measurement Technique of Steward suggests use of structured group techniques to generate viable productivity measures for the organizational system (Steward, 1979). These measures are then aggregated according to the subjective preferences of the operations manager.

Productivity-Cost-Profitability system of Gold emphasizes the hierarchical relations between different levels of measurement and analysis (Gold, et, al, 1976; Gold, 1982, 1983). These are the network of productivity relationships, the structure of cost relationships, and the managerial control ratios.

In factorial productivity analysis, productivity measures are categorized according to the number of inputs included in the productivity equation. Partial productivity measures include only one input, whereas multi-factor measures include multiple inputs and total factor measures include all of the inputs of a given organizational system. In this field pioneering work is due to Craig and Harris (1973). The most up to date references are the multi-factor model of Sink (1983, 1985) and the total factor model of Sumanth (1984; Sumanth, et. al, 1980).

Productivity measures can be either static ratios referring to the productivity value of a specific time period or dynamic productivity indexes referring to the change in the productivity value of a time period compared to that of a base period. Dynamic productivity indexes are expressed either as a ratio of productivity values of two periods or as a ratio of change in outputs to change in inputs.

Productivity Matrix is constructed as a basis for productivity analysis. A hierarchical, dynamic,. aggregate productivity measurement model is provided and outputs of the model are explained in terms of elements of the productivity matrix. The Multi-factor Productivity Measurement Model of this study enables analysis of the relationships between productivity, price recovery and profitability. Promising results of application of the model to an existing company are briefly summarized. Furthermore, methods of specifying dominant factors of aggregate productivity as well as potential factors of productivity improvement are analytically investigated.

Productivity Matrix

Let us consider a firm producing n types of products and consuming m types of inputs. The productivity matrix, the elements of which are defined to be the productivity indexes of the current period, is constructed to provide complete information about the productivity framework. Define the following quantities for a specific time period T:

O_{iT} : value of product i,

OF_T : Value of total outputs of the firm,

I_{ijT} : value of consumption of input j for product i,

I_{jT} : value of total consumption of input j,

I_{iT} : value of total consumption for product i,

IF_T : value of total consumption of the firm.

Here T may refer to any time period between the base period ($T = 0$) and the current period ($T = t$). Values of all of the quantities defined above should be expressed in monetary terms of the base period. Then the partial productivity index of input j with respect to product i for the current period is

$$PP^{\text{¢}}_{ijt} = \frac{O^{\text{¢}}_{it}}{I^{\text{¢}}_{ijt}} = \frac{O_{it}/O_{io}}{I_{ijt}/I_{ijo}} \qquad (2)$$

Furthermore, also for the current period, total productivity index of product i is

$$TP'_{it} = \frac{O'_{it}}{I'_{it}} = \frac{O'_{it}/O_{io}}{I'_{it}/I_{io}} \qquad (3)$$

partial productivity index of the firm of input j is

$$PPF'_{jt} = \frac{OF'_t}{I'_{jt}} = \frac{OF'_t/OF_o}{I'_{jt}/I_{jo}} \qquad (4)$$

and total productivity index of the firm is

$$TPF'_t = \frac{OF'_t}{IF'_t} = \frac{OF'_t/OF_o}{IF'_t/IF_o} \qquad (5)$$

Productivity indexes also represent the changes of productivity values of the current period with respect to those of the base period. Productivity indexes matrix of the current period is depicted in Table 1.

Table 1. Productivity Indexes Matrix of the Current Period

	$input_1$ ... $input_n$	total
$product_1$ ... $product_n$	PP'_{11t} ... PP'_{1nt} ... PP_{nit} ... PP'_{nnt}	TP'_{1t} ... TP'_{nt}
Total	PPF'_{1t} ... PPF'_{nt}	TPF'_t

Productivity Measurement

Productivity measures of the unit are obtained from a productivity measurement model. It is possible to categorize the productivity measurement models in terms of the range of measures they are designed to provide. Aggregate measurement models deal only with the last row of the productivity matrix. That is, they provide partial productivities of inputs and the total productivity of the firm. Product oriented measurement models on the other hand, focus on the whole matrix. That is, they also provide partial productivities of inputs with respect to individual products and total productivity of each product. It is obvious that construction and operation of product oriented models necessitates an incredible amount of data collection even in firms of medium size. Thus, for the sake of applicability we restricted ourselves to an aggregate productivity measurement model. However, an output productivity formulation is also provided which yields approximation to total productivity indexes of products under certain conditions. The details of this are explained after motivating the productivity measurement model.

To provide the hierarchical structure of the measurement model, inputs and outputs of the system are disaggregated by class, type, level, and sub-level hierarchy. The database of the model contains quantity, unit, value, and value information about inputs and outputs at the lowest level defined. Data is automatically transfered to higher levels of the model for productivity analysis. It is also possible to pursue a detailed productivity analysis by going downwards in the model, if necessary.

At the lowest level of the hierarchical model, data is collected for the base period ($T = 0$) and for the current period ($t = t$). Let,

Q_{iT} : Quantity of output i produced in period T,

P_{iT} : Unit price of output i in period T,

Q_{jT} : Quantity of input j consumed in period T,

P_{jT} : Unit cost of input j in period T.

Change ratios for the current period are : $q_{it} = Q_{it}/Q_{io}$, $P_{it} = P_{it}/P_{io}$ for outputs and $q_{jt} = Q_{jt}/Q_{jo}$, $p_{jt} = P_{jt}/P_{jo}$ for inputs. Weighted change ratios are calculated as follows in order to carry information to higher levels of the model.

$$q_{ot} = \frac{\sum_{i=1}^{n} P_{io} Q_{it}}{\sum_{i=1}^{n} P_{io} Q_{io}} \qquad (6)$$

for outputs and

$$q_{It} = \frac{\sum_{j=1}^{m} P_{jo} Q_{jt}}{\sum_{j=1}^{m} P_{jo} Q_{jo}} \qquad (7)$$

for inputs.

That is, quantitites are weighted by their base period unit values respectively.

$$P_{ot} = \frac{\sum_{i=1}^{n} P_{it} Q_{it}}{\sum_{i=1}^{n} P_{io} Q_{it}} \qquad (8)$$

for outputs and

$$P_{It} = \frac{\sum_{j=1}^{m} P_{jt} Q_{jt}}{\sum_{j=1}^{m} P_{jo} Q_{jt}} \qquad (9)$$

for inputs.

That is, unit values are weighted by their current period quantities respectively.

Then,

q_{Ot}/q_{It} : Total productivity of the firm,
q_{Ot}/q_{jt} : Partial productivity of input *j* and
q_{it}/q_{It} : Productivity of output *i*.

Whereas

P_{Ot}/P_{It} : Total price recovery of the firm,
P_{Ot}/P_{jt} : Partial price recovery of input j and
P_{it}/P_{It} : Price recovery of output i.

Furthermore,

$$\frac{q_{Ot}p_{Ot}}{q_{It}p_{It}} = \frac{v_{Ot}}{v_{It}} \qquad (10)$$

which is profitability of the firm. The above relationship between productivity, price recovery and profitability is valid at all levels of the measurement model. Productivity Measurement Model is provided in Table 2.

Let x'_t denote the output productivity vector in the measurement model and $T P'_t$ denote the total productivity index of products vector in the productivity matrix of period *t*. Then, using the previous notation,

$$TP'_t = \begin{bmatrix} O'_{1t}/I'_{1t} \\ \vdots \\ O'_{nt}/I'_{nt} \end{bmatrix}$$

and

$$X'_t = \begin{bmatrix} O'_{1t}/IF'_t \\ \vdots \\ O'_{nt}/IF'_t \end{bmatrix}$$

where

$$IF'_t = \sum_{i=1}^{n} \frac{I_{io}}{IF_o} I'_{it} \qquad (11)$$

Then,

$$TP'_t = X'_t \text{ if } IF'_t = I'_{it} = T_o \text{ for } i = 1, \ldots, n$$

This holds the whenever

$$I_{ib} = \overline{I_o}, \text{ for } i = 1, \ldots, n \qquad (12)$$

and

$$I_{it} = \overline{I_t} \text{ for } i = 1, \ldots, n \qquad (13)$$

where $\overline{I_o}$ and $\overline{I_t}$ are the arithmetic means.

In words, the output productivity vector *X'* provided by the measurement model is equal to the total productivity indexes of the products vector *TP'*, if input consumptions of products are equal to their respective arithmetic means in both periods. This is usually the case if a firm is producing goods of similar type. Let us assume that the base period conditions (12) hold. To analyze the current period let,

$$I_{it} = \overline{I_t} + \epsilon_i \text{ for } i = 1, \ldots, n$$

with

$$\sum_{i=1}^{n} \epsilon_i = 0 \qquad (14)$$

Then,

$$\frac{TP_{it} - X'_{it}}{TP'_{it}} = \frac{\epsilon_i}{I_t} \text{ for } i = 1, \ldots n. \qquad (15)$$

That is, the percentage error occuring during the use of our model in the estimation of total productivity indexes of products is bounded. For a specific product, this bound is equal to the percentage difference of the current period input consumption from the arithmetic mean while the base period conditions hold.

Application

The method described above was implemented on a wheel producing company, which started production in 1982 (Verter, 1985). Being a transition period, 1983 was not suitable to be included in the analysis. January 1984 was selected to be the base period for the production analysis focusing on the first six months of the year. Inputs and outputs of the system were disaggregated by class, type, level, and sub-level hierarchy to provide the hierarchical structure of the measurement model. The database of the model contains quantity, unit value, and value data for the six monthly periods. The factors such as general managerial costs and financial costs which are not directly related to production operations were not included in the model.

The popular spread sheet program Multiplan was used as the modelling tool which simplified the database construction and model building effort considerably. Data transfer from the low levels to high levels of the hierarchical model was also performed with the aid of this program.

In application summary which contains performance indexes for only the class totals in the first and the sixth period of the analysis is provided in Table 3. Note that, the change ratios are the weighted change ratios of the associated type totals.

Productivity Analysis

General trends of productivity improvement can be obtained by a graphical analysis of the productivity measures. Productivity indexes of the unit of analysis of our case study are depicted in Figure 1. Total productivity of the firm is a weighted sum of the partial productivi-

	BASE PERIOD			CURRENT PERIOD								
	DATA			DATA			WEIGHTED CHANGE RATIOS			PERFORMANCE INDEXES		
	Quantity	Unit Value	Value	Quantity	Unit Value	Value	Quantity	Unit Value	Value	Productivity	Price Recovery	Profitability
TOTAL OUTPUT							$q_{ot} = \frac{\sum_i P_{i\phi} Q_{it}}{\sum_i P_{i\phi} Q_{i\phi}}$	$p_{ot} = \frac{\sum_i P_{it} Q_{it}}{\sum_i P_{i\phi} Q_{i_t}}$	$v_{ot} = \frac{\sum_i P_{it} Q_{it}}{\sum_i P_{i\phi} Q_{i\phi}}$	$\frac{q_{ot}}{q_{It}}$	$\frac{p_{ot}}{p_{It}}$	$\frac{v_{ot}}{v_{It}}$
OUTPUT$_i$	$Q_{i\phi}$	$P_{i\phi}$	$V_{i\phi}$	Q_{it}	P_{it}	V_{it}	$q_{it} = Q_{it}/Q_{i\phi}$	$p_{it} = P_{it}/P_{i\phi}$	$v_{it} = V_{it}/V_{i\phi}$	$\frac{q_{it}}{q_{It}}$	$\frac{p_{it}}{p_{It}}$	$\frac{v_{it}}{v_{It}}$
TOTAL INPUT							$q_{It} = \frac{\sum_j P_{j\phi} Q_{jt}}{\sum_j P_{j\phi} Q_{j\phi}}$	$p_{It} = \frac{\sum_j P_{jt} Q_{jt}}{\sum_j P_{j\phi} Q_{jt}}$	$v_{It} = \frac{\sum_j P_{jt} Q_{jt}}{\sum_j P_{j\phi} Q_{j\phi}}$	$\frac{q_{ot}}{q_{It}}$	$\frac{p_{ot}}{p_{It}}$	$\frac{v_{ot}}{v_{It}}$
INPUT$_j$	$Q_{j\phi}$	$P_{j\phi}$	$V_{j\phi}$	Q_{jt}	P_{jt}	V_{jt}	$q_{jt} = Q_{jt}/Q_{j\phi}$	$p_{jt} = P_{jt}/P_{j\phi}$	$v_{jt} = V_{jt}/V_{j\phi}$	$\frac{q_{ot}}{q_{jt}}$	$\frac{p_{ot}}{p_{jt}}$	$\frac{v_{ot}}{v_{jt}}$

Table 2 : Productivity Measurement Formulas

	BASE PERIOD			CURRENT PERIOD								
	DATA			DATA			WEIGHTED CHANGE RATIOS			PERFORMANCE INDEXES		
	Quantity	Unit Value ($)	Value (000$)	Quantity	Unit Value ($)	Value ($)	Quantity	Unit Value	Value	Productivity	Price Recovery	Profitability
TOTAL OUTPUT	—	—	—	—	—	—	1.13	0.80	0.90	1.34	0.68	0.91
Tractor Wheel	5902	19.96	117.78	7173	17.94	128.69	1.22	0.90	1.09	1.45	0.76	1.10
Tractor Disc	3903	23.84	93.05	4444	21.05	93.55	1.14	0.88	1.01	1.36	0.75	1.00
Truck Wheel	4389	70.39	308.92	4696	55.89	262.44	1.07	0.79	0.85	1.27	0.67	0.86
Light Commercial Wheel	1069	53.65	57.35	1304	27.45	35.79	1.22	0.51	0.62	1.45	0.43	0.63
TOTAL INPUT	—	—	—	—	—	—	0.84	1.18	0.99	1.34	0.68	0.91
Material	684466	0.40	275.80	397169	0.66	262.83	0.75	1.26	0.95	1.50	0.64	0.95
Capital (000$)	7682	1.15	88.34	7802	1.14	88.34	1.03	0.97	1.00	1.09	0.82	0.90
Personnel (man-hr)	54904	1.25	68.47	50853	1.55	78.82	0.95	1.20	1.15	1.18	0.67	0.79
Energy (kwh)	119280	0.038	4.56	81280	0.044	3.58	0.68	1.15	0.79	1.65	0.70	1.15

Table 3. Application Summary

ties of inputs. It is possible to specify the dominant factors of total productivity by analyzing the productivity weights of inputs. Total productivity index of the firm satisfies the following equivalence (for every time period):

$$TPF_t' = \sum_{j=1}^{m} W_{jt} PPF_{jt}' \qquad (16)$$

where, productivity weight of input j is,

$$W_{jt} = \frac{I_{jo}}{IF_o} \frac{I_{jt}'}{IF_t'} = \frac{I_{jt}}{IF_t} \qquad (17)$$

Obviously, $\sum_{j=1}^{m} W_{jt} = 1$

The productivity weight of a nonconsumed input will be zero, which will prevent the total productivity index from being infinity while partial productivity index of that input is infinity. However, if the base period input consumption is zero then it is necessary to shift the base period in order to be able to monitor the partial productivity indexes of the following periods.

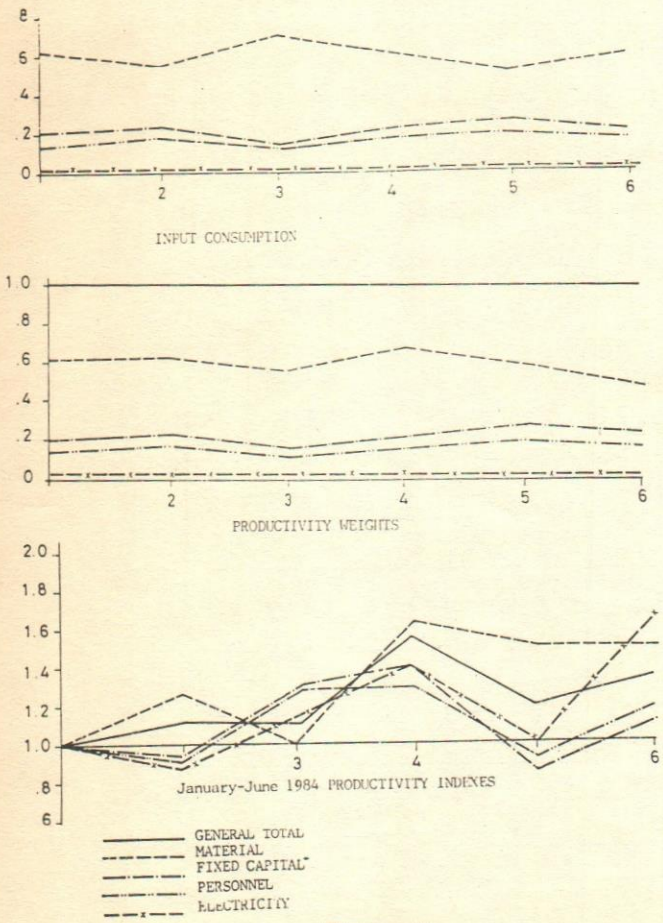

Figure 1

Productivity weights of inputs are found to be the current period consumption percentages in monetary terms of the base period. Then, the difference between productivity weights and consumption percentages of inputs depends heavily on the price changes between the base and current periods. Productivity weights and consumption percentages of the unit of analysis are also depicted in Figure 1.

Let R_{xt} denote the relative sensitivity of the total productivity index of the firm due to percentage changes in the quantity of input X consumed. Then,

$$R_{xt} = \frac{\Delta TPF_t'/TPF_t'}{\Delta Q_{Xt}/Q_{Xt}} = \frac{P_{Xo} Q_{Xt}}{\sum_{j=1}^{m} P_{jo} Q_{jt}} \qquad (18)$$

Note that,

$$|R_{Xt}| = \frac{I_{Xt}}{IF_t} = W_{Xt} \qquad (19)$$

That is, the relative sensitivity of total productivity with respect to percentage changes in the quantity of an input is equal to the productivity weight of that input. This explains why dominant factors of total productivity do not lose their dominance against incremental changes and why they appear to be the potential factors of short term productivity improvements.

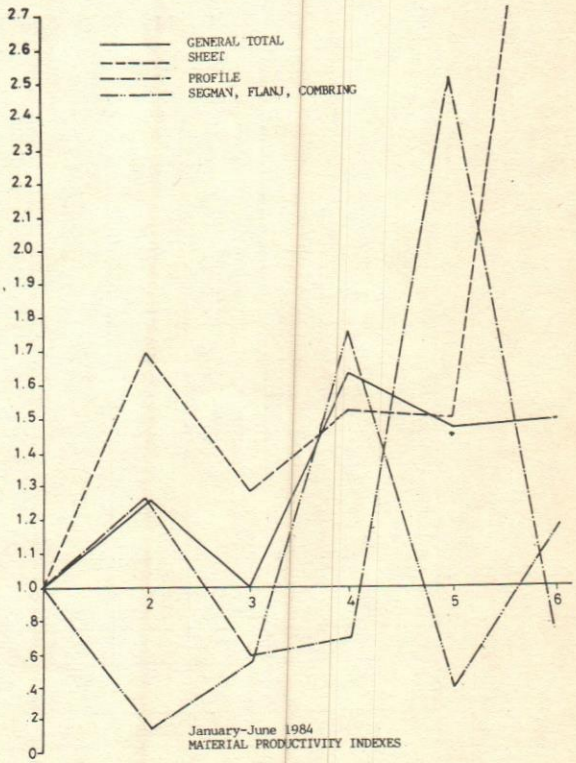

Figure 2

Application Results

The dominance of material productivity in the measure of aggregate productivity can be stated intuitively by analyzing productivity indexes while productivity weights show the same result. This necessitates further investigation on productivity indexes of material types which are provided in Figure 2. The primary analysis points out the extensive fluctuations of productivity indexes throughout the analysis period which can presumably be caused by the nonstandard material consumption of the firm.

Since the firm had not implemented any productivity improvement projects before this study, fixed capital, energy and personnel consumption do not vary considerably during a six-month period as expected. So, their productivity measures can be considered as a function of total output changes.

Conclusion

Productivity management is a continuous process having four phases : measurement, evaluation, planning and improvement. An aggregate measurement model, based on historical data is prepared to explain past behaviour of the unit of analysis and its performance criteria. The model provides additional information about total productivity indexes of products under certain conditions. Productivity weights are suggested as valuable tools for evaluating the factors affecting the system behaviour which are potential factors of productivity improvement. It is possible to perform various scenario analysis on the model to see the expected response of the system to changing outside factors. These should result in the implementation of productivity improvement projects on which continuous control provides feedback for productivity analysis.

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The Nature and Dynamics of Technovation Process

P. N. Rastogi

his paper briefly elucidates the nature , meaning, and ignificance of the process of technological innovation. The ynamic structure of the process, and the multilateral complexity f relationships underlying it, are brought out and understood n terms of a set of interacting feedback cycles. The analysis nables one to appreciate the risky, messy, and multi-imensional nature of the process. The multi-loop analysis of he process also identifies its most salient elements, and ermits the derivation of a number of inferences concerning its uccessful consummation. The analysis also makes possible coherent appraisal of the weaknesses of the technovation hain in the Indian context. Towards that end, policy directions facilitating the technovation process in the underdeveloped ountries are indicated.

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Capital, raw materials and labour are not the only critical factors of production in economic growth. A more basic and crucial factor is technology; it dominates the other three. It is the engine that drives the economies of nations. The wealth of nations is no longer dependent on colonialism and unequal terms of trade. Their wealth is now primarily generated by their technological strength. Countries with obsolete technology and obsolescent production facilities cannot survive and grow in today's highly competitive global economy.

The key to the avoidance of technological backwardness and stagnation lies in technological innovation or technovation. What is Technovation?

Technovation is the process of technology development. It consists of activities that aim at the production of new and/or better technologies in terms of products and/or processes. These activities are referred to as R and D work. Fundamental research is concerned with the discovery of new scientific and technical ideas, concepts, facts, and theories that may or may not have any immediate practical application or relevance. Applied research focusses on the practical application(s) of existing and/or new scientific and technological knowledge. Development work focusses on the utilization of completed research towards new and/or improved products, machines, equipment and processes. It consists of drawings of design, manufacturing specifications, construction and testing of prototypes, upscaling, extension, and production engineering. The technovation process is complete when the results of applied research and development are incorporated in new/improved products, processes and services in large scale commercial production and use. Technological innovation may thence be defined as the process of creating new/improved technology leading to the generation of new and/or better products/processes/ services which come into wide use. Marginal and incremental improvements in production technology

though important, do not properly belong to the category of innovation. They are more a matter of the application of productivity techniques, than of new and important developments. It is the latter that come under the category of technovation.

Technovation amplifies productivity. It transforms the nature and potential of technologies available to a national economy. Through its substantive development of technology-in-use, and production of new technology, it amplifies the resource generation capabilities of land, labour and capital. Technovation in industrially advanced countries has overcome the low labour cost advantage of developing nations in international trade. Technovation has also widened, and continues to widen the gap of technology and wealth between the developed and developing nations.

Innovations are of crucial importance for poor nations. They are necessary not only for reducing the gap between the developed and the poor countries, but also for the mitigation and solution of a number of intractable problems which affect their survival. Relentless population growth; serious inadequacies of transport, communication, and infrastructural facilities; acute shortage of housing, energy, schooling, medical care, and civic amenities; low levels of production and productivity; and grave supply deficiencies of goods, materials, commodities, and services; these are some of the major techno-economic problems facing poor countries. Effective and economical solutions to these problems primarily depend on technovation. Potentially beneficial results of technovation however, can reach the masses only when they are translated into large scale production, diffusion, and use. The problem of innovation phases comes to the fore in this context. It is discussed later.

Contexts and Opportunities for Technovation

Opportunities for technovation need to be identified through conscious and purposeful search. They are to be found in some uncommon situations. According to Drucker (1985) and others, sources of technovation opportunities lie in unexpected occurrences, incongruities in the relationships among industries and customers, process needs in the utilization of production technology, industry changes, and changes in market structure. Other sources of innovation pertain to demographic shifts, changes in the perceptions of people, and development of new knowledge. Opportunities for new products and processes are also presented by the requirements of ecological preservation and conservation of resources, and major changes in the relative prices and scarcity of raw materials.

There is however, considerable difference in the contexts for innovation in the developed and developing nations. In industrially advanced countries, the objectives of technovation are primarily commercial and military. The risks and benefits of innovation efforts are largely the concern of private sector enterprises. Governments of developed nations however, do support and encourage R and D activities in a number of ways. The latter include research grants to institutions, incentives to innovators and inventors, and facilitative fiscal, tax and procurement policies. In underdeveloped nations, where shortages of resources and facilities is acute, infrastructure for R and D is very weak and poverty is a pervasive problem, the context of innovation opportunities is quite different. Technovation effort is dominated by concern for socio-economic development, import substitution, and national self-reliance, as distinct from commercial success. Private enterprises are often uninterested in, and incapable of undertaking technovation programmes. Import, and copying of technology, constitute their major modes of R and D activity. Governments of underdeveloped nations try to play a more direct and supportive role for encouraging R and D work through their creation of national research facilities. Owing to their resource limitations and infrastructural constraints however, the linkage of laboratory research with production engineering, production, and delivery systems, is often very weak or missing.

Technovation successes however, directly enhance the techno-scientific capabilities, and resource base of enterprises and nations. The enhanced capabilities, experience, confidence, and resources, in turn lead to enlargement of opportunities for further innovations. The cyclical relationship between techno-scientific capabilities, innovation opportunities, innovations, and resource generation, is self-reinforcing (fig. 1). Technical changes brought about by technovation, produce a cascading set of effects and impacts. This follows from the nature of the production process as a system of interlinked producing units. Significant changes at one level generate varying degrees of consequential changes up, down, and across the system of production units. Product and process changes are interdependent both within and among the producing units. New products, processes, materials, machines, and equipment amplify the technological capabilities and the stock of techno-scientific knowledge available to the enterprises, industries, economic sectors and the nation. They serve

to augment the potentialities of production units for further innovative advances. Higher levels of resource generation, growing levels of technological sophistication, and increasing innovative capabilities, together serve to strengthen the techno-economic base of a country. Policy planning in developing nations should thence aim at creating the self-sustaining growth cycle of techno-scientific development, innovative capabilities, and resource generation. Identification of technovation opportunities needs to be governed by this perspective. The dynamics of technovation process is however, quite complex.

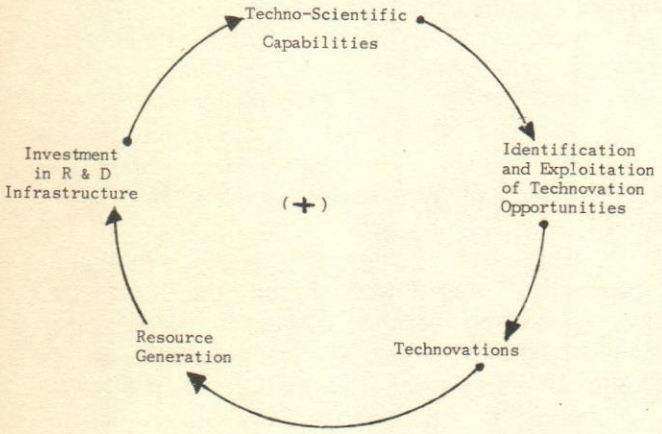

Fig. 1: Self-Reinforcing Relationship between Techno-Scientific Capabilities and Technovation

Dynamics of Technovation

Technovation is a complex, risky, and messy process. It involves a number of interrelated phases that have to be steered carefully. The phases comprise applied research, design development, prototype fabrication and testing, upscaling and extension, production/ manufacturing engineering, commercial production, use experience and diffusion in a sequential manner. If any phase of the total process is weak, incomplete, or invalidated, the process would remain unconsummated. The expected benefits from technovation would fail to materialize. Owing to its complexity and uncertainty, the process is highly susceptible to ending in costly failures. Supportive policies and structures, hard work and dedication, are needed to sustain and strengthen the process in its every phase from applied research and testing to commercial manufacture and diffusion. They together define the nature and meaning of the management of technovation in industrial enterprises.

The starting point of technovation is the identification of Innovation Opportunity. The latter is however, subject to a multitude of influences. First of all, it is powerfully affected by the organization's culture. The culture of an organization must be supportive of the risk, uncertainty, and ambiguity associated with technovation effort. It must provide an environment where technovators can thrive unconstrained by rigid structures and bureaucratic procedures. In the absence of a facilitative organization culture, the process of technovation may not take off. A firm's assessment of its Environment and Resource Capabilities, and its perception of National Problems, help it tentatively decide about exploring promising possibilities of technovation.

Technovation possibilities are further evaluated in terms of Technical Uncertainty and Market Uncertainty. Technical uncertainty results from the relative novelty of the research area, and emergence of unforeseen practical and theoretical difficulties. These difficulties may or may not be deemed to be resolvable in terms of the Current State of Techno-Scientific Knowledge and Applied Research. If the level of technical uncertainty is perceived as unacceptable, the technovation option concerned may be given up. Market uncertainty results from perceived indefinite consequences of the proposed new innovation, as well as the length of time needed for completing the technovation project. Contact with customers may help reduce the market uncertainty. The element of risk rises in proportion to the magnitudes of perceived technical and market uncertainties. Only when the risk and uncertainties are deemed acceptable, does the identification phase proceed to the phase of applied research. Applied Research reduces technical uncertainty, and may enrich the Current State of Techno-scientific knowledge.

The multilateral dynamic interaction of the foregoing factors may be shown in the form of feed back cycles as in fig. 2. This figure depicts the complex dynamic structure of the technovation process as a whole. In the multi-cyclical representation of fig. 2, the negative cycles represent goal-seeking and balancing relationships. Positive (+) feedback cycles represent mutually reinforcing relationships (Rastogi, 1979, 1987)

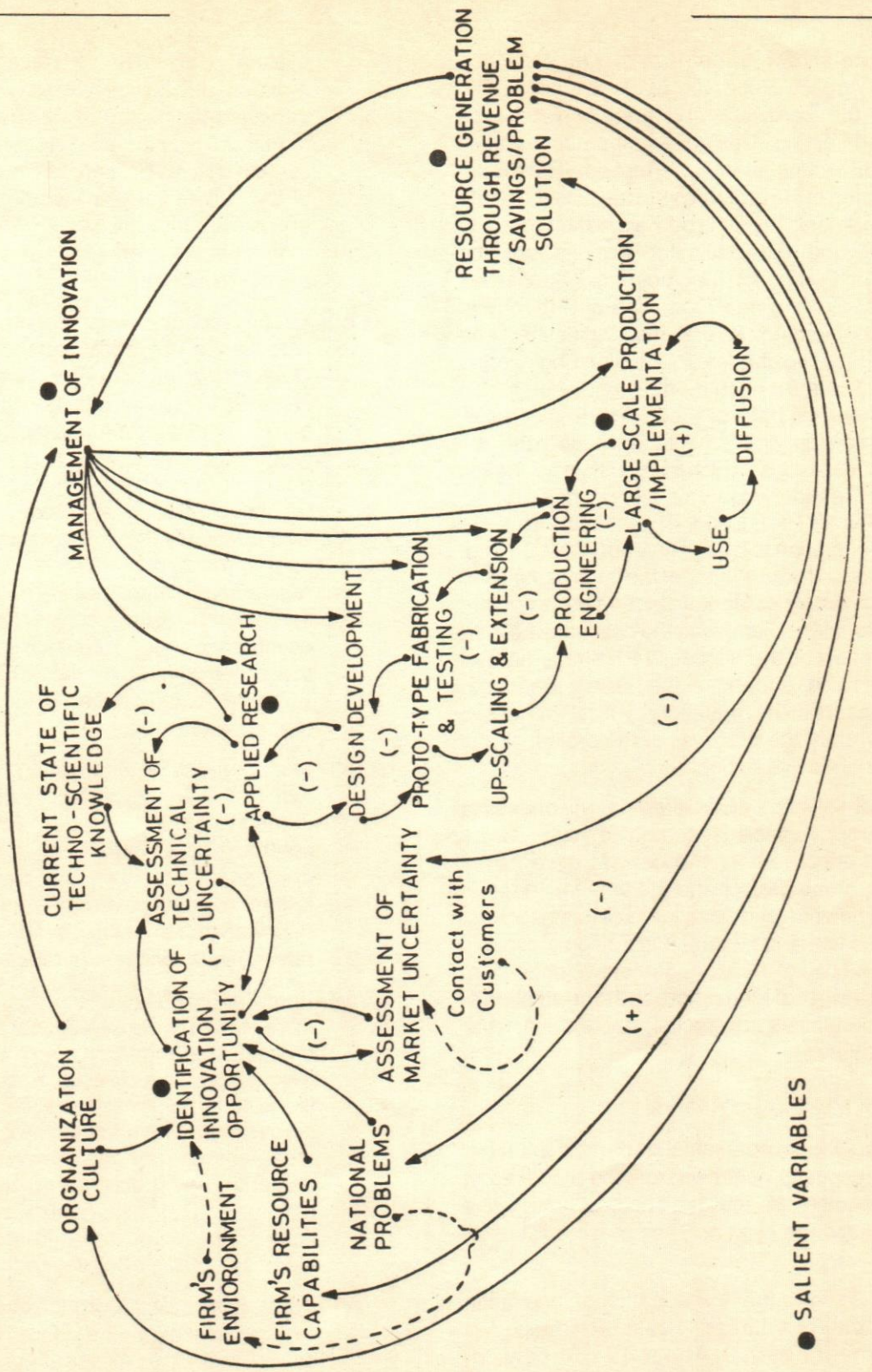

Fig. 2 : The Dynamics of Innovation Process

The figure shows further that progress towards completion in Applied Research leads to Design Development of the hardware and then to Proto-type Fabrication and Testing. Design Development signifies the successful completion of Applied Research. Successful testing of the prototype serves to validate the Design Development. Proto-Type Fabrication leads to its Up-Scaling and Extension for working out the requirements of Production Engineering. Successes achieved in Up-Scaling and Extension and thence in Production Engineering attest the validation and completion of these two phases. Production Engineering permits Large Scale Production/Implementation which in turn strengthens the base of Production Engineering. Large Scale Production/implementation leads to the use of products/process/facility, which being satisfactory leads to their Diffusion in wider economy. Increasing Diffusion sustains Large Scale Production. The latter in turn leads to Resource Generation through Revenue/Cost Saving/ Problem Solution. The adequacy of the latter signifies (*i*) the end of Assessment of Market Uncertainty, or (*ii*) the solution of National Problem(s) as the case may be, and (*iii*) the completion of the successful Management of Innovation. It also enhances the Firm's Resource Capabilities. Failure of the regulatory cyclical Processes may however, retard the progress of the project at any point of the dynamic interactions.

Management of Innovations affects all the phases of development from Applied Research to Large Scale Production. Its effectiveness or otherwise governs the success/failure of the project and the time taken for its completion. Promotion of innovation facilitating factors, blockage of the impeding factors, and design of organic structures, are all part of the Management of Innovation. Both the Management of Innovation, and Identification of Innovation Opportunities are crucially dependent on the organization culture.

Inference from Multi-Loop Analysis :

Multi-feedback loop representation permits a number of analytic inferences to be drawn from the model apart from their depiction of the multi-lateral interactive relationships within the system. They may be listed as follows :

(I) Figure 2 shows that Identification of Innovation Opportunities, Large Scale Production / Implementation, Applied Research, Management of Innovation and Resource Generation, are the *most salient variables* of the system. They have the largest number of input and output links associated with them. Salient variables define the *state* of a system. Their high viability is imperative for the attainment of system goals. Exceedingly low viability of *any* of the salient variables would lead to a failure and collapse of the system. All the variables tend to be consistent with each other in governing the system behaviour.

(II) Each feedback loop denotes a regulatory process. Salient variables stand at the interaction of several feedback loops. Hence their viability values convey the results of the operation of plural regulatory processes. If any of the feedback cycles is malfunctioning *i.e.*, failing to operate in accordance with its intended regulatory role, the effects of its malfunctioning would cascade through the system and devalue its performance. The malfunctioning of a regulatory cycle may be the outcome of internal and external disturbances in the system. Such disturbances need to be identified and corrective measures initiated for their timely rectification. Such a rectification is the function of management.

(III) Management of Innovation, and Resource Generation are not only the two salient variables of the system, they are also its most important control factors and levers of change. This is disclosed by the fact that they influence the largest number of variables in the system *i.e.*, their weakness or strength affects the system at many points, and in a number of ways.

(IV) Even if all the phases of the technovation process have been successfully completed but the process fails to generate resources, it would be evaluated as unsuccessful. Resource generation is the terminal criterion for the success of the process. Failure of the process to generate resources directly and/or indirectly, would not only adversely affect the firm's resource position, but also damage its organizational culture. The latter's innovative elan and receptivity to new ideas would diminish, markedly.

(V) If the culture of an organization is weak and incompatible with the ethos of adventurous achievement, the process of technovation cannot be successfully pursued there. The culture of an organization refers to a limited set of values or

'dominant beliefs' shared by all of its people from top to bottom. The 'excellent companies' of USA for example are 'obsessed' by the concerns for being the best in terms of quality, reliability, customer service, and employees' performance (Peters and Waterman, 1982). Cultural values and beliefs of a management are reflected in its policies, structures and practices. Technovation effort cannot be meaningfully implemented in a firm characterized by rigid bureaucratic structures and restrictive policies.

(VI) If the identification of innovation opportunity is based on erroneous assessments of the organization's external environment, internal resource capabilities, technical uncertainty, and market risk, the technovation endeavour would result in a misdirection of effort. The checklist of factors to be assessed in this context, may include the following* :

(*i*) Compatibility with the company's other plans and prior commitments.

(*ii*) Availability of needed scientific and engineering skills in R and D.

(*iii*) Critical technical problems likely to emerge.

(*iv*) Competitors' R and D programmes.

(*v*) Market prospects and potential

(*vi*) Influence of government policies and regulations.

(*vii*) Possibility of licensing agreement.

(*viii*) Prospects of cooperation from other R and D agencies and firms.

(*ix*) Availability of production and marketing skills needed.

(*x*) Estimate of the costs of development, production, and marketing.

(*xi*) Scale and timing of investment requirements.

(*xii*) Cost of capital, and so on.

Serious mistakes in respect of assessment of the foregoing factors, may result in costly failures.

* See also (Dean, 1968; Seiler, 1965)

The process of innovation disrupts the stable state of the enterprises. Dynamic systems like organizations activity seek stability and adaptation through conservation processes necessary for their survival, growth, and goal attainment. The crisis of modern organizations is that they are required to undertake technological innovation which disrupts their stability, yet is necessary for their adaptation and survival in changing conditions. This paradox accounts for the problems of and resistance to the process of innovation in organizations. Innovation forces the organizations to change their policies, structure, and behaviour, and adopt new forms, and styles, as coping mechanisms. The alternative to innovation is stagnation, decline, and eventual extinction.

Innovation and R and D in Indian Industry

Innovation in the sense of development and production of new technology is almost absent in Indian industry. The three fields where some indigenous development of technology has occurred are nuclear energy, space research, and agricultural development. Innovative developments are also known in the railways and defence. Scientific research in the country has largely remained unrelated to industrial applications. Purposeful and sustained technological research oriented towards clearly defined areas and specific problems has been lacking.

Private sector of industry has sometimes engaged in a rather low level of R and D work. In some instances, it has successfully accomplished the substitution of relatively scarce raw materials by locally available inputs. The instances refer to the use of bamboos for making rayon grade pulp, the use of sea shells in the production of cement, and the use of previously unknown seeds as a source of oil for edible and industrial purposes. But these instances of factor substitution, can hardly be characterized as innovation. An exception is however provided by the development of technology for manufacturing ultra-pure electronic grade silicon by the joint efforts of the Indian Institute of Science, Bangalore, the private sector Mettur Chemicals, and the Department of Non-conventional Sources of Energy(Prabhu, 1986).

Some of the major reasons behind the near-absence of innovation in Indian industry can be specified as follows :

(i) Indian industrial enterprises have been operating in protected markets dominated by shortages. In the absence of serious internal and external

competition in respect of the price and quality of their products, Indian enterprises have lacked any incentive for improving their production and productivity through R and D work.

(*ii*) In the absence of large economies of scale, production capabilities of industrial units have been fractionated. The state of industry is characterized by the presence of a large number of units with small production capacities. This situation has been a result of the government's industrial licensing policy. It is hardly conducive to the promotion of R and D work owing to the units' inability to generate adequate cash flows required for technology development.

(*iii*) When an industrial unit proceeds towards a new line of production, it meets its requirement of new technology through import. Even though the technical 'know how' may be available in the national laboratories, it may be inadequate for the requirements of the entrepreneurs. An industrial unit venturing into a new product line requires not only the 'know how' of production techniques but also help regarding the selection and availability of plant and equipment, availability of trained personnel and training facilities, advice regarding the solution of unexpected operational problems, and assistance towards marketing. All these vital requirements of a new industrial unit cannot often be met through domestic sources.

(*iv*) Cooperation between industry, national laboratories, research institutes and universities, towards specific goals and solution of particular problems has been missing.

(*v*) Research outlays are often inadequate to cover the financial expenditure/investment required to commercially develop the process(es)/product(s) resulting from the R and D work.

(*vi*) R and D work when successful does not often focus further on developing the delivery system needed for the wider use and diffusion of its results. Biogas plants and solar energy devices could not be used and diffused rapidly owing to the constraint of their inadequate delivery system.

(*vii*) Incentives for in-house R and D work within industrial units do not promote R and D cooperation between them. Such cooperation is vital for setting up better, larger, and more sophisticated research facilities for their common benefit. Presently R and D expenditure is incurred mainly for getting tax concessions. Pursuit of well-defined goals of productivity and innovation is largely absent. Incentives for technological research and development need to be meaningfully linked to the attainment of tangible progress/results and not merely to the amount of expenditure.

(*viii*) The total innovation chain is weak at several points. For this reason, the results of applied research in the laboratories cannot often be transferred to the field and production floor in the industry. Production engineering remains a particularly weak point.

(*ix*) The quality of science and technology personnel in the country is highly variable. Many potential leaders in the emerging new fields of science and technology are being lost to other countries or to other areas of endeavour within the country. The amenities, incentives, emoluments, promotions, and housing facilities etc. available to them are unattractive. The loss and diversion of techno-scientific talent is creating gaps in the ranks of leadership and excellence. Mediocrity is likely to spread unless the situation is rectified.

(*x*) The acquisition of technical 'know how' from abroad is not followed by efforts to understand the 'know why' of imported technology. This results in a one-time copying of the technology developed abroad. The imported technology becomes obsolete over a few years' time. Efforts to assimilate, adopt, and further develop the acquired technology in a self-sustained manner, fail to take off. The need to improve learning and innovative capacities is greater and more urgent in the case of new information technologies (Dieter, 1986).

(*xi*) The overall and, perhaps, the most important single reason for the absence of innovation in Indian industry is the country's poor culture of productivity. (Rastogi, 1988). The basal values of the present national culture negate and depress the expressions of creativity, work excellence, and work ethics.

In terms of the dynamics of technovation process (Fig. 2), the status of technovation and R and D in Indian

industry, may be seen as the logical outcome of weak organizational cultures, inadequacy of focussed applied research, ill-developed capabilities in design development and production engineering, ineffective delivery systems *i.e.*, modes of diffusion, and finally the near-absence of resource generation.

Innovation Policy for Developing Nations

The foregoing weaknesses and characteristics of the innovation process in Indian society, also to a large extent, represent the situation prevailing in other underdeveloped countries. The contextual variations may differ from nation to nation in terms of their respective histories, cultures, natural resources, and international trade. The basic fact, however, remains that the industrial systems of developing nations are exceedingly weak in respect of their productivity and innovation capabilities. Their weakness stems from poor infra-structural facilities; ill-developed, and often unbalanced base of production; constraints of capital, hardware, and trained manpower; and a non-supportive ethos of national cultures. Developing countries need to import relevant technology for increasing the productivity of their land, labour, and capital, and consolidating their base of production. The import of technology should however inevitably be followed by its assimilation, adoption, and improvement in terms of 'know why'. This would engender and strengthen the innovation capabilities of their production units.

The process of technological development and innovation should focus on well-defined goals and clearly identifiable problems. Policies of the government should not only support the modernization, and development efforts of the enterprises but also foster and nurture an ethos of cooperation amongst enterprises, academic institutions, and research organizations. Sentiments of patriotism, and human welfare, apart from individualistic concerns, are highly relevant in this context.

Developing societies need to be careful in their choice of technology for import and/or innovation. Labour saving technologies are to be avoided as far as possible in view of their unemployment implications. But if such technologies result in low cost production of goods and services for mass consumption, an improvement in the countries' export performance and large savings of resources, then their acceptance, adoption, and development, should follow logically and rationally. Generation of wealth through higher productivity and/or exports would make possible larger investments in projects for social welfare besides increasing the potential for additional employment in the service sector and construction industries.

The areas of technology that require relatively lower volumes of investment and result in an improvement in the productivity of resources and the generation of additional employment, should be accorded priority. Bio-technology, for example, is one such area. It is important not only for substantially increasing agricultural growth but also for increasing the availability of raw materials for industry, and for developing the renewable resources of energy. Genetic engineering, single cell protein fermentation, immobilized enzyme systems, monoclonal antibodies, plant cell culture and cell fusion are some of the processes and techniques in the rapidly developing field of bio-technology. Their use and application has profound potential for agricultural and livestock production, waste disposal, renewable energy, food processing, pharmaceutical industry and mineral extraction.

Micro-electronics and digital devices are another area of high and rapidly expanding technology. This area too is less capital intensive and more employment generating. New materials technology is another such developing area. Fibre reinforced composites, advanced powder metallurgy, new ceramics, optical fibres, 'macro-defect free' cement and new varieties of plastics etc, represent whole families of new types of materials whose potential for industrial expansion is tremendous.

In the context of innovations that can bring about a significant improvement in the living conditions of the poor, the problems of housing, energy, fuel and agricultural development readily come to mind. The use of locally available materials in the construction of houses instead of the conventional cement concrete structures, can considerably reduce the cost of housing. Energy from urban wastes, biogas plants and the sun, can usefully supplement the available resources of energy and fuel. Large scale cultivation of shrubs can reduce the country's dependence on imported oil. These shrubs can be grown on the vast tracts of arid and waste lands. Petrochemical products can be fractionated from the hydrocarbons derived from these shrubs. Such gasoline forests can also generate sizeable employment and income earning opportunities for the rural poor. The reduction of evaporation loss through chemical spray in canals and reservoirs, can significantly increase their irrigation and power potential. Concentration on bio-technology can lead to a development strategy based on

biomass that would not only eliminate the shortages of food, fuel and agricultural commodities, but also generate large potential for employment through non-capital intensive agro-industries and rural industrialization based on renewable resources (Nayudamma, 1985). Such examples of innovation possibilities can be multiplied.

Developing countries need to follow a flexible strategy of technology import in the relevant areas, build and consolidate their local technological capacity, engage in mutually supporting and selective programs of import substitution and export promotion and focus on the learning process of assimilation and development of imported technology. Only then may they be able to effectively proceed towards innovations for the amplification of their productivity and economic growth. South Korea represents an example of the successful application of this strategy (Fransman and King, 1984). Japan too followed this strategy in the early periods of post-war reconstruction of its national economy.

Import of technology is a basic, necessary condition for building up technological capability in an industrialising nation. Ninety percent of the world trade in technology, amounting to billions of dollars per year, is among the developed countries themselves. There is no merit in reinventing what has been adequately developed by the R and D work of other nations. It is, however, imperative for the developing countries to promote their technology learning process. They must create mechanisms for assimilating, adapting, and changing both the know-how and know-why of imported technology. They must overcome their local constraints impeding the technology learning process. For this purpose, they need to restructure and realign the technical, economic, educational, research, social, and trade conditions of their production related activities. Only in this way, can they succeed in increasing the productivity of their agriculture, industry, transport, and communication; strengthen their production base; develop their domestic technological capabilities, and create a system of values and facilities for innovation.

Conclusion

Innovation is the most powerful source and means of economic growth. The process of innovation, however, involves a complex and intricate sequence of inter-related phases. Management of innovation is seen to be the most salient aspect of the innovation process (Fig. 2). Management of innovation is, in essence, the task of designing and maintaining an *environment* within which innovation can take place and develop synergistically. Management and motivation for innovation are however, a basic function of the shared value systems *i.e.*, the cultures of organizations and society.

While the motives of wealth, status, and reputation obviously characterize the endeavours of innovators, the spirit of meeting a challenge, and a longing to contribute to human and national welfare also influence them. Motives of inventors toward their inventing activity, include fun, fame, money, instinct of workmanship, and service to mankind (Machlup, 1962) are however, not mutually exclusive. Innovative/inventive activity/ represents the aspirations of individuals to realize their creative potential, and translate their concepts and ideas into products, processes, and services. It represents their quest towards personal fulfilment. The culture and value systems of organizations and society are important in this context. They provide the supportive conditions, facilities, and incentives towards the initiation and nurturing of innovative endeavours. Without a cultural support system, the ethos and elan of innovation cannot be sustained in organizations and societies.

In a bureaucratically managed organization, R and D efforts remain isolated from the rest of the organization. The 'real world' inside and outside the organization, comes to be viewed by the innovators as a hostile, complex, and irrational environment. They are weighed down by the apprehension that their new ideas and projects as little mutations, may not survive in such an environment. In so far as each new product or process represents the internal efforts by an organization to adapt to its environment, the bureaucratic enterprises pay the price of their neglect of technovation in terms of their stagnation, decay, and decline.

Innovation differs from creativity. Creativity denotes the *thinking* of new things and new ways of doing things. Innovation on the other hand is the *doing* of new things. Important, creative, new ideas may remain unused in an organization for years even though their merit and worth are recognized. This is due to the fact that the requisite commitment for converting the idea(s) from concepts to action is not forthcoming from the organization members. Creative ideas by themselves are useless unless put to use, and translated into action. Creativity does not automatically lead to innovation. Organizations do not usually lack creativity, and creative individuals. Innovators on the other hand, are rare.

The role of management in nurturing innovators and innovation is crucial. Leadership of innovative firms reinforces the shared values clustered around autonomy, innovation, individual initiative and entrepreneurship. Apex level executives serve as exemplars and role models for the young in organizations. They serve as 'Executive Champions' of the innovators and their venture teams. They serve as the mentors, coaches, and supporters of the innovators. The innovative firms then provide an internal environment where successful innovators provide role models; the value system focusses on being entrepreneurial; failure is tolerated; facilities for experimentation are plentiful; the organization structure is highly supportive; intense and informal communication is the norm; over planning and paper work are absent; the process of progress consists of small, manageable steps; close contact with customers is maintained; and finally, internal competition and parallel efforts are encouraged.

Innovation is a disorderly, risky, and complex process. It stretches to the limit the psychological resources of tenacity, frustration tolerance, faith, and patience of individuals involved in the process. It compels them to exercise their intellectual and creative talents to the utmost in each phase of the process. The ubiquitous and indispensable requirements of human values come to the fore in this context. From the inception of ideas and concepts of an innovation to its successful consummation towards products/processes/services, the whole process is dominated by the value orientations of participating actors. The value orientations also enter into the picture from another direction. Behind every innovative idea, there are assumptions, convictions and beliefs about how the world works, how people think and behave, and how institutions function. These assumptions, convictions and beliefs imply an ethos of values prevailing in the cultures of organizations and nations. Innovators and innovations reflect the influence of organizational and social values. In so far as these values are supportive of productivity and innovation, they would generate and promote a thrust of innovative efforts towards socially valued channels.

Commitment to a vision of technical excellence and achievement; a sense of inner personal fulfilment; high levels of interpersonal trust and regard; open, constructive, and intense, communication; shared concerns, disappointments and joy; a spirit of fortitude in the face of frustrations; an ideal of service to a larger moral cause and purpose; and a compulsive sense of mission; these are the crucial value elements of successful technovation effort(s). They impart to work and relationships a larger perspective of meaning and purpose. In the absence of meaning and purpose, shared values and dedication, the process of technovation is reduced to a formal, bureaucratic, costly, lengthy, and largely unsuccessful, exercise. This has been the story of technovations in many well-equipped laboratories of governments and corporations across nations.

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input for the administrative process, leading to its own output. The productivity process in government thus, in sum and substance, can be seen as social demands determining inputs and the direction of the political process; the output of the political process provides inputs to the administrative process leading to a meeting of the demands of society resulting in social satisfaction. This process flow is projected in Illustration 2.

In the Indian context demands are generated in society (itself a part of political process) for social change and development, justice, social economic and legal and improvement in the quality of life. These demands, often competing, and conflicting are processed by the political structure through a mix of inputs such as (a) a vision of India (*sampoorna swaraj*, participative democracy etc.); (b) crystallization of the mission of state; (c) constitutionally defined goals (socialism, secularism, Directive Principles etc.); (d) constitutionally defined means (Rule of Law, equality before Law, Fundamental Rights etc.) and (e) People's mandate (political party manifesto and participation by the citizens in the electoral process).

The political process encompasses interest articulation, ideological attunement, public policy formulation, planning and priortization, legislative strategy, ensuring role – complimentarity among the many institutions as also crystallization of and commitment to the Rules of the Game, and finally the quality of leadership. The nature and quality of the output from the political process determine the adequacy and appropriateness of inputs for the administrative process.

The nature of input and the quality of the political process determine not merely its output, but more significantly, the down-the-line administrative process also. The output from the political process can be illustrated as comprising (a) clear policy, ideological harmonization; (b) commitment to policy; (c) clarity in strategy; (d) role consonance, and (e) consensus, reconciliation and legitimization, leading to acceptance on the part of people, and commitment on the part of administrators.

The administrative process comprises, from the productivity perspective, (a) ideological commitment; (b) program formulation; (c) evolving administrative strategy; (d) able and dedicated implementation, and professionalism and social accountability, and (e) securing the peoples' participation. It can then be envisaged that social change and development, social welfare, socio-economic equity, good government and self-reliance emerge as the output of the administrative process, contributing to social satisfaction in terms of (a) fulfilment of physical needs; (b) sense of belonging ; (c) social harmony ; (d) social welfare and security; and (e) participation, legitimization and reinforcement. This productivity process in government can be identified at two levels, viz., primary and supportive, for the purpose of evolving approaches and designing methodologies and techniques.

Critical Issues in the Indian Context

A critical ingredient for promoting productivity in government is the promotion of a measure of complimentarity among different instrumentalities of the State. The legislature, executive and judiciary on the horizontal plane, and the Centre, state and units of local self-government on the vertical plane may be having different, but equally important tasks in their respective places. What is more important is the recognition that they have common objectives to be achieved. However, in the Indian context, the various instrumentalities seem to be operating in isolation, and developing a culture of confrontation. It may also be observed that in the face of the dynamic objectives of society , the style of functioning and culture of organizations of state continue to reflect an ethos of stagnancy and resistance to change.

Three major issues viz., (1) political accountability; (2) bureaucratic commitment; and (3) institutional complimentarity, appear to be critical in promoting productivity in Government.

Political Accountability

While the Constitutional goals are clear and committed to by all the political parties, there are two areas viz., (a) rules of the game (being as important as the game itself, if not more in the democratic republican context), and (b) the capabilities of the political, elected representatives, emerge as the most critical in promoting productivity in government. In the Indian context whereas democracy and constitutional provisions have appropriately underlined adult franchise, the capabilities of individuals who are called upon to manage the affairs of state on the one hand and the political culture set in motion by the different political parties have not been given the importance that they deserve and demand, in promoting political accountability. If the initial inputs and processes are distorted, down the line process and productivity are bound to suffer.

ILLUSTRATION 2. PRODUCTIVITY PROCESS IN GOVERNMENT

LEVEL ONE : PRIMARY

SOCIETY	POLITICAL PROCESS		OUT PUT. IN PUT	ADMINISTRATIVE PROCESS		SOCIETY
Demands	Input	Process		Process	Output	Satisfaction
Change Develop-ment	VISION Sampoorna Swaraj Social/Economic/ Participative democracy	Interest articulation Ideological attunement Public policy formulation	Clear policy Ideological harmonization	Ideological commitment	Change/ development	Fulfilment Physical Needs
Social Justice Equity	MISSION Antyodaya Welfare State	Planning Prioretization	commitment to policy	Programme formulation	Social Welfare	Sense of belonging
Quality of life	CONSTITUTIONAL GOALS Socialism Secularism Directive Principles Social Justice	Legislative Strategy	Clear strategy	Administrative strategy	Socio-economic Equity	Social harmony
	MEANS Rule of Law Fundamental Rights	Institutional Compliment-arity. Rules of the Game	Role consonance & Complimentarity	Able and devoted implemenation Professionalism social accountability	Good Government Feedback	Social Welfare & Security
	PEOPLES' MANDATE Participation Election Manifesto	Participation Leadership-Quality	Consensus Reconciliation Legitimization.	People's participation	Self reliance	Participation and legitimization

LEVEL TWO : SUPPORTIVE

	Budgeting and Resource mobilization	Allocation	Time Targets Mile-Stones	Action Plan	Achievement	
	Capability building of political management	Development (Training) Programs in Policy Process : Political management Rules of the Game	Attunement of Political and administrative action. Integration of structures, systems and styles.	Capability building and for management Political control over administration. Result orientation.	Accountable Performance	

Bureaucratic Commitment

The role of bureaucracy seems to have been diluted through a process of increasing the degree of malignant politicization. Its professional commitment and contribution to the policy process, programme implementation, evaluation, and feed-back have been diluted significantly. The bureaucratic disposition towards the role assigned can be summed up in terms of either withdrawal and/or collusion on the one hand, and decreasing professionalization on the other. It is only a highly professional bureaucracy that can withstand the pressures of malignant politicization, while recognizing that political process of the benign nature is an essential ingredient for productive functioning of parliamentary democracy. Indeed the reemergence of democratic world over validates the relevance of politicization of society as a vital prerequisite for national productivity.

Institutional Complimentarity

That the complex process of administration of a nation calls for a network of institutions and that they have to operate in concert, is indisputable. But what is critical is that they are interwined in a manner that the 'output' of one becomes the input for another. Any distortion – inputs or process – in any one institution distorts the whole network of institutions, and the productivity of state itself.

Productivity Approaches

Approaches to the promotion of productivity of State, in the present Indian context can be identified at four different levels : viz., (1) The political process, (2) citizenship, (3) bureaucracy, and (4) institutional complimentarity. These four fold areas are explored, illustratively but not substantively here.

Political Process

Politicization is an essential process for bringing about social change and development. However, the post-independence Indian experience suggests that politicization can be either malignant or benevolent. Mahatma Gandhi's contribution to India was not the achievement of political independence but benevolent politicization of the whole nation. The process of politicization – consensus politics, national reconciliation, open and responsive institutions of state, harmonization of society etc – that Gandhi attempted have remained incomplete, and by now perhaps lost sight of.

Democratic Ethics

A political culture based on the democratic ethics, characterised by participation, consensus and reconciliation (which may have been called by Jayaprakash Narayan and others as partyless democracy) is a vital prerequisite for the movement towards democracy and development in India.

Citizen Participation

Citizen awareness (education), identification (esprit de corps) and commitment leading to his effective participation in the interrelated processes of democracy and development ar a *sine qua non* for national productivity, as admitted by the Planning Commission after a period of seven five year plans. The multiplier effect of citizen participation positively or of non-participation negatively, cannot be over- emphasized.

Political Skill Development

Having adopted adult franchise and a dynamic and complex constitution, and having further assigned a significant role to the State in bringing about socio-economic transformation, we have not equipped our political elite, appropriately and adequately with the skills of political management. The Indian paradox in regard to modernization of political management is revealed by the fact, in quantitative terms, of our nation today spending more than a hundred crores of rupees each in developing (updating) the knowledge and skills of the relatively better educated, skilled and experienced sectors of (a) industrial management, (b) public administration and (c) the educational sector. But, on the relatively less equipped sector of political management, which is called upon to take decisions on complex issues ranging from nuclear energy and international trade to industrial and rural development, we are not spending even one crore of rupees per annum.

Citizen Orientation

What consumer satisfaction is to production and distribution in the field of economic activity, citizen satisfaction is to public administration, especially in a developing country where the State has assumed a role that goes far beyond regulatory tasks.

Commitment, the magic term and process that energise individuals, institutions and whole national groups has to be routed in and sustained and nourished

by ideology. Bureaucratic commitment, the much maligned term in the Indian context, has to be related to the national ideology – not nationally by substantially – as enshrined in the Constitution of India.

Bureaucracy at Crossroads

Bureaucracy and meritocracy, which until recently used to be synonymous in the Indian context,have over a period of time, become antonyms'. This transformation, which is not disputed by the bureaucrats themselves, is primarily due to what may be called its 'politicization' of the malignant type, and distortions in the politicization of the benevolent type essential for democracy and development.

Malignant politicization of the bureaucracy is caused and characterized by four factors viz., (a) *withdrawal* from its legitimate role, arising from inability and willingness to resist political upmanship; (b) *neutralization* of the political process and the politicians – the 'yes minister' type, with wide variation between saying and doing; (c) *connivance* with the political elite by playing court, willingly accommodating partisan interests, for a *quid pro quo*, and (d) *collusion*, where bureaucrats join hands with the politicians corrupting not merely the bureaucratic but also the democratic process.

This shift in the bureaucracy in India, a movement from meritocracy to malignant politicization, has implications for the processes of democracy and development. Even as the society wants openness, bureaucracy is working towards increasing degrees of secretiveness. Citizens want participation; bureaucracy is not only impeding participation but also contributing to the alienation of the citizens from the mainstream of nation building; where the society resolves to have decentralization, bureaucracy not only resists and sabotages, but has set in motion increasing degrees of centralization. Society opts for freedom of information, but bureaucracy promotes confidentiality and secrecy. Public service has been diluted by protecting partisan interests; discretion granted to bureaucracy has been transformed into discrimination. These bureaucratic dispositions could prove critical and negate democratic development. If these orientations are not corrected adequately and expeditiously it could lead to a negative image and loss of credibility coupled with increasing degrees of alienation between the public and the administration.

Change Within Public Administration

Any strategy for change designed and directed by the State has to recognise that changes within the administration constitute a *sine qua non*, for the administration to be able to bring about social change and development. Administrative change should be initiated on the basis of three major premises viz., that (senior) administrators are not merely operators of the system, but they themselves constitute the change agents, that they do have the professional capabilities which need to be brought into play and sharpened, and that they have to develop the skills of interfacing, positively and effectively, with the other complimentary instrumentalities of state. They cannot operate in isolation, nor at cross-purposes, while seeking to achieve common objectives.

Administrators as Change Agents : Myth and Reality

Firstly, there is a myth even among senior administrators, (not only of the I.A.S., but also even the I.P.S. and other services) that the 'administrative system' within which they are operating is so strong and immune to change, that the 'system' has to be changed before their 'training'. The reality is that it is the senior officers who have to initiate, facilitate, promote and sustain change within, and thus contribute to the image and performance of the administrative system. That many senior officers do bring about significant changes in the system is revealed by the fact that the 24 states in India represent as many different realities even within the single all-India canvas. Similarly, some districts within any state represent their own uniqueness, despite the fact that the structure and systems are uniform. The potential of individual officers in initiating and bringing about changes within the system ought to be analysed, strengthened and shared with others in the system.

Secondly, many senior officers of the all India services tend to perceive and project a negative image of their group as insular, rigid, complacent; showing signs of professional atrophy, with excessive emphasis on careerism, inability to work as a cohesive professional group, lack of *esprit de corps*, suffering from erosion of values due to rigid hierarchy and political pressures. Even if this negative perception has a valid base, an equally widespread but positive reality of civil service in India is that, even today, it is characterized (in a substantial measure) by integrity, impartiality, anonymity, adaptability, ability to manage crises and socio-economic development. Management development for I.A.S. (and others as well) should be built around these positive realities so as to strengthen the officer's personal

commitment and professional competence. More often than not, contemporary efforts of management development start with an analysis of the negative attributes and thus negate the potentially positive impact.

Thirdly, performance of public administration is enmeshed by the complimentarity of institutions (unlike in industry and business where the boundary lines are clearer); consequently no one can 'perform', independent of others. The buck stops no where but rotates, and the citizen is literally driven from pillar to the post. In order to arrest this 'trend' relative roles of the various instrumentalities of state (civil servants, political executives, judiciary, the press, professions and the people) have to be clarified and their role and goal complimentarity established and demonstrated. Unless and until this integration (both horizontal and vertical) is facilitated, training programmes will prove theoretical, having made no positive impact on the system. In order to be able to play their professional roles, the management institutions have to dilute their segmented disciplinary and sectoral boundaries.

Fourthly, management development programmes to be meaningful have to focus not merely on 'developing' the officers, but equally on the development of the administrative system. Training is an essential but not an adequate prerequisite for promoting productivity of administrative systems.

Institutional Complimentarity

For a variety of historical reasons various instrumentalities of state as also other social institutions have, over a period of time, developed an ethos of working more in hierarchical terms with superior subordinate relationships rather than in terms of complimentarity among themselves having distinct roles but common social objectives.

Various institutions have developed bureaucratic attributes such as hierarchy, centralization and such other attributes with the result that vertical interaction is achieved even if unproductively. This is the case not only with regard to bureaucratic and executive structures but also the legislative and judicial institutions. The High Court are seen as subordinate to the Supreme Court, the district Courts in turn are seen as subordinate to the High Courts. Similarly, though the Constitution defines the independent role of Parliament, the state legislatures etc. the Centre-State relations in India are characterized by a superior subordinate status. The institutions of local self-government (Zilla Parishad, Panchayat Samithi etc.) not having been given constitutional status by the Constituent Assembly, have become playthings in the game of politics between the Centre and the states.

While the institutions thus suffer from all the unproductive attributes of hierarchy, centralization etc, the problem of horizontal integration is proving to be even more unproductive in the Indian context. Issues emerging in the form of *Legislature* Vs. *Executive*, *Executive* Vs. *Judiciary* and *Judiciary* Vs. *Legislature*, illustrate the point that the intended culture of complimentarity has given place to a culture of versus, conflict and confrontation.

Thus viewed, efforts at skill development have to be toned up with a view to (a) making all complimentary units equally effective; (b) professionalising all functionaries manning them, and (c) promoting complimentarity, by bringing all of them together.

Social Accountability

Accountability of the various institutions, and thus of the State, cannot be promoted on the basis of strict legality. All of them should be made to develop sensitivity and accountability to society, beyond the framework of law. Accountability is ultimately a value-disposition, and can be developed and enforced only when there is a shift in values, from a perception of administration as a career, to that of a disposition that administration affords an opportunity for rendering service to the community.

□

Investment Allocation : A Goal Programming Approach

Babu Zachariah

This study attempts to apply the approach of goal programming to investment allocation. The problem pertains to a textile mill. The objective is expansion of production capacity. The task is to develop a mathematical model that would determine the suitable combination of New (N's), Old (O's) and Partially-modernized (P's) machines for each department of the mill, such that the objectives of the management are met.

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Goal Programming is a decision-making technique used to tackle multi-objective allocation problems. Lee (1972), Ignazio (1978, 1980), have studied the application of this technique to various allocation problems. This paper presents a model for investment in a textile mill. The problem pertains to decision-making on investment. The principal task is to identify the proportions of investments to various departments within the mill. The process is carried out by determining N's, O's and P's. N's, O's and P's quantify: new, old and partially-modernized machines in the new setup.

The case is a textile mill with both spinning and weaving sections. This study pertains to the spinning section. Table-1 gives the general information about the existing system

Table: 1 The Existing System

Sr. No.	Departments	Number of Machines	Average Production Capacity per Machine per Shift Kgs*
1.	Mixing	–	–
2.	Blow Room	2	3184.00
3.	Carding	64	94.70
4.	Drawing	8	754.00
5.	Fly Frames	14	426.70
6.	Ring Spinning	154	37.00
7.	Cone Winding	50	57.87

* *Applicable to 40's count.*

The production capacity could be increased by a suitable combinationof the following three options :

1. Insert new machines in each of these departments,
2. Ratain useful machines from the old lot without any modifications,
3. Retain machines from the old lot with part wise modifications.

It is economical to have partial modernization. But in the long term interests it is not preferable. This study considers partial modernization in ring frames. In other departments, this process is technically infeasible. Thus, the task is to determine the suitable comibination of the number of :

1. New, 2. Old, and 3. Partially modernized

Machines in the new setup subject to the achievement of certain objectives and constraints known as goals. The goals are listed in the order of priorities as follows :

1. Increase the overall production in spinning section by 150%;

2. Restrict the total investment to Rs. Six crores;

3. Optimize the return on investment;

4. Retain twice the number of new machines from the old stock;

5. Machines retained from old stock should not exceed the availabilty in each department;

6. Since the output of one department is the input of the next, each should produce the required input for the next department.

Formulation

Let N_i, O_i and P_i represent the number of new machines inserted, old machines retained and partially-modernized machines in the i^{th} department.

In what follows, the goals are represented through their mathematical equivalents :

1. Production Capacity :

Present Output = 5,800 kgs. of yarn per shift.

Expected production on modernization :

$$\frac{5800X150}{100} = 8{,}700 \text{ kgs. yarn per shift.}$$

Table 2: Production ratio and the anticipated rate of production.

Sr. No.	Department	Ratio of Production	Production (Kg/Shift)
1.	Mixing	1.115	9702
2.	Blow Room	1.097	9552
3.	Carding	1.094	9091
4.	Drawing	1.040	9048
5.	Fly Frames	1.030	8961
6.	Ring Spinning	1.000	8700
7.	Cone Winding	1.000	4350

Only 50% of the yarn from the Spinning Section is sent for cone winding, Hence, the production rate is 4350 kgs.

Table 3 : Production capacity of machines.

Sl. No.	Departments	Production Capacity (kg/shift) New	Old	Partially Modernized
1.	Mixing	9702.00	–	–
2.	Blow Room	3184.00	3184.00	–
3.	Carding	114.40	97.70	
4.	Drawing	900	754.00	–
5.	Fly Frames	525.00	426.70	–
6.	Ring Spinning	39.00	37.66	38
7.	Cone Winding	64	57.30	–

(–) Indicates the non-availability of the category.

Let dp_1^- represent the underachievement in production of the ithdepartment.

dp_1^+ represent the surplus production of the i^{th} department

thus,

$$9702n_1 + dp_1^- + dp_1^+ = 9702$$

$$3184n_2 + 31840_2 + dp_2^+ = 9552$$

$$114.4n_3 + 97.70_3 + dp_3^- - dp_3^+ = 9091$$

$$900n_4 + 97.70_4 + dp_4^- - dp_4^+ = 9048$$

$$525n_5 + 4260_5 + dp_5^- - dp_4^+ = 8961$$

$$39n_6 + 37.660_6 + 38P_6 + dp_6^- - dp_6^+ = 8700$$

$$64n_7 + 57.37O_7 + dp_7^- - dp_7^+ = 4350$$

In each of these constraints, both the deviational variables are to be minimized in order to maintain a uniform rate of production.

2. Investment :

Table 4 : cost of machines.

Sr. No.	Machine	Cost of Machine (Rs. in Lakhs)
1.	Forklift Truck	2.25
2.	Blowroom Line	28.00
3.	HP Cards	5.50
4.	Draw Frame	2.00
5.	Fly Frame	6.00
6.	Ring Frame	3.60
7.	Partially-modernized Ring Frame	1.26
8.	Cone Winder	2.50

Let,

de^- represent the slack expenditure, de^+ represent the surplus expenditure. Thus,

$$2.25n_1 + 28n_2 + 5.5n_3 + 2n_4 + 6n_5 + 36n_6 + 1.26P_6 + 2.5n_7 + de^- - de^+ = 600.$$

3. Return on Investment

Maximization of return on investment could be done by equating the corresponding linear equation to a large positive value and minimizing the negative deviation.

Table 5 : The values of R.O.I.

Sr. No.	Machine	Return on Investment New	partially Modernized
1.	Forklift Truck	0.15	–
2.	Blowroom Lane	0.19	–
3.	H.P Cards	0.20	–
4.	Draw Frames	0.17	–
5.	Fly Frames	0.21	–
6.	Ring Frames	0.21	0.25
7.	Cone Winder	0.20	–

$$0.15n_1 + 0.19n_2 + 0.20n_3 + 0.17n_4 + 0.21n_5 + 0.21n_6 + 0.25P_6 + 0.20n_7 + d_r^- - d_r^+ = 300$$

d_r^- and d_r^+ represent the slack and surplus R.O.I.'s.

Minimization of the negative deviation would maximize the R.O.I.'s.

4. Optimum Utility of Available Resources :

This is achieved by using the formula :

$$\text{(No. of Old Machines)} - 2\,\text{(No. of New Machines)} + dn_i^- + dn_i^+ = 0$$

Minimization of negative deviation would result in the objective. Let,

dn_i^-, dn_i^+ represent the slack and surplus numbers in the i^{th} department.

If dn_i^+ carries a positive value that would quantify the unused number of old machines. If dn_i^- carries a positive value that would quantify tiwice the excess number of new machines.

$$0_2 - 2n_2 + dn_2^+ - dn_2^+ = 0$$
$$0_3 - 2n_3 + dn_3^+ - dn_3^+ = 0$$
$$0_4 - 2n_4 + dn_4^- - dn_4^+ = 0$$
$$0_5 - 2n_5 + dn_5^- - dn_5^+ = 0$$
$$0_6 - 2n_6 + P_6 + dn_6^- - dn_6^+ = 0$$
$$0_7 - 2n_7 + dn_7^- - dn_7^- = 0$$

5. Availability from the old Stock :

$$0_1 + da_1^- = 0$$
$$0_2 + dn_2^- = 0$$
$$0_3 + dn_3^- = 0$$
$$0_4 + dn_4^- = 0$$
$$0_5 + dn_5^- = 0$$
$$0_6 + P_6 + dn_6^- = 0$$
$$0_7 + dn_7 - dn_6^- = 0$$

da_1^- represents the slack availability in the i^{th} department. The positive deviations are not taken into consideration as they are practically insignificant. Thus, the minimization of the negative deviation would achieve the goal.

6. Production Requirement :

One can observe that this is already incorporated in the sets of linear equations of goal no. 1.

Objective Function

The goals were listed in the order of priorities. Let

P_j represent the priority attached to j^{th} goal.

Thus, the objective function is

Minimize : $Z =$

$$p_1 (dp_1^- + dp_2^- + dp_3^- + dp_4^- + dp_5^- + dp_6^- + dp_7^-)$$

$$+ dp_1^+ + dp_2^+ + dp_3^+ + dp_4^+ + dp_5^+ + dp_6^+ + dp_7^+) + P_2 (de^+) + P_3 (dr^-)$$

$$+ P_4 (dn_2^- + dn_3^- + dn_4^- + dn_5^- + dn_6^- + dn_7^-)$$

$$+ P_5 (da_1^- + da_2^- + da_3^-) + da_4^- + da_5^- + da_6^- + da_7^-)$$

Assumptions

1. Any set of solutions should have only integer values or fractional values with the fractional part smail enough to be approximated to the nearest integer or values large enough so that the fractional part could be ignored without deteriorating the aspiration levels.

2. The test data pertains to 40's counts and the relative allocation is assumed to be unaltered for other varieties.

3. The model could be made free from the time horizon by updating the data.

Analysis of Results

A modified version of the FORTRAN based software provided in Lee (1972) was used to solve the problem. The program was run by a mainframe PSI –OMNI.

Table 6 : variable value and the total allocation of each department.

Sr. No.	Department	Number of Machines New	Old	Partially Modernized	Allocation (Rs. Lakhs)
1.	Mixing	$n_1 = 1$	$0_1 = 0$	$P_1 = 0$	2.25
2.	Blow Room	$n_2 = 1$	$0_2 = 2$	$P_2 = 0$	28.00
3.	H.P. Cards	$n_3 = 29.96$	$0_3 = 59.92$	$P_3 = 0$	165.00
4.	Draw Frame	$n_4 = 3.75$	$0_4 = 7.51$	$P_4 = 0$	8.00
5.	Fly Frame	$n_5 = 6.50$	$0_5 = 13.51$	$P_5 = 0$	42.00
6.	Ring Frame	$n_6 = 72.87$	$0_6 = 117.81$	$P_6 = 24.33$	298.00
7.	Cone Winder	$n_7 = 24.33$	$0_7 = 48.67$	$P_7 = 0$	60.00

The first goal could be achieved completely. Thus the production capacity would go up by 150%. The total expenditure would be restricted to six crores of rupees. The goal pertaining to the return on investment cannot be evaluated properly due to the very nature of optimization.The fifth goal could not be accomplished and as many as fifteen old machines from various departments are to be replaced. These facts could be seen from below.

Goal	Underachievement
5	15.12
4	0.00
3	264.51
2	0.00
1	0.00

Conclusion

Goal programming is an excellent tool of decision-making in investment. Whenever someone thinks of starting a new industry or rewinding an old factory or expanding the existing business, there will be certain aspirations that made the person take such a decision. In goal programming, these aspirations are treated as goals. Once these set of goals are converted to their mathematical equivalents, it is easy to seek a computer-oriented solution. But as is evident, there is a possibility of fractional values making a solution infeasible. This is clearly stated in the assumption 1. A remedy for this is the integer version of the goal programming technique. Otherwise, this model could be used for the determination of N's, 0's and P's which make for the optimum allocation.

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Maintaining the Quality of Rivers and Lakes

Any stretch of river, lake, estuary or coastal water may be subjected to more than one organised use, like drinking, industry, power generation, irrigation, fisheries, wild life propagation, navigation and recreation, and as a receptacle for treated wastes. The Central Pollution Control Board of India has adopted water quality requirements for different uses; the designated best uses and nomenclature are shown below:

Designated Best Use	Nomenclature (Class of water)
Drinking water source without conventional treatment and after disinfection.	A
Outdoor bathing	B
Drinking water source with conventional treatment followed by disinfection	C
Propagation of wild life.	D
Irrigation, industrial cooling, controlled waste disposal.	E

Apart from the fact that the above criterion is not capable of reflecting a total picture of water chemistry and ecological health, it is recommendable more for rivers than for lakes. Lakes are a more complicated ecosystems, and each lake is unique. It is not always possible to transfer the results obtained from one lake to another, as the problems depend on the geological regimes the lakes are located in. The common problems with our lakes are prolific weed growth, algal blooms due to eutrophication, toxic pollution leading to depletion of aquatic fauna and flora and sediment in filling reducing the storage capacity of the lakes.

Water Quality Monitoring in lakes is more vital than in rivers since the latter are flowing aquatic systems with the consequent beneficial physical factors, while these benefits are largely absent in relatively static water bodies like lakes.Human activity therefore, must be closely restricted in lake catchments, so that eco-systems are not out of balance.

Status of Water Quality Monitoring for Toxicity

It has been estimated that world wide about 63000 chemicals are in common use and that the world's chemical industry is marketing an estimated 900 to 1000 new synthetic chemicals every year. The rapid industrialisation and the successful green revolution in India have also introduced a large variety of chemicals into our environment. Many of these agro and petro chemicals cause damage to the health of human beings and animals and cause ecological problems, besides occupational disorders among the workers. In the last two or three decades, the production of pesticides in India has increased more than 40 fold, the production of dyes 30 fold, drugs 5 - 10 fold, petrochemicals 40 fold, fertilisers 30 fold and metals 3 fold. Inspite of the comparatively low amounts of pesticides used for unit area in India (450 g/ha) a WHO report showed that the body burden of pesticides in India is very high on account of defective irrigation and agricultural practices.

It is true that toxicological data on most of the chemicals is available in international literature but toxicological evaluation of chemicals under conditions specific to a country is essential. Studies on the toxic effects of chemicals under local conditions have been considered to be of priority in all advanced nations of the world. Several countries have laid down their standards for Maximal Allowable Concentration (MAC), or Threshold Limit Value (TLV) depending upon their conditions and requirements, but such an exercise has not been done in our country at the national level. The massive monitoring, testing and training facilities needed for implementation of the recommendations of committees like the Goitunde Committee are yet to be developed.

WHO has suggested that India should play a leading role in the safety evaluation of pesticides in the Asian

continent. What is required is not just accumulation of knowledge in the laboratories on the subject of toxic bioaggregation in the human body due to exposure to hazardous chemicals and pesticides, but a field level study on the hydrodynamics of persistent poisons, combined with an action plan for mitigating the possible disaster potentials caused by their accumulation in our surface and ground water resources which have come to be used as sinks more than as resources. While emphasising on the need to develop the adoption of aquatic toxicology as a thrust area in our planning process, it has become a ritual to allude to some internationally known toxic disasters. But a glance at home is now necessary. Case study on the Periyar river catastrophy of 1982 is available. The Zuary fish kill is another lesson apart from some lesser known tragedies.

Ganga Action Plan

At the operational level, India has made a big leap forward in river water hygeine in the shape of the Ganga Action Plan. This project is meant to tackle the pollution abatement problem in the mightiest of India's rivers. The Ganga basin is the home of more than 37% of the population of the country. The river provides livelihood to nearly 1/3rd of the country's population. The Ganga basin drains 8 states and 47% of the total irrigated area in the country is in this basin. Success gained in this venture is likely to set the pace for other rivers. 900 MLD of industrial and domestic wastewater finds its way into the river from 27 class I towns and 264 industries on the bank of the river.

The Ganga Action Plan has commissioned about 52 divisions of public health organisations in the three states of UP, Bihar, and West Bengal to lay intercepting sewers in the project towns, and to divert the waste water before it enters the river, to locations for treatment and resource recovery. Thirtyfive treatment plants based on a variety of technologies, 28 main and seven intermediate pumping stations are being constructed. Thirtyfour electric crematoria are being constructed on the banks of the river to provide for more hygeinic and speedy disposal of human bodies many of which are allowed to float in the river half burnt or unburnt due to economic reasons. The objective before the Ganga Action Plan is to restore the river to standard B listed above.

Intensive macro level water quality monitoring is being done at 27 locations on the river, and at the micro level in some of the project towns. The results so far achieved show that wherever the interception and diversion schemes have been completed and the monitoring information collected in the macro and micro system can be harmonised, the river water quality has shown improvement in terms of BOD, DO and other general parameters. Although the chemical pollution in the river has not been tackled in the current phase, a special trouble identification programme implemented through the ITRC Lucknow has revealed the presence of pesticide residues and heavy metals in the river at some locations upto a critical level. A rigidily monitored regulatory campaign to force the industries to instal effluent treatment plants is likely to take care of this aspect to some extent. The water quality modelling exercise taken up on the river comprehends the chemical pollution and is likely to result in a workable model for the abatement of both biological and chemical pollutions in the rivers of India. As far as the pesticides and insecticide residues due to agricultural run off are concerned, a pilot study to identify its load and evolve a model for anticipatory and remedial measures is being conducted in the field.

Wetland Management Programme

A wetland programme was launched by the department of environment covering, in the first phase; 10 lakh eco systems in the following geographical regions.

Kolleru	Andhra Pradesh
Wular	Kashmir
Chilka	Orissa
Loktak	Manipur
Bhoj	Madhya Pradesh
Sambar	Rajasthan
Pichola	Rajasthan
Ashtmund	Kerala
Harike	Punjab
Ujni	Maharashtra

A management action plan for these lakes has been drawn up and the states have constituted steering committees to oversee the implementation of the action plan prepared for the conservation of these lakes. In order to develop a strong ecological base, nodel agencies involving universities, colleges and research institutes have been associated in an action oriented eco development research to identify the hydrobiology of the lakes. A directory on the wetlands giving information on various features has been compiled.

A National Strategy and Areas of Possible Technology Collaboration

It would be necessary to formulate a strategy at the national level for controlling the discharge of hazardous chemicals and heavy metals wastes into the water bodies in the country. To develop such a strategy, it would become necessary to prepare an inventory of industries producing toxic chemicals, along with the available storage handling facilities. A review of treatment and predisposal infra facilities will have to be undertaken. A national toxicology programme has been proposed for the standardisation and validation of efficient, sensitive protocols for safety evaluation and for building mathematical models to predict toxicokinetics and structure toxicity relationships of different chemicals. On the preventive side, regulation of urban habitats and industries would assume importance. These could include incentives for inhouse pollution abatement programmes, recycling of wastes or reduction of waste by change of process, etc. New treatment technologies may have to be developed, specially in respect of agrochemicals. A water quality atlas of the water bodies in the country will have to be prepared, identifying the sources, load and nature of pollution, and toxicity. In this connection, bio-monitoring of water bodies and early warning systems would assume special importance. Laboratory facilities will have to be augmented. There is need for specific R&D work in respect of certain pesticides with reference to their carcinogenic effects and for the development of suitable agrochemicals which have lesser toxicity and effect on the ecology of water bodies or for the development of chemicals which are bio degradable. Following are some of the areas where technology collaboration would be possible :

1) Bio-monitoring and early warning systems for heavy metal pollution and toxicity.
2) Means of safe disposal and detoxification of pesticide residue through biotechnologies.
3) Enhancing and enlarging the existing toxicity testing facilities in the country.
4) To generate data needed for fixing ADI/MAC Values for toxic chemicals in the Indian context.
5) To develop and standardise sensitive protocols for safety evaluation of chemicals.
6) Preparation of a blueprint for disaster management for accidental spill of certain hazardous chemicals into the water bodies.

ITRC at Lucknow, while proposing a national toxicology programme as a thrust action area, has suggested the following specific activities in which foreign technologies and know how would be needed to a great extent :

1) To develop, standardise and validate efficient sensitive protocols for safety evaluation and mathematical models to predict toxicokinetics and structure the toxicity relationship of different pesticides.
2) To undertake R&D work to elucidate the molecular mechanism in the carcinogenic, mutagenic, teratogenic, reproductive, immunotoxic, developmental neuro behavioural and cardiopulmonary effects of pesticides, after exposure through inhalation, ingestion and dermal routes.
3) To conduct research in clinical toxicology to help in medical management, biological monitoring and in the diagnosis of the effects of environmental and occupational exposures to pesticides and to develop simple portable kits for field work.
4) Using simulated experimental models, to study the effects of predisposing conditions of nutritional, health and environmental status on the toxicity of the pesticides, to develop suitable preventive methods to abrogate such deleterious effects and to generate data needed for fixing ADI/MAC values in the Indian context.
5) To undertake R&D work in the field of biotechnology for the genes responsible for biodegrading organochlorine pesticides and for developing pesticide resistant plant.
6) To carry out R&D work on the toxicity of pesticides on the beneficial plants, soil organisms including nitrogen fixing ones, flora and fauna beneficial insects, and aquatic flora and fauna in suitable test model systems for understanding non target and ecological effects.
7) To understand the fate of agrochemicals in the environment, preferential bio accumulation, biodegradation and biomagnification mechanisms and the quantification of risks of persistent residues through environmental monitoring.

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Government Controls & Regulation of Industry

The controversy over what should be the extent of governmental interference in business has resurfaced in a big way, focussing on whether there should be 'more government in business" or 'more business in government'. In this context it should be realised that even in the days of so-called *laissez faire*, government closely regulated and controlled industrial activities. The real question has, therefore, never been whether or not a government should regulate and control but how the government can regulate best without stifling the productivity, creativity, enterprise and freedom of its people. Blind acceptance of government regulations is as stupid as automatic rejection of all regulations.

Conceptual Framework

Control carries a negative connotation both in its literal sense and in its use to describe government influence on industrial development. But the role of government in industry is not always negative or restraining. It can be, and often is, positive and promotional.

Government assists or promotes industrial activity in different ways; it helps industry by different methods. It promotes the interests of labour to organise and bargain collectively; it seeks to stimulate manufacturing by tariff protections; and it tries to foster trade by instituting commodity standards. The government stands committed to provide social goods, viz. an efficient communication and transportation system, efficient energy projects, institutions for developing human and physical resources. It operates and owns various activities like atomic energy, defence production etc. This does not exhaust the list of state activities or functions. Besides, the traditional one, state has to deal with problems arising from market imperfections, *viz.*, monopolies and restrictive trade practices, trade cycles, disparities in the distribution of income and wealth, economic imbalances in regional development or growth of industrial sector. Its functions encompass the macro-economic controls, the problems of stable value of national currency for the benefit of domestic and international trade, the problems of purchasing power, credit, spending and capital investment.

The government and industry have, thus, a challenging task to compromise and harmonise the conflicting objectives in a complex and dynamic millieu. Industry is concerned with exerting itself for economic progress within the framework which the state sets up in response to social urges. Fulfilling the industrial objectives within the social parameters is to maximise welfare of the society as a whole.

Historical Setting

The system of control and regulation of industry in our country has quite a long history and goes back to the Second World War period when the entire economy was functioning under a fairly rigid system of controls. Regulation of foreign exchange, control on imports and exports and control of the entire range of production, prices and distribution had been comprehensively developed during the period prior to independence. Even today the legal basis of most commodity controls flows from the regulatory measures enacted during this period. During the post independence years and particularly after the initiation of planning in 1951, regulation of industry has sought to be given a different approach and direction. While some controls such as capital issues and the company law continued in a form modified from time to time, a fairly comprehensive system of industrial licensing developed over the years.

The Industrial Policy Resolution of 1956 laid down the principles of mixed economy and over the years the role of the public and private sectors have remained relatively well defined with both being dove-tailed into a fairly consistent whole through the system of regulations and controls. Broader considerations such as that of bringing about a greater degree of regional development of

industries were also sought to be achieved. Detailed targets of production and required capacities in various industrial sectors were laid down which served as a very useful guide to entrepreneurs during a difficult and transitional stage of industrial expansion and growth. At an early stage of industrial growth when a vast range of basic and consumer goods industries had to be set up, pragmatism demanded that production in various industrial sectors developed on regulated and controlled lines. This was all the more necessary because heavy capital inputs together with foreign technical know-how was essential for a number of these industries and quite undesirable results would have followed, had the industrial expansion been left completely free and unfettered at that stage. This is not to suggest that licensing of industries has been an unmixed blessing. In a number of industrial units, the capacity licensed remained far from being achieved, the procedural delays and other inbuilt defects of licensing tended to aggravate the already high-cost economy. Nevertheless even with the shortcomings and practical difficulties it needs to be emphasised that a system of licensing and control was essential at that time.

Current Scenario

The picture facing the country today is quite different with a vast range of capital goods including sophisticated machine tools, complex equipment and machinery and hi – tech industrial products being indigeneously produced and supported by growth of indigenous know-how. In many fields including that of consultancy engineering, a reasonably strong industrial base has now been created. With this, our dependence on foreign technology and engineering personnel and talents should be gradually reduced. The tendency of foreign collaboration and the performance of foreign machinery and equipment must give way to increased emphasis on indigenous technology and insistence of indigenous equipment both of which will form the cornerstone of rapid industrial growth in the future.

With this vast industrial base having the infrastructural facilities such as power, transport and communication, the time has come when we can consider the establishment of industries not having foreign exchange implications on a more flexible and less restricted basis than in the past when most industrial projects were based on heavy inputs of capital equipment, foreign technology and foreign personnel. In fact, with the substantial production capacity of plants manufacturing sophisticated machinery and engineering equipment over a wide range, there is a need for rapid multiplication of industrial units to utilise such production capacity.

Like licensing, the company legislation is used as a check on the setting up of new companies and also to regulate the functioning of the corporate sector along certain lines in the general interest. The measures were primarily designed to bring about the healthy functioning of the corporate sector and channelizing saving and investments in a manner designed to give confidence both to the individual investors and to the public at large. In fact, the purpose of these controls is to assist the corporate sector in growth and development on desired lines and in a healthy manner. The primary objective is to ensure that they do not lead to exploitation, waste and exhaustion of resources, lopsided development and concentration of wealth and economic power.

It is against these objectives that the provisions of Company Law have to be viewed. It is possible to conceive of, for example, a different role for shareholders, social audit may be given a different form, or the question of workers' participation in management may have to be given greater emphasis. The role of financial institutions in the management of companies when they have considerable financial stake could also be differently viewed. As corporate management moves to an era of greater professionalism, the role and responsibilities of the professional manner will require greater elaboration.

Licensing and company law are not the exclusive devices of Government regulations and control. They must be seen in the totality of various control measures. The Capital Issues (Control) Act, 1947 and 1956 require the Central Government's consent to the issue of capital by companies. The Import and Export (Controls) Act., 1947, empowers the Central Government to prohibit or restrict import into and export from the country. The Foreign Exchange (Regulation) Act, 1947 prohibits dealings in foreign exchange, making payment to persons not resident in India, importing or exporting gold and silver etc. The Essential Commodities Act, 1955 regulates the prices, distribution, supply etc. of essential commodities. The purpose of the Monopolies and Restrictive Trade Practices (MRTP) Act, 1969 is to control concentration of economic power in a few monopoly or large houses and to regulate monopolistic and restrictive trade practices. To these may be added a number of controls which exist in the field industry.

The first and the foremost impact of these controls and regulations is that no major decision can be taken

except with the prior permission of the Government or at the risk of subsequent Government disapproval or rejection. Where to locate one's plant, or what would be the rate of return on one's capital, or on which project to invest - all these simple decisions are influenced by the Government. Secondly, in a system of controls, the application of one set of controls has a tendency to make necessary the application of others. Though controls and regulations give an expression that small and new units should be encouraged, it is common knowledge that these controls always favour, in practice, the monopoly and big business houses having direct access to the power-that-be. In India, extensive inquiries were made on the subject of Government controls and regulations of industry. The Vivian Bose Inquiry Commission, the Hazari Committee on Industrial Licensing, the Dutt Commission on Monopolies etc. are the cases in point. On the other side of the picture, these controls are a source of encouragement to industry. A major condition in fixing the prices of goods and services produced in the public sector is to keep them low to encourage private enterprise. Then, the state undertakings in basic industries and public utilities have the effect of improving the conditions under which private sector operates. Rates of interest are kept low and credit and money markets are held down for this reason and special credit institutions are created that often provide credit facilities at less than market rates. Various tax exemptions and tax incentives are given to encourage new business and industry. Moreover, every enterprise that gets an import licence or a permit or foreign exchange receives a *de facto* subsidy. It is well-known that each licence fetches any thing between 100 percent to 500 percent of its face value if sold or transferred. There are some controls and devices due to which costs are decreased and returns are increased for industry.

In conclusion, it may be said that controls are the means by which the Government maintains a balance between various sectional interests. They limit the freedom of action on the part of certain sections of the society; they provide correspondingly an incentive to certain other classes and the practical problem is always to balance the loss of satisfaction in one case against the gain to the other. It is also vital to make necessary adjustments and modifications in their formulation and working from time to time as the condition governing them changes. The point to stress is that each control and regulatory measures has to be looked on as a part of the system and it must be operated so as to contribute effectively to the objectives of industry. The successful working of these controls will automatically depend on the measures of inducement they provide for the betterment of industry. In short, Government regulations and controls should genuinely regulate and control and not restrict or inhibit.

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Productivity in Auto Component Industry

NPC Research Section

The Auto Components in India has gradually developed into an impressive high technology industry in recent years. The manufacturers in the organised sector number between 275 and 300 and provide direct employment to approximately 50,000 persons. In addition, there are about 6,000 units in the small scale sector accounting for about 25 per cent of the annual production of auto components. This report reviews such aspects of industry as growth of the sector, capacity, utilisation, productivity performance, import & export of auto components, technology etc.

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Auto component manufacture, an essential adjunct of the Automobile Industry, has emerged as a highly specialized industry in India during the past few decades. After a modest beginning in the late fifties, it has gradually developed into an impressive high-technology industry in recent years. With the fast growth of the automobile industry in the Eighties, both in quality and in sophistication, the auto ancillary industry got the much needed push which has led to its fast expansion and growth to become a fairly large segment of the engineering industry (Table 1). The auto-component manufacturers in the organized sector today number between 275 and 300 and provide direct employment approximately to 50,000 persons and indirect employment to many more in warehousing trading and servicing of auto parts. In addition, there are about 6000 units in the small scale sector accounting for about 25 per cent of the annual production of auto components, supplying to both the original equipment manufacturers as well as to the replacement markets. Together, the two sectors represent a vital industrial group within the engineering industry. In 1984-85, the engineering industry had a share of approximately 30% in the total industrial production in India and the contribution of the auto component units (organised sector) was a little over 2.5 per cent of the total engineering goods output. (CEI, 1988).

The auto component manufacturers are spread over a large number of centres like Bombay, Pune, Aurangabad, Nasik, Madras, Coimbatore, Bangalore, Faridabad, Calcutta and Delhi. Small Scale unitsare largely concentrated in the states of Punjab, Haryana, Delhi, Maharashtra, Karnataka and Tamil Nadu

Table 1 : Progress of Auto-ancillaries in India

Year	No. of Units in the Organized Sector	Value of Production (Rs. Crores at current Prices)	Growth (% per year)
1961-62	N.A.	17.84	-
1965-66	N.A.	161.45	-
1970-71	N.A.	133.20	-
1975-76	N.A.	252.35	-
1980-81	N.A.	531.80	-
1981-82	150	647.96	21.8
1982-83	175	642.41	(–) 0.8
1983-84	175	696.47	8.4
1984-85	200	837.05	20.2
1985-86	200	974.60	16.4
1986-87	250	945.37	(–) 3.0
1987-88	250	1180.36	24.9
1988-89	275	1262.50	7.0
1989-90	300	1560.00 (Estimated)	23.6

Source : 1. TDA (1989)
2. ACMA (1988)
3. DGTD (1989)

Growth of Auto Ancillaries

Because of the nature of its operations, the growth of auto ancillaries is inextricably linked to the progress of the automobile industry itself. The vehicle manufacturers, in the early stages, either imported the auto components or set up in-house manufacturing facilities. This trend has now changed, to a large extent; the auto manufacturers largely depend on the auto component ancillaries for their requirements of both simple and sophisticated components. The auto ancillaries have, thus, assumed the role of an important import substitution industry in India. The automobile industry has made rapid strides during the last few years and so has the auto component industry (Table 2). The growth of atuo ancillaries over the years has been subjected to significant ups and downs. From an output of Rs. 17.84 crores in 1961-62, it reached a production level of Rs. 1262.50 crores in 1988-89 showing an average annual growth rate of about 18%. During recent years, the existing auto ancillary units have expanded their capacities and added several new manufacturing units to meet the growing needs of the vehicle manufacturers.

Table 2 :Comparative Growth Rate of Automobile & Auto-Component Industry

Year	Total no. of Vehicles produced	Rate of growth %	Total Value of Auto Component output (Rs. Crores)	Rate of growth %
1981-82	807,944	22.6	547.96	21.8
1982-83	878,493	8.7	642.41	0.8
1983-84	1,051,046	19.6	696.47	7.8
1984-85	1,218,579	15.9	837.05	20.9
1985-86	1,545,537	26.8	974.60	16.4
1986-87	1,781,678	15.3	926.59	4.9
1987-88	1,881,126	5.6	1074.40	16.0
1988-89	2,047,000 *	8.8	1262.50 *	17.5
1989-90	2,505,000 **	20.4	1560.00 *	23.6 *

Source: AIAMA & ACMA

** Estimated*
*** Target*

The auto ancillaries manufacture a wide variety of items ranging from simple rubber moulded components to sophisticated items like engine parts and electrical accessories. The range now covers a variety of electrical parts, engine components, transmission and steering items as well as brake system parts. According to known estimates, a finished motor car consists of almost 300 parts and, on an average, about 40% of an automobile's production cost is contributed by the auto components obtained as original equipment from the auto ancillaries. The link between Automobile industry and auto components can be seen from Fig. 1. Despite its impressive growth, the auto-component industry cannot be said to have kept pace with the automobile industry; there are still wide gaps between what the expanding vehicle industry needs and what the auto component manufactures can supply. This gap is amply reflected in the large-scale imports of components year after year.

Capacity & Capacity Utilization

In conformity with the demand growth for auto components, the capacity for various items has been progressively increasing over the years. According to one study (TDA, 1988), the installed capacity is more than 70 per cent of the licensed capacity for most of the auto component items, except for a few complex electrical items such as starter motors, generators, ignition coils, spark plugs etc where it is less than 50 per cent. The gap

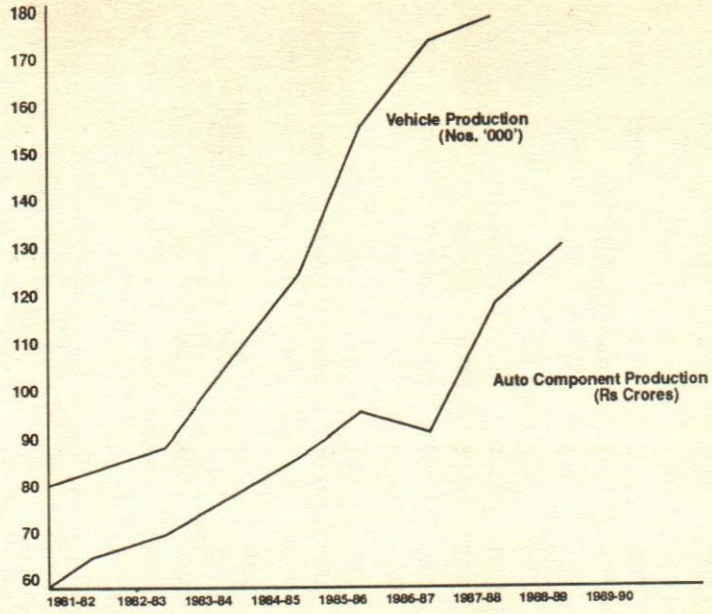

Fig. 1 Growth Relationship of Automobiles & Auto Component in India

Table 3 : Licensed and installed capacities in Selected Auto Components.

	1976		1986		1988			
Component	No. of Units	Installed Capacity	No. of Units	Installed Capacity	No. of Units	Licensed Capacity	No. of Units	Installed Capacity
Pistons	7	3,700	8	5,545	6	9701	9	9091
Engine Valves	7	14,000	9	18,520	8	29,830	4	18,650
Carburattors	6	1,176	9	2066	8	2963	6	3026
Radiators	–	182	7	217	7	429	7	429
Starter Motors	5	200	5	392	10	1,100	7	846
Spark Plugs	2	7,800	2	8250	3	14450	3	14950
Clutch Assembly	5	380	8	567	12	1348	10	1029
Gears *	9	8,800	14	14,760	18	27,770	16	21,786
Wheels	2	1,280	2	2,068	4	2,963	2	2,670
Shock Absorbers	4	2,480	6	5,355	8	6,055	9	7,055
Brake Linings *	6	8,000	7	14,678	9	15,000	6	13,450
Panel Instruments	–	–	3	4,043	4	6,383	3	5,033
Axle Shafts	–	–	10	701	10	480	8	494
Oil Seals	–	–	5	12,918	5	21,318	5	20,318

* Tonnes

1 For each of these items (except clutch assembly), letters of intent have been issued to more than one unit to bridge the gap between the current available capacity and the estimated demand.

2. Under the libarlized licensing policy, the manufacturers are now permitted to increase their capacity within prescribed limits.

Source: TDA, ACMA,

between the licensed capacity and installed capacity is likely to be bridged in the near future, as fresh letters of intent have been issued to a large number of component producers. In some cases even technology and financial collaborations have also been approved. Liberalization of licensing and extension of broad-banding to the auto component manufactures have further facilitated creation of additional capacities and its utilisation in the sector . Table 3 gives a broad indication of the available capacities for a selected set of auto-components.

In the absence of comparable data on the production and capacities of individual manufacturers of auto components, we have worked out capacity utilization percentages for a selected group of auto components. Even here, the capacity data is not complete. We have, therefore, utilized available capacity figures (licensed or installed) to assess the capacity utilisation of the auto component industry. Results presented in Table 4 give a general indication of how the manufacturers of a particular component compare with the units producing other auto parts. For example, a group of 9 companies manufacturing pistons shows an overall capacity utilization of about 75%; but another group of companies producing engine valves has a capacity utilisation of less

than 65 per cent. Capacity utilisation percentages have also been worked out for some of the component manufacturers during 1984-85 –1988-89 (Table 5). Clearly there are wide variations in the capacity utilisation from company to company. Even within the same company the capacity utilisation for one individual item varies from another as is the case in Goetze and Talbros. Similar conclusions have been reached by the Productivity Board for Automobiles & Ancillary Industry also (NPC, 1988). Out of the 13 units studied by PBAAI, 8 had shown poor capacity utilization during the year 1984-85 and 9 out of 12 fared badly during 1986-87. Relevant extracts from the PBAAI report are given in Table 6.

Table 6: Extracts from PBAAI Report on Capacity Utilization in Automobile & Ancillary Industries.

Range of capacity utilization	No.of Units		
	1984-85	1985-86	1986-87
15 % – 35 %	1	1	1
36 % -- 50%	2	1	1
51 % – 75%	5	6	7
75% –100%	4	5	2
Above 100%	1	–	1

Source : *NPC (1988)*

The average capacity utilization for the transport equipment industry during 1986 was around 75% and for the entire manufacturing sector it was 72.01 per cent (CMIE,1987). Compared to these, the capacity utilization in the case of some of the component manufacturers shown in Table 5 appears to be rather on the lower side, particularly for those engaged in the manufacture of starter motors, clutch assembly, gears, etc.

One major reason cited by the auto component manufacturers for low capacity utilisation is the fragmentation of capacities and markets; in other words, there are far too many units producing the same item at below economic levels than warranted by the market demand. While more units manufacturing the same item, no doubt, introduce an element of competition, this, in some cases, leads to uneconomical operation levels, leading to severe under-utilization of capacities and higher production costs. Another reason, often mentioned by the industry is the 'unfair advantages' extended to the small-scale counterparts which make it difficult for the organized sector units to compete with them in production costs. This compels component units in the organised sector to curtail output, thus, leading to lower capacity utilization.

While voluntary consolidation and rationalization of capacities within the industry would certainly be of considerable help in building economic production levels, the results may prove to be illusory unless adequate attention is given by these units to productivity improvement also. In the past, and even now, the vehicle manufacturers have been taking advantage of fragmented capacities spread over 3 or 4 component suppliers by inducing unhealthy competition amongst them. The practice has proved detrimental to the overall interests of the automotive industry as a whole. The current trend world over is towards consolidation of capacities which is clearly indicated by the large number of mergers and take overs. To become competitive in the world markets, both the Indian vehicle manufacturers and component manufacturers will have to evolve a mutually acceptable policy for building reliable and economical supplies of components through rational restructuring with modern technologies supplemented by indigenous development of designs. In the larger interests of the industry, such a policy would appear to be unexceptionable. Cost effectiveness and quality consciousness are the two other important areas which the industry will have to give a lot more attention, if ever it hopes to gain a respectable place in the comity of world's automotive component manufacturers.

Productivity Performance of Automotive Ancillaries

Although automotive component industry has more than 250 units in the organised sector, our analysis has been based on a sample of 24 companies engaged in the production of a few important automotive parts. The distribution of the sample units according to the type of components produced is given in Table 7. The productivity performance of these units has been examined with the help of the following ratios :

Total Earnings to Conversion Cost
Purchased Services to Total Earnings
Salaries and Wages to Sales (%)
Profit to Conversion Cost
Profit to Sales (%)
Profit per Employee
Sales per Employee

Comparative results are presented in Annexures 1-5

It may be pointed out that a few of the sample units

Table 7: Product-wise Distribution of Sample Companies Studied.

Type of Component	No. of Units	% of total no. of units examined
Engine Components	6	25.0
Dashboard Instruments	3	12.5
Electrical Components	4	16.7
Clutch Assembly	2	8.3
Gears	3	12.5
Gaskets & Brake linings	3	12.5
Miscellaneous–Wheels & Axles	3	12.5

have diversified their activities and thus, produce more than one item of automotive components or other non-automobile products. To that extent, their results may not be fully comparable with the others.

Our analysis is based on the productivity ratios for 5 years from 1983 to 1988 in most cases, but in a few units, the available data being limited, the study has been confined to two to three years. A summary picture in terms of the productivity performance is given in Table 8. Companywise data on productivity performance reveal a mixed picture. While in some of the old established units the productivity is well above the average, the performance of some of the smaller units is somewhat unsatisfactory and points to the need for greater vigilance and better managerial control on the utilization of resources.

Table 8.: A Summary of Productivity Ratios during 1983-88 (Average)

Companies Examined	Total Earnings to conversion Cost	Profit to conversion Cost	Profit to Sales %	Purchased services to Earnings	Salaries & wages to sales %	Profit per employee (Rs.Lakhs)	Sales per employee (Rs.Lakhs)
Engine Valves Ltd.	1.63	0.16	6.7	0.24	17.9	–	–
Goetze	1.35	0.33	16.9	0.30	23.9	0.99	0.168
India Pistons	1.28	0.064	3.15	0.27	28.2	0.035	0.011
Shriram Pistons	1.09	0.026	1.91	0.66	147	–	–
Escorts Ltd.	1.19	0.13	2.94	0.37	10.45	0.121	2.39
India Radiators	1.26	0.04	1.19	0.35	12.7	–	–
Autometers	1.38	0.18	4.5	0.28	20.3	–	–
Yenkey	1.12	(0.32)	(18.3)	0.31	33.8	0.277	1.51
Premier Instruments	1.41	0.19	5.7	0.30	13.5	–	–
Lucas TVS	1.28	0.28	10.5	0.36	15.2	0.263	2.49
Best and Crompton	1.02	0.011	0.85	0.79	14.0	–	–
Sahney Paris Rhone	1.03	(0.21)	(7.9)	0.44	16.3	–	–
Motor Industries	1.56	0.16	6.8	0.19	23.9	–	–
API	0.94	(0.08)	3.12)	0.25	29.2	(0.0336)	0.98
Clutch Auto	1.04	(0.30)	(13.5)	0.61)	12.6	(0.89)	1.31
Bharat Gears	1.18	0.03	1.54	0.39	15.7	–	–
Gajra Gears	1.17	0.05	2.35	0.40	19.7	–	–
Ramon and Demm	0.81	(0.44)	(26.3)	0.53	29.5	–	–
Perfect Circle Victor	1.26	0.19	0.79	0.48	12.4	0.26	4.0
Talbros Automative	1.14	0.07	2.95	0.44	17.9	0.031	1.07
Hindustan Ferodo	2.1	(0.37)	(11.5)	0.13	21.3	(0.227)	1.963
Wheels India	1.41	0.19	4.2	0.34	7.95	–	–
Sankey Wheels	1.11	(0.06)	(1.6)	0.40	13.0	–	–
Automotive Axles	0.79	(0.35)	(15.4)	0.62	8.7	(0.43)	3.5

Source: Derived from Annexures1 to 5

Total Earnings to Conversion Cost (Annexure 1)

Obtaining a high level of total earnings is a necessary condition for the healthy growth of an organisation. At the same time, if the rate of generation of total earnings per unit of conversion cost is also high, the organization can be considered to be productive as well. Out of the 24 manufacturing units examined, there are, atleast, three (12.5%) whose total earnings-conversion cost ratio is below 1 and only one unit has this ratio above 2. The lowest average ratios achieved is 0.79 in the case of Automotive Axles. Of the remaining 20 companies whose earnings conversion costs ratio is above 1, there are, atleast four (16.6%) whose average is only marginally above 1. Therefore, the situation calls for greater attention to improve performance and

Table 10: Profit to Conversion Cost Ratio for 24 Companies (Average During 1983-88)

Companies incurring loss		Companies making even		Companies making profit	
Ramon & Demm	(.44)	Best & Crompton	0.11	Goetze	0.33
Ferodo	(.37)	Shriram Pistons	.026	Lucas TVS	0.28
Auto Axles	(.35)	Bharat Gears	.03	Premier Instts	0.19
Yenkey	(.32)	India Radiators	.04	Perfect Circle	0.19
Clutch Atuo	(0.30)	Gajra Gears	.05	Wheels India	0.19
Sahney Paris Rhone	(.21)	India Pistons	.064	Autometers	0.18
API	(.08)	Talbros	.07	MICO	0.16
Sankey Wheels	(.06)			Engine Valves	0.16
				Escorts	0.13

Table 11: Profit to Sales (percentage) for 24 Companies (Average During 1983-88)

Companies incurring loss	%	Companies making even	%	Companies making profit	%
Ramon & Demm	(26.3)	Perfect Circle	0.79	Goetze	16.9
Yenkey	(18.3)	Best & Crompton	0.85	Lucas TVS	10.5
Auto Axles	(15.4)	India Radiators	1.19	MICO	6.8
Clutch Auto	(13.5)	Bharat Gear	1.54	Engine Valves	6.7
Ferodo	(11.5)	Shriram Piston	1.91	Premier Intts.	5.7
Sahney Paris Rhone	(7.9)			Autometers	4.5
API	(3.1)			Wheels India	4.2
Sankey	(1.5)			India Pistons	3.15
				Talbros	2.95
				Escorts	2.94
				Gajra Gear	2.35

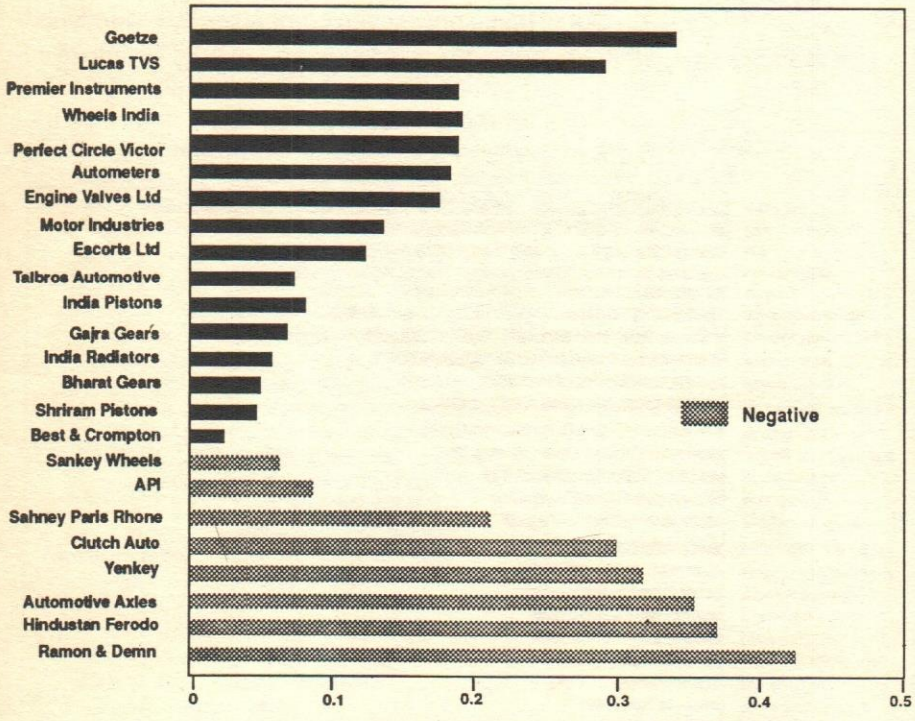

Fig.5 Ratio of Profit to Conversion Cost

Table 12: Comparison of Earning Cost Ratios and Profit Contribution Ratios (Averages During 1983-88)

Company	Earning to conver Cost	Profit to conv. Costs	Profit to Sales %
Ferodo	2.1	(0.37	(11.5)
Engine Valves	1.63	0.16	6.7
MICO	1.56	0.16	6.8
Wheels India	1.40	0.19	4.2
Premier Instts	1.41	0.19	5.7
Autometers	1.38	0.18	4.5
Goetze	1.35	0.33	16.9
Lucas TVS	1.28	0.28	10.5
India Pistons	1.28	0.06	3.15
India Radiators	1.26	0.04	1.19
Perfect Circle	1.26	0.19	0.79
Escorts	1.19	0.13	2.94
Bharat Gears	1.18	0.03	1.54
Gajra Gears	1.17	0.05	2.35
Talbros	1.14	0.07	2.95
Yenkey	1.12	(.32)	(18.3)
Sankey Wheels	1.11	(.06)	(1.6)
Shriram Pistons	1.09	.026	1.91
Clutch Auto	1.04	(0.30)	(13.5)
Sahney Paris Rhone	1.03	(.21)	(7.9)
Best & Crompton	1.02	0.011	0.85
API	0.94	(0.08)	(3.1)
Ramon & Demm	0.81	(.44)	(26.3)
Auto Axles	0.79	(.35)	(15.4)

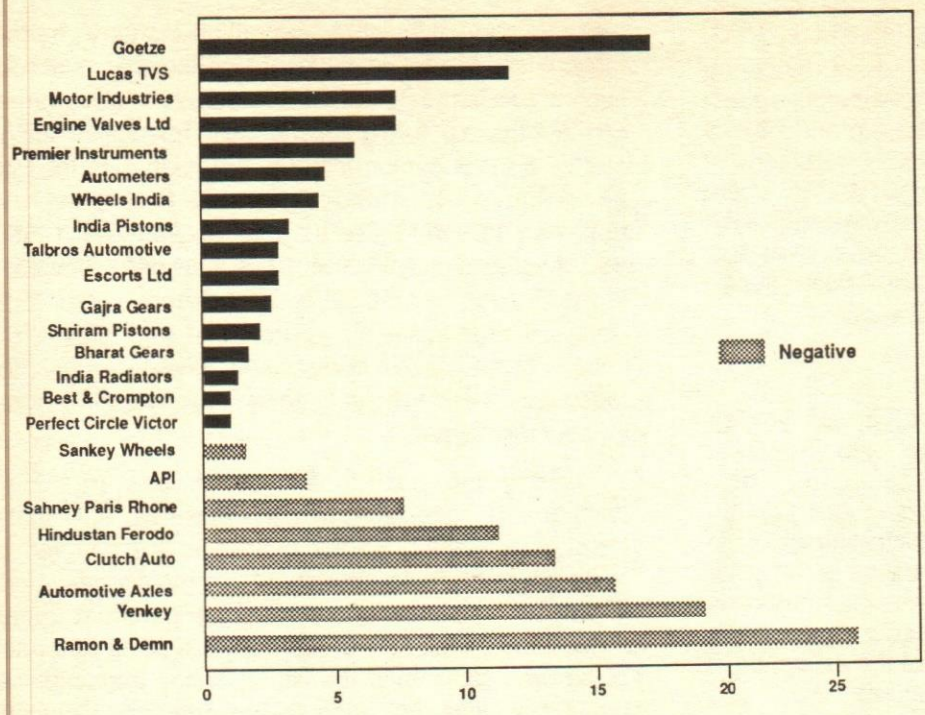

Fig.6 Ratio of Profit to Sales %

Table13:Employee Productivity Ratios (Rs. lakhs) Averages for available period

Company	Profit per Employee	Sales per Employee
1	2	3
Goetze	0.99	0.168
India Pistons	0.035	0.011
Escorts	0.094	2.39
Lucas TVS	0.263	2.49
API	(0.034)	0.98
Perfect Circle	0.26	4.00
Talbros	0.031	1.07
Ferodo	(0.227)	1.96
Auto Axles	(0.43)	3.50

Note: Figs in bracke & represents loss

(except Goetze), the sales per employee is fairly high in most of the companies. Atleast one company has explained it in its annual repoft :

"Payroll costs, at above 30% of sale turnover, continue to impose an unreasonable burden on the company. It is imperative that the work force is reduced and productivity improvement obtained to ensure viability and competitiveness of the factory". (Ferodo Annual Report, 1988-89). This is, perhaps, true of most other units also and they would do well to explore the possibility for readjusting the manpower according to their actual needs.

There is plenty of scope for productivity improvement and a regular productivity audit can provide the much needed direction in this respect. In an earlier study carried out by the Productivity

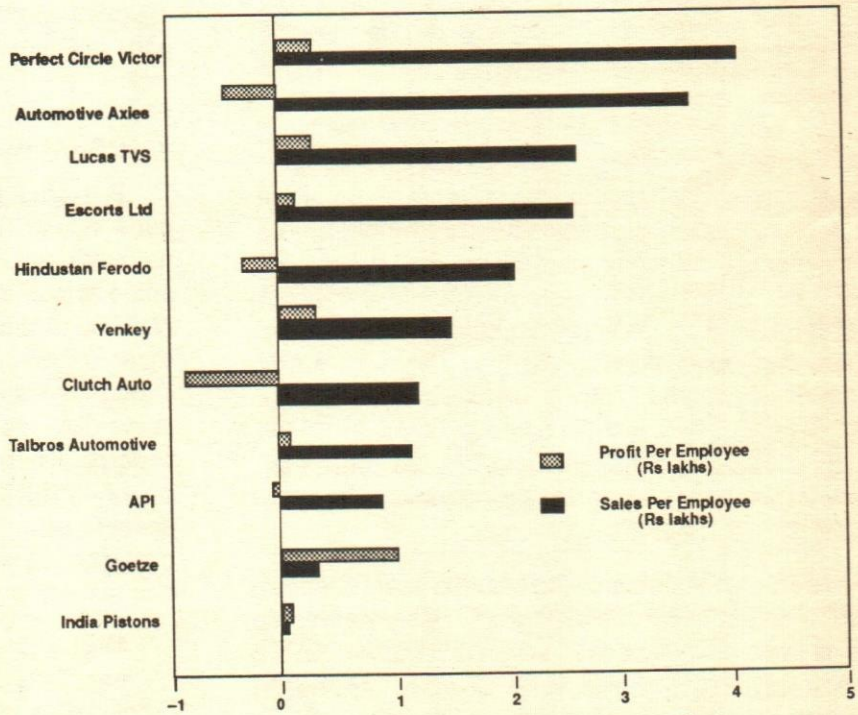

Fig.7 Employee Productivity Ratios

Table 18: Exports of Selected Auto components (Rs. crores)

Component	1981-82		1982-83		1983-84		1984-85		1985-86	
	Value	% of Total Component Export	Value	% of Total Component Export	Value	% of Total Component Export	Value	% of Total Component Export	Value	% of Total Component Export
Pistons	0.34	0.5	0.10	0.15	0.073	0.11	0.10	0.15	0.11	0.14
Piston Riings	1.10	1.6	0.37	0.5	0.70	1.1	0.63	0.94	0.79	1.0
Engine Valves	1.0	1.4	0.69	1.0	1.21	1.9	1.28	1.9	3.4	4.3
Bimetal Bearings	0.18	0.25	0.05	0.07	0.056	0.09	0.22	0.33	0.03	0.04
Generators	0.21	0.29	0.031	0.04	0.073	0.1	0.44	0.66	0.48	0.6
Spark Plugs	0.53	0.75	0.37	0.5	0.37	0.6	0.49	0.73	0.87	1.1
Starter Motors	0.70	0.10	0.49	0.7	0.30	0.5	0.39	0.58	0.38	0.5
Other Engine Parts	9.6	13.5	5.5	8.1	9.3	14.4	9.9	14.8	8.2	10.4
Other Equipment Parts	1.2	1.7	0.81	1.2	0.49	0.76	0.68	1.0	0.18	0.93
Leaf Springs	0.9	1.3	0.67	1.0	0.44	0.68	0.39	0.6	0.36	0.71
Accessories	1.1	1.6	3.1	4.6	1.2	1.8	1.9	2.8	2.3	2.9
Equip Ignition	–	–	–	–	–	–	–	–	0.09	0.11

Source: ACMA & EEPC

international standards. With growing global competition, technical sophistication has now become a regular feature within the vehicle industry. For entry into the primary export markets, the industry will have to induct high level technologies and ensure economies of scale. In other words a constant look out for spotting and acquiring better technologies and a matching high level indigenous R&D effort are absolutely necessary for the Indian auto ancillaries to keep pace with the fast changing product development taking place in the developed countries. Vehicle manufacturers abroad are also encouraging the component suppliers to go in for improved manufacturing processes and technologies so as to raise their productivity and ensure lower costs which in the long run will turn out to be in the interests of both the parties. Similar co-operative efforts will have to be initiated by the Indian automotive industry also to gain international recognition as dependable suppliers of quality automotive components.

Wherever Indian vehicle manufacturers have established joint ventures abroad, the opportunity for component manufacturers to establish themselves as dependable associated component suppliers would be readily available, but before this happens, a complete change of attitude towards technology, product quality, cost effectiveness and mutual co-operation and joint efforts would be needed.

Potential for Exports

The world trade in auto components runs into several billions dollars per year. The potential for export is, thus, almost unlimited. However, it will not be easy to become a supplier of parts to the established vehicle manufacturers abroad. According to a market survey report from Netherland, "Becoming a supplier of car parts to vehicle manufacturer is difficult. In future, there will be fewer, but bigger, contracts of supply. The cooperation between parts-suppliers and vehicle-assemblers will become closer. The 'Just-in-Time' delivery concept is now standard for most assembly operations and is gaining ground in the area of stocks for provision to dealers. Reliability of supply is given high priority by car manufacturers. The production of car parts will become more and more international around the world to establish plants close to the factories. Capital inputs will be higher. New materials and techniques will replace outdated ones. Typical examples are ceramics, plastics and the increased use of electronics" (CBI, 1984). In regard to replacement parts, the survey goes on to say': "The situation in this market is less demanding. Quality is not as demanding as in the original parts area; delivery by and large, need not be so tightly controlled, but this does not mean it is not extremely important. It is expected that the volume of car parts for repair purposes will increase as the statutory technical examination of cars extends to larger proportion of the Dutch automobile fleet. For some parts such as tyres and batteries, there is cut-throat competition because of overcapacity and production. Consequently market prices are relatively

low for these items. The volume of the trade in the future is hard to predict. Generally, it is assumed that 1986 was a top year in car sales. Thereafter sales will settle at a lower level.".

The government on its part has recently offered a fresh package of incentives to help bolster exports to both primary & secondary markets. The industry, however, seems to feel that a lot more needs to be done in this respect particularly in the matter of financial concessions. It is estimated that the average annual outflow of foreign exchange on account of the import of auto components will be in the region of Rs. 500-600 crores per year. To finance this level of imports, an equally high level of exports are imperative. As table 17 shows, component exports so far have been hovering around a figure of Rs. 40-50 crores during the past ten years or so, which is about 3 to 4 percent of the total average annual output of auto components. With the projected annual growth rate of about 15-20% in the production of auto-components, it would seem that the exports may not exceed a modest value of Rs. 100 crores or so by 1990-91. Thus a very serious effort will be needed to close the increasing gap between the exports & imports of auto components.

According to TDA's Supply Study (TDA, 1988-89), the major markets till 1982-83 were West Asia, Africa, South East Asia, West Europe & America in that order. During 1985-86 this order underwent a change and Africa followed by West Europe, West Asia and South East Asia emerged as major importers of Indian Auto Components. As things stand at present, Africa may continue to be the biggest market for India but the size of this market, compared to that of large volume markets of U S A FRG and other European Countries, is insignificant. If, therefore, the auto ancillaries, wish to make a real impact on the export market, they will have to look for more bountiful markets, which in turn will demand a sustained export drive over the next few years. The Indian manufacturers of auto components, will do well to bear in mind that they will have to counter fierce competition in these markets from countries such as South Korea, Italy, Mexico, Brazil etc, which are already well established there. A long term export plan would, therefore, need to be worked out so as to ensure that through realignment of capacities; appropriate fiscal concessions; and high quality production of international standards, a substantial annual growth of 20-25% can be achieved in exports over the next few years.

The small scale sector plays a significant role in building exports of simple auto components, and if their example can be followed by the organized sector by building exports of more complicated parts, the overall share of exports from the indigenous automotive parts industry can be raised to a respectable level during the next decade or so.

Technology Upgradation

High technology is the backbone of the Auto parts Industry. From the very beginning, foreign collaborations for technology transfer were liberally sanctioned. Today, every auto part manufacturer has technology support from one or the other country. In their 1984 submission to the Development Council, the ACMA had listed as many as 120 technical collaborations for atleast 44 major products then in production. Table 19 shows a typical list of the nature & extent of technological dependence. The automotive sector including the auto ancillaries group operates with both simple and sophisticated technologies. Hitherto, vehicle

Table 19: Technology Collaboration in Selected Auto Parts in 1984

Component	No. of Units in prodn.	No. of Collaboration	Countries Concerned
Pistons	7	4	W. Germnay UK
Gaskets	3	3	Denmark UK and USA
Engine Valves	5	4	UK & West Germany
Corburettors	7	3	France, Italy & Switzerland
Radiators	7	2	W. Germany
Bimetal Bearings	5	4	USA, Japan & UK
Starter Motors	4	4	UK & USA
Generators	4	4	UK
Spark Plugs	2	2	W. Germany
Clutch Assembly	7	8	Australia, W.Germany USA, UK & Japan
Gears	18	2	Italy & W.Germany
Axle Shafts	7	2	UK & USA
Oil Seals	3	2	UK
Wheels	2	1	UK
Shock Absorber	3	3	UK, USA & West Germany
Brake Linings	4	4	UK, USA
D.B.Instruments	3	3	UK, & W.Germany

Note : In a no. of cases more than one unit utilizes the technology obtained from a foreign manufacturing firm.

of a simpler nature and include generally rubber and plastic components, diecast parts, auto locks, electric horns, chasis and axle parts, oilseals, cylinder cases, forgings etc. According to the Annual Report of the Ministry of Industry, (Deptt. of Industrial Development, 1988), the number of small scale units of all types was 15.92 lakhs at the end of the third year of the Seventh Five Year Plan. Small scale units producing auto parts (6000) are thus less than 1% of the total number of small scale units. Auto parts units in the small scale sector are largely concentrated in Punjab, Haryana, Maharashtra & Karnataka. The technology level in the small scale units is however, not on par with the units operating in the organized sector and calls for further improvement to make them more efficient. These units also suffer from several technological weaknesses particularly in the areas of R & D and testing facilities, tool room services, modern equipment and machinery as well as specialized services like physical and chemical testing, annealing,normalizing, shot blasting etc. A large number of small scale units are one-man shows and, therefore, their investment is rather small, which places a lot of basic high cost equipment & testing facilities out of their reach. In an effort to improve the competitive strength of the small scale sector, the government has provided certain service facilities at important regional centres. These include a Central Tool Room, a Tool Design Institute, Testing Centres etc. Despite all these facilities, sickness within the small scale sector, too has grown. According to the Ministry of Industry report, out of a total credit of Rs. 9,815 crores, almost 16% was locked up in sick small scale Units. What is true of small scale sector, in general, also applies to small scale units manufacturing auto components. Government has taken several steps to resuscitate such units, but these efforts did not seem to have borne much fruit. Despite all its problems & deficiencies, the small scale auto parts units have displayed remarkable tenacity capturing a fairly large share of both the indigenous and export markets. The ancillary units in the small scale sector have a grouse against the automotive industry, in general, for their lack of promotional efforts and encouragement to the ancillaries. "The automotive industry takes small scale ancillaries for granted and do not give us even a fair price for the components we are supplying them. Is this not amounting to exploitation"? (Times of India, 1988) complained one of the small scale entrepreneur. This may not be true of the entire small scale sector manufacturers but is certainly indicative of a general feeling amongst them.

The Malaise of spurious parts :

Trading in spurious component parts has become the bane of the manufacturers of genuine auto parts, particularly in the replacement markets. The practice has been branded as 'a menace of the first order' by ACMA. Some others have termed it as "the incipient cancer'. These reactions from the auto component producers in the organized sector are understandable considering the fact that the trade in spurious parts has assumed enormous proportions and seriously affects the image of the autoparts sector, in general. According to an ACMA commissioned study in 1984, the volume of trade in sub-standard and spurious parts was as high as Rs. 500 crores per annum, which is almost 42% of the total traded value of auto parts. Since the profit margins in the case of spurious parts are exceptionally high, the trade in such parts has attracted a large number of unscruplous people. The flow of sub-standard parts is, sometimes, the handiwork of those entrepreneurs who, due to lack of adequate skills and technology, are unable to produce components of acceptable standards. They often find themselves loaded with sub-standard items and to reduce their losses, offer these at attractive prices to the auto part dealers.

The sheer size of the trade in spurious parts has serious implications at all levels including the automotive industry and the society at large. It has been estimated that at least 10% of automobile accidents can be attributed to spurious or sub-standard parts, resulting in an estimated 2000 deaths and 10,000 human injuries every year (Business World, 1986). Since a good portion of the trade in spurious parts is in the black, it causes heavy losses to the exchequer in the form of tax evasion. The damage caused to the nation's image as a reputated genuine part manufacturer is, however, beyond any quantification. The concern of the auto part manufactueres has, therefore, rightly reached the level of a perceived threat to their very existence. With heavy investments in their enterprises, if someone else drains away the profits, it is bound to become a matter of serious concern. ACMA has raised the issue, from time to time, in several forums and also approached the Government with certain suggestions for legislative and fiscal measures, with a view to curb the evil, but apparently without much success. The nuisance continues to grow

unchecked and shows no signs of abating. Apparently the suggestions of ACMA have not found favour with the authorities because of their wider implications. Since the roots of the problem lie in the greed of a section of the industry, perhaps, the solution cannot be found in the mere enactment of new laws. An awareness programme in the form of a high pressure campaign against the pernicious practice of trading in counterfeit parts can perhaps lead to more positive results. If this is further backed by stiff penalties, the menace can certainly be contained to the satisfaction of the auto ancillary industry. The problem is undoubtedly a serious one and calls for a full appreciation of its all round unfavourable impact on the society in general and the industry in particular. The Managing Director of an auto-ancillary unit has suggested the launching of an intensive campaign against spurious parts for a period of five years (Financial Express, Nov. 30, 1988). According to him the expenditure incurred on such a campaign will more than pay off and the industry can recover its cost in the sixth year itself, in addition to the service which it will have rendered to the public at large. At the same time he also points out to the need for the industry to ensure the availability of genuine spare parts, at the right place, in right quantities and at the right price. Without this no measure, legislative, fiscal or otherwise, can succeed.

Standardization and Commonalization

Despite an unprecedented rise in the demand for auto components and heavy investments in plant and processes the auto parts industry has not been able to achieve economies-of-scale. This is largely due to the fragmentation of capacities as a cause and to, some extent, as a consequence of non-standardization of parts. In almost all cases, the number of licensed units seems to be more than what the current demand can sustain. (Table 22.)

Table 22 : No. of licencedunits for some selected Units

Component	No. of licensed units	No. letters of intent issued	No. regis tered with DGTD	No. regis-tered with SIA
1	2	3	4	5
Pistons	6	4	–	19
Carburettors	8	6	3	12
Filters	9	1	3	1
Starter Motors	7	7	4	3
Clutch Plate	14	3	4	2
Radiators	7	2	–	10

A world Bank study on industrial licensing has also made similar observations and pointed out that the indigenous component industry has in some cases 3 to 4 times the number of units which can be commerically viable at the current low volume production. (PTI,1987) Although the government is aware of the over capacity spread over a large number of units and has taken certain steps to alleviate the problem, the situation remains unchanged primarily because of the lack of non-standardinzation of automotive components. This is true of all segments of the automotive industry, be it LCVs, Cars, Jeeps, 2 wheelers or 3 wheelers.

While the aggregate demand of auto components should be enough to achieve scale economies in a small number of units of the auto component industry, standardization would also help to reduce unit production cost and improve quality of the product to render domestic auto components more competitive in the international markets. In Japan, standardization of components has been used as a means to make the automotive industry economically viable (PTI, 1987). It is, therefore, surprising that similar component standardization was not insisted upon when foreign collaborations were being considered, mostly from Japanese automotive companies. Notably in Australia and Indonesia, the Japanese companies have been pressurised into employing standardized components, with a view to avoid fragmentation of capacities and achieving lower production costs. The Development Council (1985-86) in their report have also emphasized the need for standardization & commonalization of auto components and parts. Some years back a luke warm attempt was made to initiate such an exercise which resulted in the identification of 30 simple items for commonalization. During the exercise, the Committee on Commonalization came across a number of problems and constraints, the main ones being :

(*i*) unwillingness of vehicle manufacturers making auto components/parts in house, to participate in the commonalization exercise and

(*ii*) difficulties in sharing information on designs etc. of components protected by specific stipulations in the technical collaboration agreements.

Despite these difficulties, the need for standardization remains paramount and must be pursued with greater vigour. The committee set up earlier by the Industry Ministry can be revived and entrusted afresh with the task of not only identifiying such items for commonalization but also to see that these are brought into use without delay.

Standardization must go apace. Its importance does not brook any delay. The problem should be viewed as part of a long term policy. Metal based industries, which include, the automotive industry, have greater chance to become internationally competitive during the nineties on the basis of domestic resource cost estimates. A recent study has suggested that the current bias in favour of chemical industries needs to be reversed to encourage metal based industries if some of the avowed objectives of greater employment, regional balance, international competitiveness etc have to be achieved (Kelkar and Rajiv Kumar, 1990)

Table 23: Estimated Automobiles and Automotive Component Production (1990-94) ('000)

Year	Cars	Cross Country Vehicles	LCVs	M/HCVs	Total	2 Wheelers	3 Wheelers	Auto Components (Rs. Crores)
1990-91	200	46	70	80	150	1900	100	1.780
1991-92	220	53	80	85	165	2100	115	2,030
1992-93	240	60	90	90	180	2300	130	2,310
1993-94	260	70	105	95	200	2500	150	2,630
1994-95	280	80	115	100	215	2700	170	3,000
Total	1200	309	460	450	910	11500	665	11,750
2000 AD	450	120	175	125	300	4500	250	–
Average Annual growth over 1990 (%)	9.0	14.0	15.0	5.8	10.0	9.0	14.5	–

Future Growth

Different people view the future of Indian auto parts industry differently. While some feel that the industry has vast potential and its future is really very bright, others consider that it has still miles to go. Yet a few others see nothing but darkness in the path of the industry's future growth. The truth, perhaps, lies elsewhere.

There is no doubt that the industry's growth is intertwined with that of the automotive industry, but besides that it also depends on a few other interlinked issues, some of which are :

a) Modernization/upgradation of its technology

b) Standardization of parts and consolidation of capacities

c) Improving productivity, quality and cost effectiveness in both the indigenous and export markets.

d) Concerted R&D efforts.

The industry has grown into a massive Rs. 800 crores group in a matter of few years. Starting sometime, in the late fifties, it has now gathered enough moss to reach a respectable level of investment, production, exports and employment by the end of the Seventh Plan, as the following figures reveal :

Total Investment in 1988 - Rs. 800 crores

Total Production in 1988 - Rs. 1262.50 crores

Total Employment in 1988 - Rs. 50,000 plus

Total Exports in 1988-89 - Rs. 95 crores

The Sub-group appointed by the Eighth Plan Working Group on Road Transport for Eight Five Year Plan has estimated vehicle production for the next five years, on the basis of the average annual growth rate during the 7th Five Year Pan. These projections are shown in Table 23 along with the estimated value of production of auto parts. Based on these demand projections, the estimated requirements of certain selected auto components are given in Table 24. Table 25 shows the growth in the vehicle population during the past three decades, indicating a uniform rate of yearly increase of about 15%. More vehicles on the road should lead to an expansion of the trade in replacement parts creating further opportunities for the industry to expand. It will be seen that out of the fourteen items listed, capacity additions would be required urgently in the case of 12 components to meet the projected demands for these items during the 8th Five Year Plan. It is estimated that this may call for an investment of more than Rs. 1000 crores (Planning Commission, 1989). This picture, more or less, reflects, the capacity needs for most other auto parts currently in production in the country. Greater indigenization, under the phased manufacturing programme, by the vehicle industry should also provide necessary stimulus to the auto component industry. It is well known that Maruti Udyog has already planned a definit import substitution

Table 24: Demand Projections for Selected Auto Components 1990-94 ('000)

Component	Demand Projection 1989-90	Prodn. 1987-88	% Achievement	Demand Projection 1984-85	Installed Capacity 1988-89	Additional Capacity required %
Pistons	12774	6795	53	17,300	9091	90
Gaskets	95903	91665	96	1900000	166000	14
Engine Valves	19598	11299	58	22100	18650	18.5
Carburetors	2391	1721	72	3500	3026	16
Radiators	790	285	36	950	429	121
Starter Motors	618	400	65	750	846	11
Generators	623	385	62	760	878	13
Spark Plugs	12930	12358	96	28000	14950	87
Clutch Assembly	815	464	57	1300	1029	26
Gears *	37656	10192	27	66,000	21786	205
Oil Seals	33974	16728	49	93000	20318	357
Wheels	2865	2124	74	3600	2670	35
Shock Absorber	8390	4935	59	15600	7055	121
Brake Lining*	11,526	7289	63	16000	13450	19
D.B.Instts.	4950	–	–	8500	5033	69

** Tonnes.*
Source: ACMA and DGTD.

Table. 25 : Vehicle Population 1951-1988

Year	Nos.	% rise annually
1951	306313	
1961	664475	11.6
1971	1865315	18.1
1981	5173013	17.7
1982	5844493	13.0
1983	6718539	15.0
1984	7759351	15.5
1985	9006000	16.1
1986	10481138	16.4
1987	12346545	17.8
1988 (E)	13486190	9.2

Source: ACMA and AIAMA.

programme and so have most of the other vehicle manufacturers, including the LCV units. Answering a question in the Parliament on 30.11.88, the Minister indicated that in the passenger car sector 66% indigenization has been achieved by the Maruti in 1987-88, 38.6% by Contessa Classic, and 37.25% by Premier 118 NE. In the LCV sector the indigenization level reached by the new units varies from 40% to 57%. Even more satisfying results have been achieved by the two-wheeler group where the indigenization ranges between 71.2% and 90%. This augurs well for the auto parts sector which can now gear up its capacity to adequately meet the growing challenge of indigenization.

After the initial success achieved by the Maruti in exporting vehicles to some of the European markets, it is now making efforts to sell Maruti 800 and Gypsies in the French and Australian Markets. There are also suggestions of Maruti's Japanese collaborators, Suzuki, vacating the European markets in favour of Maruti (PTI, 1989). If all these come true and the export efforts of Hero Honda and Lohia Machines now on the way also materialize, it should provide a further impetus to the auto ancillaries. Thus, a very good potential (both domestic & international) exists for the growth of the auto industry and if organized well to dovetail its capacities with the growth prospectus of the vehicle industry, the auto parts sector may well be in for another minor boom.

All these factors i.e., expansion of vehicle production, projected growth in exports, fast increasing rate of indigenization and improved prospects for trade in replacement parts etc. are sure pointers to a bright future for the auto-ancillaries. However, all these may not ensure the kind of future the auto parts industry may look forward to. It will have to put in a lot more effort to realize its full potential. The foremost need for the industry is to try and become internationally competitive. This holds true for both the automobile vehicles as well as for the component manufacturers. Achieving this, would however, demand an all out endeavour to overcome the current weaknesses in such areas as product quality, standardization of components and R&D facilities. Manufacturing quality components for the new generation vehicles calls for adequate tooling facilities, reliable testing equipment and a state of art technology. Standardization of components is essential to avoid fragmentation of capacities and also operating at below economic levels. Similarly, a planned programme for the

upgradation of technologies is equally important. Access to modern technologies does not seem to be a problem but its effective use. This may call for adequately trained personnel to ensure cost effective operations and quality products. In all these areas close co-operation between the original equipment manufacturers and the auto component units as well as the Govt. is most essential to achieve the goals. Continuous dependence on foreign sources for design and technology which seems to be the current fad with most of the component manufacturers does not seem to be the right strategy for building a sound future for the industry. It must take urgent steps to set up indigenous R&D facilities of higher order than are available at present. The available R&D facilities such as that of the Automotive Research Association of India must also be put to full use and exploited to their full capacity by the industry. The development of right quality materials without affecting the durability and sturdiness of the component/vehicle is another area where R&D efforts need to be focussed.

Auto component industry has always had a very crucial role to play in the development of the Indian automotive industry. Indeed, without its development along right lines, the pace of planned indigenization may never reach the anticipated levels and the export capability of the entire industry may continue to suffer. On a hind sight, one may say now that the development of automobile industry has gone the wrong way. Instead of developing a strong component industry mainly, with an eye on exports to established vehicle manufacturing countries, we went in for the establishment of the manufacture of new model vehicles and then made attempts at their indigenization with an inadequate and weak base of an auto component industry. Though the order of things cannot now be reversed, it is still open to us to change the locale of our industrial policy thrust. A clear cut automobile policy is long overdue. Without such a policy, our efforts to hasten the development of the automotive sector may go haywire as, a piece meal approach to the problems of the industry may not take the industry very far on the road to success.

Problems of the Industry :

From time to time, several suggestions have emanated from the ACMA, the apex body of the auto-part manufacturers. While some of these suggestions/ recommendations are in the nature of fiscal concessions, others relate to licensing policy, import of technology and facilities for import of special materials etc. Briefly, some of these are :

a) The auto parts industry should be given similar freedom to import such of the indigenously available raw materials of which the quality standards do not meet their requirements, as allowed to the vehicle manufacturers.

b) The customs duty on raw materials and tooling permitted to be imported should berationalised by extending the same duty concessions as are given to the vehicle manufacturers for the import of auto parts. Currently the duties levied have an inflationary impact on the cost of manufacture of related products.

c) De-canalization of raw material imports.

d) Import of replacement parts for imported CNC & other special purpose machinery at concessional duty rates applicable for mechanical spares.

e) Rationalization of duty rates on imported machinery both for capital goods needed for new projects as well as for modernization. Placing special steels not manufactured in India, under OGL as also those items for which the current domestic production is inadequate.

f) Concessions in respect of cash compensatory support, entry price support, product liability insurance, PRS scheme, export incentives etc.

There is no doubt that some of these suggestions deserve attention. The tendency to demand fiscal concessions is unfortunately often a cover for inefficient operations and poor productivity management at home. It may be worthwhile for the industry to give a hard look at its working, set its house in order and then speak from a position of strength to demand concessions which may not, then, be difficult to secure.

Conclusion

Indian Auto Component Industry originated in the early fifties and has since developed into a strong segment of the engineering industry. Its technology base has been strengthened through foreign technical collaborations as a result of the policies pursued over the past thirty years. The value of its output during 1989-90 reached an estimated figure of Rs. 1560 crores and is expected to touch Rs. 2000 crores during 1990-91. It is a fast growing industry; the annual growth rate ranging between 15% and 20% barring a few years. The industry caters to both the high-tech based sophisticated parts as

well as for simple standard items used as original equipment.

Being linked to the automobile industry, its capacity utilization over the years has been fluctuating according to the demand variations from the automobile producers. Overall, the capacity utilization has varied from as low as 20% in some products to a maximum of 132% in a few others. The capacity utilization in the industry remains below the average achieved by the total manufacturing sector. The major cause of the low capacity utilization is found to be the fragmentation of capacities, i.e. several units producing the same item. Lack of standardization of components has also contributed to the poor capacity utilization in the component industry. The industry, however, holds unfair competition from small scale units also as a contributory factor for underutilization of capacity, in the organised sector.

Productivity analysis based on the data from 24 selected auto component units presents a somewhat disturbing picture. Barring a few units, the impression obtained from the data is that of a general lack of consciousness about productivity. The ratios show wide variations across the units, particularly in the case of employee productivity. Employee costs are high, labour productivity is low, and earnings to conversion cost ratio needs improvement. Profitability is poor in some cases despite good sales performance. The conclusion is inescapable that productivity needs a great deal of improvement in order to make the industry competitive and efficient.

Imports of auto parts have been growing rapidly over the years whereas exports have shown only a marginal rise. The gaps between the values of imports & exports are increasing every year. This calls for concerted efforts to penetrate into new high volume export markets. This can be achieved only if the industry adopts 'high quality' as an objective of its performance. For the full realization of its vast potential for growth all available export avenues must be exploited to the maximum for which a medium to long term strategy has to be arrived at by the automotive industry.

Considering the long term national economic interests of the country, the automotive component industry must plan its growth on sound lines. For this, continuous upgradation of technology, its optimum exploitation and development with continuous indigenous R & D efforts are essential. Several areas/components for foreign collaborations have been identified. It is for the industry to take advantage of the facilities offered, keeping also the national interests in view.

Small scale sector has been playing an important role both in meeting the indigenous demand for auto components as well as in their exports. Instead of treating it as an unfair competitor, the organised sector of automotive industry will do well to use them to its advantage. Small scale units are there to stay and if strengthened with right kind of market strategy, and supported by technological back up, can supplement the production capabilities of the auto industry to the advantage of all.

Linked to the small sector is the unhealthy practice of trading in 'spurious/counterfeit' components in the replacement market to the disadvantage of genuine component manufacturers. Despite all the noise made by the organised sector from time to time the trade in spurious components continues and is bringing in a bad name to the entire industry. Stringent financial & legislative measures alone are not sufficient to overcome this evil practice. The best means to counter the threat, it appears, would be to launch a regular and intensive awareness campaign by the component industry itself at least for a period of next five years, ensuring at the same time regular supply of right components in right quantities and at the right price.

The future of the components industry, despite all its current disabilities, appears to be promising. To exploit its full potential, the industry must work out a long term plan and consider how best it can improve its competitiveness through better quality; greater emphasis on R & D; standardization of components; rationalization/ consolidation of capacities, regular productivity audits and better utilization of the available resources. The direction for the industry is clear. Instead of looking towards the government to let if off the hook, the industry may find it advantageous to rely on its own strengths to move on the path of prosperity.

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Engine Valves Ltd.,	1.67	1.71	1.24	1.66	1.80	—
Goetze	–	1.22	1.31	1.45	1.35	1.39
India Pistons	–	1.30	1.26	1.28	1.20	1.35
Shriram Pistons	1.08	1.08	1.13*	1.11	1.03	
Escorts Ltd.	–	1.21	1.1	1.16	1.20	1.20
India Radiators	1.35	1.24	1.20	–	–	–
Autometers	–	–	–	–	1.39	1.38
Yenkey	1.15	0.98	1.21	1.36	–	0.85
Premier Instruments	–	–	–	–	1.41	1.41
Lucas TVS.	–	1.31	1.26	1.22	1.30	1.30
Best & Crompton	–	1.02	1.01	0.98	1.03	1.04
Sahney Paris Rhone	1.35	0.98	–	1.12	0.84	0.90
MICO	–	1.45	1.43	1.50	1.55	1.78
API	0.98	1.02	1.07	0.46	1.32	–
Clutch Auto	–	0.90	1.24	0.76	0.92	1.35
Bharat Gears	–	1.18	1.09	1.25	1.13	1.23
Gajra Gears	–	1.1	1.2	1.04	1.3	1.18
Ramon & Demm	–	0.69	1.02	0.82	0.69	0.81
Perfect Circle Victor	–	1.03	1.19	1.22	1.35	1.4

Annexure - 3 Percentage of Wages & Salaries to Sales

Companies examined	1983	1984	1985	1986	1987	1988
Engine Valves Ltd.	18.9	18.6	19.2	17.4	16.5	
Goetze	–	23.8	24.9	23.6	23.8	23.7
India Pistons	–	31.2	29.8	28.7	29.1	23.9
Shriram Pistons	14.4	15.2	13.2	15.1	17.5	–
Escort Ltd	–	9.6	10.8	11.0	10.4	10.4
India Radiators	11.0	13.3	14.2	–	–	–
Autometers	–	–	–	–	21.3	19.6
Yenkey	30.7	38.5	30.1	36.9	–	32.1
Premier Instruments	–	–	–	–	13.6	13.4
Lucas TVS	–	15.2	15.8	16.8	15.1	13.9
Best & Crompton	–	18.2	16.8	18.6	9.9	8.9
Sahney Paris Rhone	12.1	15.1	–	15.6	21.1	20.8
MICO	–	26.7	27.6	24.7	22.3	21.0
API	27.4	29.1	26.0	43.0	24.4	–
Clutch Auto;	–	10.7	9.9	16.1	16.9	11.6
Bharat Gears	–	16.7	15.6	14.4	15.9	16.0
Gajra Gears	–	21.5	19.7	19.8	19.2	18.9
Ramon & Demm	–	30.4	26.5	27.0	30.3	34.0
Perfect Circle Victor	–	12.5	12.5	13.3	12.8	11.4
Talbros Automotive	–	18.1	16.5	17.3	19.2	18.0
Hindustan Ferodo	–	21.8	21.8	19.4	23.3	20.6
Wheels India	8.8	9.2	7.8	7.25	7.3	–
Sankey Wheels	13.6	15.4	12.2	13.7	11.5	–
Automotive Axles	–	–	12.8	15.8	10.7	6.9

Annexure - 4 Profit Contribution Ratios

Companies Examined	Profit to Conversion Cost						Profit to Sales %					
	1983	1984	1985	1986	1987	1988	1983	1984	1985	1986	1987	1988
Engine Valves Ltd.	0.16	0.12	0.13	0.18	0.18	–	6.3	7.1	6.5	6.7	6.7	–
Goetze	–	0.22	0.36	0.38	0.36	0.35	–	12.7	19.818.9	15.9	16.7	
India Pistons	–	0.15	0.06	0.07	0.02	0.04	–	7.4	2.7	3.8	0.85	2.01
Shriram Pistons	0.02	0.02	0.06	0.06	(0.006)	–	1.89	1.32	4.36	2.08	(0.46)	–
Escorts Ltd.	–	0.13	0.20	0.09	0.12	0.11	–	2.9	4.9	2.2	2.8	2.4
India Radiators	0.06	0.03	0.005	–	–	–	2.05	1.18	0.17	–	–	–
Autometers	–	–	–	–	0.01	0.21	–	–	–	–	0.5	7.9
Yenkey	0.05	(0.28)	0.02	(0.72)	–	2.6	(1'7.4)	1.10	()43.4)	–	(20.3)	
Premier Instruments	–	–	–	–	0.16	0.21	–	–	–	–	4.71	6.77
Lucas TVS	–	0.31	0.26	0.22	0.30	0.31	–	11.2	10.3	9.1	11.1	10.8
Best & Crompton	–	0.03	0.02	(0.008)	0.001	0.014	–	2.36	1.50	(0.66)	0.09	1.15
Sahney Paris Rhone	0.13	(7.6)	–	(4.2)	(19.2)	(19.0)	0.36	(0.48)	–	(0.39)	(0.52)	(0.46)
MICO	–	0.13	0.16	0.16	0.16	–	5.6	7.3	8.0	7.0	6.5	
API	(0.15)	(0.06)	0.09	(0.23)	(0.06)	–	(5.6)	(2.6)	3.2	(13.5)	(1.8)	–
Clutch Auto	–	(0.25)	(0.08)	(0.65)	(0.61)	0.09	–	(10.3)	(3.1)	(35.7)	(35.1)	3.6
Bharat Gears	–	0.08	0.06	0.08	0.09	(0.09)	–	6.6	5.6	6.5	7.2	(4.2)
Gajra Gears	–	(0.21)	(0.08)	0.04	(0.08)	0.013	–	(11.0)	3.6	1.9	(9.6)	0.55
Raman & Demm	–	(0.58)	(0.24)	(0.35)	(0.38)	(0.66)	–	(39.1)	13.9)	(19.9)	(21.1	(41.9)
Perfect Circle Victor	–	(0.29)	(0.005)	0.027	0.06	0.17	–	(13.1)	(0.20)	1.2	2.7	12.4
Talbros Automotive	–	0.04	0.07	0.11	0.05	0.08	–	1.65	2.75	4.15	2.3	3.3
Hindustan Ferodo	–	(0.27)	(0.50)	(0.34)	(0.24)	(0.47)	–	(8.2)	(16.0)	(9.4)	(8.2)	(14.8)
Wheels India	0.39	0.15	0.16	0.17	0.15	–	8.3	3.4	3.2	3.7	3.4	–
Sankey Wheels	0.05	0.0	(0.003)	–	(0.28)	(.076)	1.47	0.0	.07	–	(6.73)	(1.47)
Automotive Axles	–	–	(0.35)	(0.46)	/90.36)	(0.31)	–	–	(30.5)	(35.2)	(15.4)	(11.6)

Annexture - 5 Employee Productivity Ratios

Companies Examined	Profit per Employees (Rs. lakhs)						Sales per Employee (Rs. lakhs)					
	1983	1984	1985	1986	1987	1988	1983	1984	1985	1986	1987	1988
Engine Valves Ltd.	–	–	–	–	–	–	–	–	–	–	–	–
Goetze	–	0.097	0.184	0.196	0.170	–	0.76	0.93	1.04	1.14	1.01	
India Pistons		0.064	0.028	0.04	0.009	0.032		0.009	0.010	0.010	0.011	0.016
Shriram Pistons	–	–	–	–	–	–	–	–	–	–	–	–
Escorts Ltd.	–	0.067	0.121	–	–	–	–	2.29	2.49	–	–	–
India Radiators	–	–	–	–	–	–	–	–	–	–	–	–
Autometers	–	–	–	–	–	–	–	–	–	–	–	–
Yenkey	–	(0.3)	.009	0.81	–	0.38	–	0.78	0.81	1.87	–	1.87
Premier Instruments	–	–	–	–	–	–	–	–	–	–	–	–
Lucas TVS	–	0.22	0.20	0.20	0.31	0.37	–	1.96	1.93	2.24	2.82	3.5
Best & Crompton	–	–	–	–	–	–	–	–	–	–	–	–
Sahney Paris Rhone	–	–	–	–	–	–	–	–	–	–	–	–
MICO	–	–	–	–	–	–	–	–	–	–	–	–
API	.05	0.026	0.04	(0.106)	–	–	0.9	0.99	1.2	0.79	–	–
Clutch Auto	–	(0.13)	0.48	(0.40)	(0.39)	0.05	–	1.3	1.5	1.1	1.09	1.5
Bharat Gears	–	–	–	–	–	–	–	–	–	–	–	–
Gajra Gears	–	–	–	–	–	–	–	–	–	–	–	–
Raman & Demm	–	–	–	–	–	–	–	–	–	–	–	–
Perfect Circle Victor	–	–	–	–	–	0.26	–	–	–	–	–	4.0
Talbros Automotive	–	0.013	0.026	0.06	0.022	0.05	–	0.8	0.93	0.96	0.96	1.6
Hindustan Ferodo	–	0.15	(0.29)	(0.18)	0.14	0.39	–	1.81	1.81	1.89	1.7	2.6
Wheels India	–	–	–	–	–	–	–	–	–	–	–	–
Sankey Wheels	–	–	–	–	–	–	–	–	–	–	–	–
Automotive Axles	–	–	–	–	0.30	0.52	–	–	–	–	1.96	4.5

Sports Goods Industry and Productivity

J. P. Sharma

India is an young entrant in sports goods industry. As on 1987-88, the estimated capacity of the industry was in the range of Rs. 153.55 crores. However, the production being in the range of Rs. 95.87 crores, the capacity utilization in the industry was as low as 62 per cent. The seasonal character of the industry has, to a large extent, been responsible for the poor capacity utilization in this small units dominated sector. Other major contributory factors are problems relating to raw materials, skilled labour, availability of finance, lack of demand etc., according to this review.

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Production which is conceived as transformation of inputs into output is taken as an Index of progress. A mere increase in the number of industrial units and sudden enhancement of amount of investment in the industry cannot beget progress unless they ultimately result in a steady increase in production. However, the study of production is important, for it gives an insight into the effective utilisation of productive resources and economic health of the units and the industry. Though some studies have been undertaken on production in small-scale industries in the country, not much in-depth work has been undertaken about the sports goods industry. The only intensive study on the production aspects of the industry has been by the Indian Institute of Foreign Trade in 1983-84.

The growth of an industry can be gauged in terms of trends in its production and productivity. An industry which exhibits increased production would be able to absorb rising costs, face competition in both the domestic and international markets and, thereby, succeed in expanding its markets for its products. It can generate surpluses to meet the expansion programmes also.

The sportsgoods industry seems to be presently facing many problems at different levels calling for immediate action, particularly when it is poised for a high turnout in its output in the wake of the fillip received by the setting up of Process-cum-Product Development Centre in the country under the United Nations Development Programme. Apart from low quality, the important constraints in market expansion identified are the high prices of sports products coupled with low purchasing power (Indian Express, 1984). Since it is found that the demand for sportsgoods is highly price elastic, an important policy indication that follows is that the market for sportsgoods could be expanded by a gradual reduction in its price. Price reduction is possible only when the industry is capable of sustaining a rising productivity

level. The task, then, is not merely tracing productivity trends but also to identify factors that might support a continuous rise in production and productivity.

An attempt is made here to examine:—

(*i*) trends in production in the sportsgoods industry (region and item-wise) and installed capacity;

(*ii*) under-utilisation of capacity and the reasons thereof; and

(*iii*) cost structure.

Region-wise Production Trends

The industry's region-wise installed capacity and production is given in table 1

Table 1 : Region-wise Installed Capacity and Production of Sportsgoods in India. (Rs. Lakhs)

Centre	Capacity *	Production *			
		1980-81	1982-83	1985-86	1987-88@
Jallandhar	5842.3	2400.1	3240.3	4065.3	4471.8
Meerut	4472.0	612.7	734.8	1872.5	2059.7
Delhi	1205.4	392.1	444.1	647.2	711.5
Calcutta	922.5	508.2	584.4	595.7	655.2
Bombay	791.0	350.0	487.3	541.4	595.5
Moradabad	392.4	146.4	139.3	166.3	182.9
Agra	298.5	98.7	63.0	61.3	67.4
Ludhiana	205.0	91.7	126.3	148.5	163.3
Patna	201.0	11.5	22.7	20.8	22.8
Malerkotla	125.8	24.0	31.2	38.2	42.0
Batala	121.6	61.8	61.4	57.7	50.0
Allahabad	113.8	27.2	47.4	62.2	68.4
Madras	112.0	52.8	68.0	79.3	87.2
Jammu	111.8	50.5	71.7	94.6	104.0
Srinagar	95.5	42.3	51.3	84.6	93.0
Hyderabad	90.0	52.0	56.5	57.3	63.0
Varanasi	81.8	34.1	41.5	52.7	57.9
Poona	77.0	29.8	38.7	46.5	51.1
Amritsar	51.0	27.8	32.8	11.7	12.9
Lucknow	36.2	10.3	14.3	17.2	18.9
Rampur	5.0	4.3	4.0	4.5	4.9
Kathua	3.5	1.6	1.7	3.0	3.3
Total	15,355.1	5030.3	6362.6	8728.4	9587.0

*Source: - * Indian Institute of Foreign Trade (1984)*
@ Association of Sportsgoods Manufacturers in various centres and District Industries Centres.

Out of the 22 centres of production the highest contribution during the period is made by Jallandhar; more than 50 per cent of the total production of the industry. Meerut, the second major centre, contributes about 21 per cent of the industry's production. Delhi, Calcutta, Bombay and Moradabad are some of the other important centres. The lowest contribution is made by Kathua in Jammu region. It may be noted that production of almost all the centres has increased over the period. The sudden jump in production of Meerut during 1982-83 and 1985-86 was the result of the diversion of inter-state sports business from Jallandhar towards Meerut because of disturbances in Punjab.

Agra, Amritsar and Batala have registered substantial decline in the value of output over the period under reference. In Amritsar and Batala the industry has suffered due to politically disturbed conditions. Agra based units have been facing raw-material bottlenecks which got compounded by the migration of skilled labour from the city. Nevertheless, the total production has been on the increase. The favourable government policy towards sports and leisure time activities particularly after Asiad 1982 has been responsible for this growth.

Out of the total capacity of Rs. 15,355 lakhs, the actual production was Rs. 9,587 lakhs during 1987-88, indicating the capacity utilisation in the industry to be of the order of 62%. Underutilisation is in all the centres of production studied and there is, thus, substantial scope for increasing the production. The rampant underutilisation of production capacity is due to reasons like raw-material availability, scarcity of skilled labour, shortage of finance and demand constraint.

Itemwise-Production Trends

The number of items of sportsgoods and accessories produced in India is quite large. Out of around 1000 items identified by the Survey of Administrative Staff College of India, Hyderabad (ASCI, 1972), India is presently manufacturing around 200 items both for indoor and outdoor activities (Working Group Report, DCSSI, 1987, p. 9). The production in India is concentrated in just 20 major items which are mainly traditional ones.

It is clear from Table: 2 that India is producing a wide range of sports equipments. 'Inflatable Balls' is the most important produced in India followed by soft leather goods (e.g. protective equipments for cricket, hockey, etc.) and 'Cricket Bats'. The reasons for the continuous

positive trend in the production of 'Inflatable Balls' may be bulk order from Russia for Indian made 'Inflatable Balls' and increasing demand in the domestic market (Sports Goods Export Promotion Council, 1984).

Table 2 : Item-wise Installed Capacity and Production of Sportsgoods in India (Rs. lakhs)

Item No.	Capacity *	Production*			
		1980-81	1982-83	1985-86	1987-88@
Inflatable Balls	6727.1	1488.3	1916.3	2625.3	2887.8
Soft Leather goods	1048.4	358.1	570.4	781.4	859.5
Bladders	566.5	187.0	198.4	271.8	298.9
Carrom Boards (incl. Indoor games	612.4	233.4	335.0	459.0	504.9
Sportswear	481.6	190.9	266.4	365.9	402.4
EPNS Soft-wears	454.7	186.0	188.0	257.6	283.3
Cricket Bats	925.8	426.4	546.5	748.7	823.5
Cricket & Hockey Balls	413.6	192.0	232.3	328.3	361.1
Hockey sticks	365.3	193.9	223.6	306.3	336.9
Rackets	457.0	192.8	203.2	278.4	306.2
Rubber & Plastic based Moulded Sports goods	287.7	80.1	138.9	190.3	209.3
Athletic/ Gymanstic/ Weight lifting & Playground Equipments	578.4	286.4	357.3	489.5	538.4
Shuttlecocks	475.4	206.3	253.4	347.2	381.9
Sports Badges & Insignias	130.0	51.1	68.2	93.2	102.5
Sports Shoes & Uppers	604.8	286.7	220.3	318.9	350.7
Badminton (Steel) Rackets	125.8	24.0	31.2	42.5	46.7
Rubber Play Balls	94.0	37.7	51.5	70.6	77.6
Rubber Balloons	255.0	82.3	131.7	180.2	198.2
Air Guns/ Air Rifles	119.7	79.3	91.4	105.2	115.2
Carrom (Wooden)	125.0	77.5	94.5	119.5	131.5
Others	509.0	170.1	246.2	324.1	356.5
Total	15355.1	5030.3	6362.6	8703.9	9582.9

*Source: - * Indian Institute of Foreign Trade (1984)*
@ Association of Sportsgoods Manufacturers in various centres and District Industries Centres.

The share of production of soft leather goods increased from 7.12 per cent in 1980-81 to 8.97 in the total production in 1987-88, thus, showing a growth of 24 per cent. 'Cricket Bats' which was showing a growth of 6 per cent upto 1982-83, increased in 1985-86 to 15 per cent. The production of Cricket equipments e.g. cricket bats and cricket balls, etc. is showing an increasing trend over the last 5-6 years because of sudden spurt in the demand for the cricket items in the domestic market due to cricket craze that engulfed the nation, after India won the World Cup in 1982-83 (Sharma, 1990, P 213). Trend of production in the Carrom Boards (including Indoor games) is showing a positive sign because Indian made Carrom Boards are gaining popularity in Soudi Arabia and UAE.

Under Utilisation of Capacity – Reasons

To analyse the problems and prospects relating to production, it is necessary to examine the state of capacity utilisation in the industry. It may be recalled that in 1987-88 only 62 per cent of Industry's capacity is utilised leaving a large 38 per cent as unutilised. The reasons for under-utilisation were identified through a survey of 120 units spread over major production centres, which was conducted by the author in 1988.

While, some unutilised capacity is inevitable because of the seasonal character of the industry, the sample survey of the industry shows that a large chunk of underutilisation is due to man-made factors. Table 3 summarizes findings of the sample survey regarding the causes of underutilisation.

Table 3 : Reasons for Under utilisation of capacity

Reasons	Percentage of units
Raw materials Problems	73
Labour Problems	60
Financial Problems	35
Lack of Demand	82
Other Reasons	45

Source: Compiled from Questionnaire data.

It can be observed from the table that 82 per cent of the units surveyed considered lack of demand as the main reason for unutilised capacity. Problems in the availability of right kind of raw materials is the other major reason attributed to. The units assigning labour and financial problems as the reasons are fewer in number. Only 35 per cent of the units belonging to the unorganised sector of the industry have found financial constraints as the reasons for unutilised capacity. Seasonal character of the industry and poor quality of products are some of the other reasons causing under-utilisation. A detailed discussion of these various reasons follows:

Problems regarding Raw material Availability

Hurdles in the timely procurement of right type of raw materials at reasonable rates is one of the important reasons attributed to by 73 per cent of the units for

working below capacity. In certain cases, lack of availability of standard quality raw materials precludes the industry from moving into the high quality, high-priced market segments, in the country as well as overseas. Another major problem expressed by the respondent units relates to the inter-state restrictions on the movement of raw-materials. With the result, most of the units in wood based items are working under capacity, because of their dependence on the local markets for the supply of materials which are substandard as well as highly priced. However, some of the units stated that the insufficiency of raw-material was not a problem for them and that they were able to get sufficient material from the market, particularly items of which the state government concerned was a source. But units which depend for the supply of raw materials from other states, which have put restrictions on the movement of items such as Cleft, Cane and Mulberry used in the wood based units, the units are facing considerable difficulties. It is usually the units with low capital investment which are vulnerable and are not able to buy the materials in the open market.

Scarcity of Skilled Labour

Non-availability of labour was cited as one of the reasons for under-utilisation by as many as 60 per cent of the units surveyed. Though plenty of unskilled labour is available in and around the production centres, shortage is felt for skilled labour. Whenever workforce with specialised skills is in short supply, workers take advantage of the situation and frequently abstain themselves from work demanding higher wages or higher advances and consequently the work is hampered. This results in the under-utilisation of capacity. Making training facilities available in different centres of production is likely to help overcome the problem of scarcity of the supply of labour and the idle capacity created on this account (Indian Institute of Foreign Trade, 1984). Presently there are only four training institutes, three in Jallandhar and one in Calcutta.

Financial Problems

Lack of finance is also one of the important reasons attributed to underutilisation of capacity. 35 per cent of the units surveyed stated that there is sufficient demand for their products, but they are not able to expand production due to lack of finance. Lack of finance as an obstacle in increasing production to the level of installed capacity generally relates to the lack of working capital. The funds obtained by them are not sufficient to keep the units in continuous operation throughout the year. It was suggested by a number of units during the survey that liberal loans from banks would help them raise production to higher levels and minimise if not completely eliminate the idle capacity.

Lack of Demand

As is evidenced in the table 3, the most important impediment for the sportsgoods units in raising the actual production to the level of installed capacity is the lack of demand. The industry being of a seasonal character, the shortage of demand in some cases is due to seasonal fluctuations in demand for the products. The sample units expressed that demand for sportsgoods is less during summer and rainy seasons respectively. Similarly, lack of demand may also be due to the fact that goods produced by some units are not of the required quality. Moreover, some units suffer due to lack of adequate publicity for their products, (Indian Express, 1987).

Lack of demand is largely due to the absence of proper planning at unit, industry as well as government levels. The necessary ingredients for appropriate planning to tackle this problem include information on the existing capacity, the actual production, level of demand and future demand projections. But the data on these dimensions are not available with either the Sportsgoods Export Promotion Council, District Industries Centres, the Industry Association and not even with The Development Commissioner (SSI).

Cost Structure

The economic viability of an industrial unit is to a great extent determined by its cost structure. The structure of cost implies the relationship among various components of cost. The advantages enjoyed by one unit in relation to others obviates the fear of competition to a great extent and enables the unit to be self-supporting. A small-scale unit which lacks cost advantage is in constant threat of extinction at the hands of competitors and as such is always in need of subsidy and protection and in abject dependence on the bounty of the Government.

The cottage units and artisans in the sportsgoods industry do not show any awareness of the advantages of proper maintenance of records. Due to lack of relevant data, it is difficult to workout the accurate cost for all the items of sportsgoods. The study of cost structure in the present analysis is, therefore, confined to one year

finance, primarily due to their inability to cope with huge paperwork involved and to provide security and guarantee due to their low fixed capital investment. However, the analysis of the structure of fixed cost further reveals that interest on capital (owned and borrowed) is the most important element of fixed cost.

Raw-Material

Raw material constitutes the most important element in the cost structure of the sportsgoods industry. It accounts for 75 per cent of the total cost and 78.95 per cent of variable cost. A look at the cost components of various sportsgoods items as given in table 5 reveals that this average closely approximates the raw material cost components of these items. The only exceptions being, corkballs, hockey/cricket balls and stockings, in which raw material accounts for 50 per cent, 55 per cent and 55 per cent of the total cost respectively.

Wages

Wages and salaries are payments to the labourers. Wage bills may include payments to permanent workers, also which are in the nature of fixed costs. But as they cover only a negligible proportion of the total wage bill, no attempt is made to separate the payment to permanent workers from the total wage bill. It is due to the fact that a major proportion of total workforce employed is contractual. Wages constitute 18 per cent of the total cost of production. This is because most of the units (about 70 to 80%) are scattered in rural areas where the prevailing wage rate is lower than that in urban areas.

These variations notwithstanding, overall wage cost component is small. One explanation can be found in the practice of not calculating the family labour cost completely. Wages computed for family labour is hardly 4 per cent the total cost. In some small units, it was found that family members are engaged in production and in almost every cottage unit, the proprietor (owner) performs certain jobs himself alongwith the help of his family members. It was also noticed that one of the reasons for the success of the small units is the involvement of family labour in the manufacturing process, and particularly in items where there is a division of labour. There are certain jobs which only skilled labour can perform and if these are performed by the family members the chances of labour absenteeism, low quality and poor craftsmanship diminish.

Table 5 : Cost Structure of Selected Sportsgoods Items
(Percentage)

Items	Raw Material	Labour	Others
Inflatable Balls			
a) Football (Leather)	86	13	1
b) Football (Synthetic)	60	35	5
c) Volley Ball	85	14	1
d) Basket Ball	87	12	1
Cricket/Hockey Ball	55	40	5
Soft Leather goods			
a) Legguard	88	10	2
b) Gloves (all kinds)	83	15	2
Cricket bat (Willow)	77	18	5
Hockey Stick	70	25	5
T. T. Bat	70	18	12
Rackets			
a) Racket (Wooden)	65	25	10
b) Racket (Steel)	77	18	5
Shuttle cock	70	25	5
Carrom board	80	15	5
Stumps	77	18	5
Tennis Table	60	30	10
Cork Ball	50	40	10
Chest Expander	85	10	5
Gymnastic & Physical Equipments	80	15	5
Bladder (Football)	65	30	5
Sports net	80	15	5
Stockings	55	40	5

Source:– Indian Institute of Foreign Trade (1984)

Repair & Maintenance

Repair and maintenance costs are an insignificant proportion of tne cost of production in this industry, constituting just 0.5 per cent of the total cost. There is very little use of machinery because the industry is labour intensive and of cottage type.

Other Expenses

Other miscellaneous expenses include largely the expenditure on marketing, incorporating expenses on sales, advertisement and sales promotion, packaging, etc. These too form a small proportion of the cost of production. Unfortunately the attention paid to sales promotion and advertisement is very little. Not to talk of small units which just cannot afford the 'extravagance' even large organised units do not display much interest in it. It was found in one unit with a turnover of 2.69 crores that the amount spent on publicity was only 1.19 per cent of sales in 1987-88. The explanation for such a low priority to marketing, can be found in the seasonal character of industry. During summers and rains, sales will be lukewarm whether one advertises or not. Similerty

during winter, the playing season, the sales will be brisk, whether one advertises or not.

Some suggestions

The Indian sportsgoods industry has so far been dependent upon export markets to a considerable extent. Not much effort has been made to increase the internal demand. It is, therefore, imperative that not only for greater utilisation of capacity but for providing stability to the production units, concerted efforts are made to boost internal demand by encouraging development of different games. Exploitation of the non-brand conscious huge rural market with low price but reasonably good quality sportsgoods and improvements in product quality, capturing the better quality and high priced market segments etc. are some steps which will contribute generously to the improvement in the health of this industry. In addition, a process of deliberate shift in creating capacity for non-traditional items mainly for export markets, will have to be initiated. However, it must be emphasised that the strengthening of the home base should have precedence over creation of capacity exclusively for export markets. Over-dependence on export markets exposes the industry, especially those which are composed of small and cottage sector units, to the vicissitudes of external environment.

Creation of capacity for new and non-traditional items does not imply a complete break of the industry away from its existing manufacturing pattern. What is, infact, needed is to utilise the available skills and manufacturing capacities on a selective basis to produce those items which have a rising demand.

The technological upgradation of various traditional sportsgoods items which are already manufactured by this industry, has become a necessity. The PPD Centre, Meerut and Design-cum-Development Centre, Jallandhar, may initiate action for undertaking Research and Development by procuring necessary tools, equipments and machinery and also acquiring necessary technical knowhow to improve the already outdated technology of making traditional sportsgoods. These centres may also conduct necessary market surveys for developing new and non-traditional items of sportsgoods e.g. camping equipments, fishing equipments, physical fitness equipments, mountaineering equipments, archery, fencing, synthetic products and other sportsgoods not yet produced. Necessary infrastructure may be created at these centres to provide common facility service for the manufacture of these items alongwith necessary training facilities. These centres must be equipped with a laboratory for testing and quality control, separate workshops for sportsgoods based on wood, leather, metal, rubber and plastics and also a training room.

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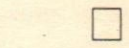

Data Bank

Labour and Capital Productivity Estimates for Indian Economy

NPC Research Section

In our earlier exercises, attempts were made to arrive at labour productivity for various sectors of the Indian economy (Productivity, 29(4), 1989; 30(1), 1989; 30(2), 1989) and capital productivity , (Productivity 30(3), 1989) during the period 1980-81 to 1987-88. International comparisons in labour productivity was also attempted (Productivity 30(4), 1990). In the present study, an attempt has been made to arrive at the capital as well as labour productivity for various sectors of the Indian Economy for all the years during the period 1950-51 to 1988-89. (Tables 1 & 2)

For the present analysis output data (Net Domestic Product) at 1980-81 factor cost for various sectors of the economy are taken from the National Accounts Statistics of the Central Statistical Organisation. For arriving at the capital productivity estimates, we have used Net Fixed Capital Stock (Annexure 1) at the 1980-81 prices which is also taken from the National Accounts Statistics sources. However, there is no labour input data (employment) for various sectors of the economy on an year to year basis. Therefore, the sectoral employment have been estimated based on the compound growth rates of employment between any two census years. For the post 1980-81 period, data on employment are arrived at based on the percentage of workers engaged in various sectors to the total population (1981 Census). For this purpose the yearwise population figures are those available from the Registrar General of India, Ministry of Home Affairs. (Annexure 2)

Limitations :

1. Since the data, particularly on output and labour input, are taken from two sources there may arise problems of sectoral coverage.
2. The definition of workers has not been uniform between any two censuses, e.g., in the 1981 Census concepts of main workers and marginal workers were brought in. Only the "Main Workers" are taken into account from 1980-81 onwards because 'main workers' of 1981 census corresponds to the 'workers' of 1971 census (Census of India, 1981 Reports). Similarly in 1971 census 'total workers' were shown less than that in 1961 census. This is because of the changes in the concept of 'workers' between the two censuses. Despite the corrections introduced afterwards by the Registrar General, there was decline in employment in 'Other services' which included Banking and Insurance, Real Estate and Business Services, Public Administration and Defence etc. Besides, there has been no increase in employment in the construction sector also. Because of these reasons, no estimates on labour productivity for these two sectors between 1961-62 and 1969-70 were arrived at.
3. The assumption of a fixed percentage of workers to total population for arriving at employment figures would mean that there occurred no major structural changes in the economy during the post 1980 period.
4. For arriving at Capital Productivity estimates we have used the Net Fixed Capital Stock only. This would exclude changes in stocks for all the years under consideration.

(Table 1. Contd.)

SECTORS	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Agriculture, Forestry	0.809	0.771	0.708	0.742	0.714	0.792	0.718	0.767	0.754	0.627
& Fishing	(118.3)	(112.7)	(103.5)	(108.5)	(104.5)	(115.8)	(105.0)	(112.1)	(110.2)	(91.7)
Mining & Quarrying	0.491	0.466	0.472	0.439	0.434	0.427	0.348	0.297	0.275	0.251
	(191.8)	(182.0)	(184.4)	(171.5)	(169.5)	(166.8)	(135.9)	(116.0)	(107.4)	(98.0)
Manufacturing	0.445	0.445	0.443	0.446	0.437	0.407	0.426	0.432	0.456	0.418
	(111.8)	(111.8)	(111.3)	(112.1)	(109.8)	(102.3)	(107.0)	(108.5)	(114.6)	(105.0)
Electricity, Gas &	0.049	0.049	0.044	0.041	0.040	0.045	0.047	0.043	0.045	0.039
Water Supply	(144.1)	(144.1)	(129.4)	(120.6)	(117.6)	(132.4)	(138.2)	(126.5)	(132.4)	(114.7)
Construction	2.727	2.695	2.724	2.503	2.444	2.811	2.935	3.041	2.824	2.548
	(102.0)	(100.8)	(101.9)	(93.6)	(91.4)	(105.1)	(109.8)	(113.7)	(105.6)	(95.3)
Trade & Commerce	3.079	2.616	2.338	2.134	1.973	2.029	1.972	2.015	2.079	1.906
	(161.1)	(136.9)	(122.3)	(111.7)	(103.2)	(106.2)	(103.2)	(105.4)	(108.8)	(99.7)
Transport, storage &	0.096	0.095	0.099	0.099	0.107	0.114	0.120	0.119	0.125	0.129
Communication	(71.1)	(70.4)	(73.3)	73.3)	(79.3)	(84.4)	(88.4)	(88.1)	(92.6)	(95.6)
Other Services *	0.159	0.163	0.164	0.163	0.163	0.169	0.173	0.176	0.181	0.183
	(86.9)	(89.1)	(89.6)	(89.1)	(89.1)	(92.3)	(94.5)	(96.2)	(98.9)	(100.0)
Total	0.405	0.394	0.377	0.381	0.373	0.393	0.382	0.395	0.401	0.362
	(108.6)	(105.6)	(101.1)	(102.1)	(100.0)	(105.4)	(102.4)	(105.9)	(107.5)	(97.1)

SECTORS	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88 P	1988-89**
Agriculture, Forestry	0.684	0.702	0.670	0.728	0.711	0.699	0.669	0.664	-
& Fishing	(100.0)	(102.6)	(98.0)	(106.4)	(103.9)	(102.2)	(97.8)	(97.1)	
Mining & Quarrying	0.256	0.251	0.210	0.199	0.192	0.171	0.169	0.126	-
	(100.0)	(98.0)	(82.0)	(77.7)	(75.0)	(66.8)	(66.0)	(49.2)	
Manufacturing	0.398	0.407	0.413	0.426	0.427	0.439	0.453	0.437	-
	(100.0)	(102.3)	(103.8)	(107.0)	(107.3)	(110.3)	(113.8)	(109.8)	
Electricity, Gas &	0.034	0.034	0.031	0.034	0.037	0.038	0.038	0.037	-
Water Supply	(100.0)	(100.0)	(91.2)	(100.0)	(108.8)	(111.8)	(111.8)	(108.8)	
Construction	2.674	2.454	2.007	1.996	1.924	1.998	2.005	2.070	-
	(100.0)	(91.8)	(75.1)	(74.6)	(72.0)	(74.7)	(75.0)	(77.4)	-
Trade & Commerce	1.911	1.926	1.910	1.902	1.869	1.893	1.862	1.893	-
	(100.0)	(100.8)	(99.9)	(99.5)	(97.8)	(99.1)	(97.4)	(99.1)	
Transport, Storage	0.135	0.144	0.150	0.155	0.158	0.169	0.169	0.165	-
& Communication	(100.0)	(106.7)	(111.1)	(114.8)	(117.0)	(125.2)	(125.2)	(122.2)	
Other Services'	0.183	0.184	0.187	0.188	0.201	0.209	0.217	0.227	-
	(100.0)	(100.5)	(102.2)	(102.7)	(109.8)	(114.2)	(118.6)	(124.0)	
Total	0.373	0.361	0.355	0.385	0.382	0.384	0.380	0.394	0.399
	(100.0)	(96.8)	(95.2)	(103.2)	(102.4)	(102.9)	(101.9)	(105.6)	(107.0)

* *Includes Finance & Reat Estate, Public Administration & Defence and related Services*

*P : Provisional **Quick Estimates*

Figures in brackets are the index nos. (Base : 1980-81)

Table 2 : Labour Productivity in Indian Economy by Kind of Economic Activity (Rs./Worker at 1980-81 Prices)

SECTORS	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60
Agriculture, Forestry	2305	2300	2334	2474	2499	2433	2524	2367	2569	2498
& Fishing	(83.2)	(83.1)	(84.4)	(89.3)	(90.2)	(87.9)	(91.2)	(85.5)	(92.8)	(90.2)
Mining & Quarrying	5214	5898	6036	6107	6357	6440	6762	7141	7365	7753
	(46.7)	(52.8)	(54.1)	(54.7)	(56.9)	(57.7)	(60.6)	(63.9)	(66.0)	(69.4)
Manufacturing	3671	3677	3695	3898	4086	4288	4478	4490	4580	4761
	(51.2)	(51.3)	(51.5)	(54.4)	(57.0)	(59.8)	(62.5)	(62.6)	(63.9)	(66.4)
Electricity Gas &										
Water Supply	-	-	-	-	-	-	-	-	-	-
Construction	9182	9391	8284	8141	8741	9851	10424	8693	9270	9412
	(61.4)	(62.8)	(55.4)	(54.5)	(58.5)	(65.9)	(69.7)	(58.1)	(62.0)	(62.9)
Trade & Commerce	4942	5026	5165	5332	5672	6056	6444	6543	6772	7160
	(50.4)	(51.2)	(52.7)	(54.4)	(57.8)	(61.7)	(65.7)	(66.7)	(69.0)	(73.0)
Transport, storage	3495	3539	3511	3543	3625	3742	3930	4023	4139	4250
and Communication	(59.6)	(60.3)	(59.9)	(60.4)	(61.8)	(63.8)	(67.0)	(68.6)	(70.6)	(72.5)
Other Services	4418	4493	4593	4652	4777	4907	5042	5161	5294	5459
	(42.7)	(43.4)	(44.4)	(44.9)	(46.1)	(47.4)	(48.7)	(49.8)	(51.1)	(52.7)
Total	2898*	2914*	2947*	3081*	3156*	3178*	3301*	3192*	3382*	3390*
	(81.3)	(81.8)	(82..7)	(86.5)	(88.6)	(89.2)	(92.6)	(89.6)	(94.9)	(95.1)

SECTORS	1960-61	1961-62	1962-63	1963-64	1964-65	1965-56	1966-67	1967-68	1968-69	1969-70
Agriculture, Forestry	2607	2582	2503	2539	2749	2403	2340	2677	2644	2794
& Fishing	(94.1)	(93.2)	(90.4)	(91.7)	(99.3)	(86.8)	(84.5)	(96.7)	(95.5)	(100.9)
	8941	9256	10291	10333	10170	11420	11472	11600	11769	12286
Mining & Quarrying	(80.1)	(82.9)	(92.2)	(92.5)	(91.1)	(102.3)	(102.7)	(103.9)	(105.4)	(110.0)
Manufacturing	5036	5431	5770	6272	6643	6594	6539	6444	6735	7443
	(74.0)	(75.8)	(80.5)	(87.5)	(92.7)	(92.0)	(91.2)	(89.9)	(93.9)	(103.8)
Electricity, Gas	9600	9889	10000	11065	10559	10351	10385	10395	11087	10980
& Water Supply	(117.8)	(121.4)	(122.7)	(135.8)	(129.6)	(127.0)	(127.5)	(127.6)	(136.1)	(134.8)
Construction	10348	-	-	-	-	-	-	-	-	-
	(69.2)									
Trade & Commerce	7750	8124	8431	8917	9418	9335	9426	9615	9880	10252
	(79.0)	(82.8)	(86.0)	(90.9)	(96.0)	(95.2)	(96.1)	(98.0)	(100.7)	(104.5)
Transport, Storage	4377	4405	4508	4515	4384	4334	4206	4324	4372	4475
& Communication	(74.6)	(75.1)	(76.9)	(77.0)	(74.7)	(73.9)	(71.7)	(73.7)	(74.5)	(76.3)
Other Services	5565	-	-	-	-	-		-	-	-
	(53.8)									
Total	3563	3634	3667	3816	4068	3852	3839	4126	4188	4430
	(75.2)	(76.7)	(77.4)	(80.6)	(85.9)	(81.3)	(81.0)	(87.1)	(88.4)	(93.5)

(Table 2. Contd.)

SECTORS	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Agriculture, Forestry	2980	2858	2648	2786	2683	2981	2739	2962	2964	2506
& Fishing	(107.6)	(103.2)	(95.6)	(100.6)	(96.9)	107.7)	(98.9)	(107.0)	(107.0)	(90.5)
Mining & Quarrying	11163	11000	11152	10728	10887	11754	11395	10949	10764	10258
	(99.9)	(98.5)	(99.9)	(96.1)	(97.5)	(105.3)	(102.0)	(98.0)	(96.4)	(91.9)
Manufacturing	7548	7467	7424	7426	7292	7079	7423	7582	8223	7540
	(105.3)	(104.2)	(103.6)	(103.6)	(101.7)	(98.7)	(103.5)	(105.8)	(114.7)	(105.2)
Electricity, Gas &	10500	10719	10180	9308	8957	10081	10696	10036	10708	9411
Water Supply	(128.9)	(131.6)	(124.9)	(114.3)	(109.9)	(123.7)	(131.3)	(123.2)	(131.4)	(115.5)
Construction	17433	16699	16306	14646	13430	14779	15579	16446	15345	13839
	(116.9)	(111.7)	(109.1)	(97.3)	(89.8)	(98.8)	(104.2)	(110.0)	(102.6)	(92.6)
Trade & Commerce	10583	10266	9802	9731	9689	10100	9948	10278	10658	9805
	(107.9)	(104.7)	(99.9)	(99.2)	(98.8)	(103.0)	(101.4)	(104.8)	(108.6)	(100.0)
Transport, Storage &	4423	4360	4552	4538	4933	5239	5499	5383	5599	5687
Communication	(75.4)	(74.3)	(77.6)	(77.4)	(84.1)	(89.3)	(93.8)	(91.8)	(95.5)	(97.0)
Other Services	8825	9058	9174	9183	9185	9455	9708	9828	10157	10344
	(85.2)	(87.5)	(88.6)	(88.7)	(88.7)	(91.3)	(93.8)	(94.9)	(98.1)	(99.9)
Total	4611	4529	4382	4469	4396	4692	4615	4850	4990	4563
	(97.3)	(95.6)	(92.5)	(94.3)	(92.8)	(99.1)	(97.4)	(102.4)	(105.3)	(96.3)

SECTORS	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89
Agriculture,	2769	2868	2753	2992	2927	2874	2746	2723	3157
Forestry & Fishing	(100.0)	(103.6)	(99.4)	(108.1)	(105.7)	(103.8)	(99.2)	(98.3)	(114.0)
Mining & Quarrying	11167	12363	12971	14014	14771	14687	15867	12712	13417
	(100.0)	(110.7)	(116.2)	(125.5)	(132.3)	(131.5)	(142.1)	(113.8)	(120.1)
Manufacturing	7169	7605	7957	8602	8991	9666	10390	10442	11099
	(100.0)	(106.1)	(111.0)	(120.0)	(125.4)	(134.8)	(144.9)	(145.7)	(154.8)
Electricity, Gas &	8147	8663	8651	9752	11234	12106	13261	13636	14608
Water Supply	(100.0)	(106.3)	(106.2)	(119.7)	(137.9)	(148.6)	(162.8)	(167.4)	(179.3)
Construction	14951	15411	14233	14917	14950	15390	15474	15710	16110
	(100.0)	(103.1)	(95.2)	(99.8)	(100.0)	(102.9)	(103.5)	(105.1)	(107.8)
Trade & Commerce	9809	10222	10562	10874	11086	11630	11872	12419	13136
	(100.0)	(104.2)	(107.7)	(110.9)	(113.0)	(118.6)	(121.0)	(126.6)	(133.9)
Transport, Storage	5865	6320	6674	7009	7384	8068	8398	8315	8761
& Communication	(100.0)	(107.8)	(113.8)	(119.5)	(125.9)	(137.6)	(143.2)	(141.8)	(149.4)
Other Services@	10352	10536	11136	11345	11896	12486	13158	14015	14625
	(100.0)	(101.8)	(107.6)	(109.6)	(114.9)	(120.6)	(127.1)	(135.4)	(141.3)
Total	4737	4924	4954	5258	5341	5496	5588	5674	6169
	(100.0)	(103.9)	(104.6)	(111.0)	(112.8)	(116.0)	(118.0)	(119.8)	(130.2)

@ Includes Finance & Real Estate, Public Admn & Defence and related services

* *Excludes Electricity, Gas and water Supply.*

Figures in Breakets are the Index Nos. (Base : 1980-81)

Annexure 1 : Estimates of Net Fixed Capital Stock In India (at 1980-81 prices) (Rs. crores)

Industry	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-87	1957-58	1958-59	1959-60
Agriculture	28473	29420	30148	31013	31738	32549	33314	34038	34685	35160
Forestry & logging	348	350	352	354	359	367	377	390	403	417
Fishing	56	78	97	131	169	211	275	317	343	331
Mining & Quarrying	146	220	242	274	331	364	364	377	401	431
Manufacturing	3919	4720	5343	6001	6617	7480	8874	10594	11616	12789
Electricity, gas & Water Supply	114	276	406	517	880	1268	1726	2154	2485	2778
Construction	164	169	169	198	315	466	608	601	624	657
Trade, Hotels and Restaurants	656	705	734	763	791	830	897	980	1049	1135
Transport, Storage & Communication	4270	4542	4744	4959	5324	5907	6672	7564	8559	9476
Banking & Insurance	142	168	185	201	214	209	220	258	278	301
Real Estate ownership of Dwelling & Business Services	53924	54260	54622	55038	55467	55941	56457	56969	57546	58200
Public Administration & Defence	2771	3057	3340	3747	4245	4976	5661	6325	6990	7736
Other Services	1078	1141	1218	1290	1377	1539	1696	1906	2081	2282
Total	96061	99106	101600	104486	107827	112107	117142	122473	127060	131693

Industry	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Agriculture	35886	36646	37499	38474	39526	40611	41668	42963	44170	45556
Forestry & logging	437	456	482	506	534	565	582	605	617	627
Fising	338	337	305	288	303	343	361	359	382	402
Mining & Quarrying	556	691	862	1080	1366	1444	1611	1754	1829	2024
Manufacturing	14319	15148	15432	17725	19202	21133	23133	24845	26087	27438
Electricity, gas & Water Supply	3131	3767	4519	5426	6250	7265	8134	9044	9890	10786
Construction	851	858	907	1097	1193	1291	1377	1447	1506	1560
Trade Hotels and Restaurants	1169	1244	1382	1548	1672	1893	1991	2179	2326	2521
Transport, Storage & Communication	10521	11567	12911	14201	15569	16901	17864	18452	19039	19587
Banking & Insurance	329	345	370	391	409	449	491	572	613	648
Real estate ownership of Dwelling & Business Services	58860	59544	60237	60973	61780	62527	63231	64018	64832	65685
Public administration & Defence	8617	9519	10532	11642	12795	14030	15074	16038	16880	17757
Other Services	2542	2815	3044	3304	3507	3679	3850	4037	4238	4424
Total	137556	142937	149482	156655	164136	172131	179367	186313	192409	199015

(Annexure 1. Contd)

Industry	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Agriculture	467976	48090	49455	50705	51693	52841	54597	56356	58483	60651
Forestry & logging	637	653	660	669	677	689	723	756	799	847
Fishery	397	397	401	412	427	458	493	523	537	546
Mining & Quarrying	2092	2242	2341	2517	2660	3028	3728	4424	4809	5227
Manufacturing	28693	29619	30912	32043	33560	36463	38153	40125	43058	44913
Electricity, gas & Water Supply	11689	12523	13962	14653	15304	16488	17859	19437	21107	22686
Construction	1566	1586	1604	1627	1610	1614	1704	1817	1907	1993
Trade Hotels land Restaurants	3104	3717	4167	4751	5368	5709	6068	6438	6786	7146
Transport, Storage & Communication	20256	20900	21765	22554	23362	24205	24968	25574	26277	26792
Banking & Insurance	688	743	777	854	887	924	975	1026	1087	1137
Real estate owner-ship of Dwelling & Business Service	66390	67171	68034	68957	69952	71041	72220	73464	74803	76262
Public adminis-tration & Defence	18742	20080	21722	23258	24089	24896	25820	26847	28200	29639
Other Services	4473	4547	4739	4921	5078	5201	5365	5580	5828	6053
Total	205523	212268	220539	227921	234667	243557	252673	262367	273681	283892

Industry	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88
Agriculture	62778	64622	66418	67675	69178	70381	71538	72778
Forestry & logging	915	981	1057	1148	1227	1283	1358	1423
Fishing	558	576	601	635	677	729	793	866
Mining & Quarrying	5766	6650	8505	9915	11089	12627	14123	15477
Manufacturing	46944	49804	52480	56150	59783	63674	67727	71893
Electricity, Gas and Water Supply	24422	26734	29241	31535	33687	36230	39812	43337
Construction	2158	2474	2858	3072	3263	3296	3373	3378
rade, Hotel and Restaurants	7495	7918	8426	8903	9426	9954	10538	11057
Transport, Storage & Communication	27517	28457	29532	30707	32343	33602	35631	37037
Banking & Insurance	1238	1360	1528	1706	1947	2185	2487	3189
Real Estate, ownership of Dwelling & Business Services	77938	79651	81389	82796	84447	86190	88032	89902
Public Administration	31352	33136	34989	36721	38640	40650	42797	44777
Other Services	6341	6679	7030	7330	7698	8154	8652	9110
Total	295422	309042	324054	338293	353405	368955	368861	404224

ANNEXURE 2 : Estimated Workers in Indian Economy by Kind of Economic Activity (Million)

SECTORS	1950-51	1951-52	1952-53	1953-54	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60
Agriculture, Forestry & Fishing	100.94	102.56	104.19	105.86	107.56	109.28	111.03	112.80	114.61	116.44
Mining & Quarrying	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.85	0.85	0.85
Manufacturing	12.60	12.89	13.19	13.49	13.80	14.12	14.44	14.77	15.11	15.46
Electricity, Gas &- Water supply	-	-	-	-	-	-	-		-	-
Construction	1.54	1.61	1.69	1.77	1.85	1.94	2.03	2.12	2.22	2.33
Trade & Commerce	7.28	7.32	7.37	7.41	7.46	7.50	7.55	7.59	7.64	7.68
Transport, Storage & Communication	2.10	2.17	2.25	2.32	2.40	2.48	2.57	2.65	2.74	2.84
Other Services	14.70	1.4.86	15.03	15.19	15.36	15.53	15.70	15.87	16.04	16.22
Total	140.00	142.25	144.56	146.88	149.27	151.69	154.16	156.65	159.21	161.82

SECTORS	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Agriculture,Forestry & Fishing	119.10	120.17	121.25	122.34	123.45	124.56	125.68	126.81	127.95	129.10
Mining & Quarrying	0.85	0.86	0.86	0.87	0.88	0.88	0.89	0.90	0.91	0.91
Manufacturing	15.78	15.89	16.00	16.11	16.23	16.34	16.45	16.57	16.69	16.80
Electricity, Gas & Water Supply	0.25	0.27	0.29	0.31	0.34	0.37	0.39	0.43	0.46	0.50
Construction	2.44	-	-	-	-	-	-	-	-	-
Trade & Commerce	7.75	7.87	7.98	8.10	8.23	8.35	8.47	8.60	8.73	8.86
Transport, Storage & Communication	2.92	3.04	3.17	3.30	3.44	3.59	3.74	3.89	4.06	4.23
Other Services	16.47	-	-	-	-	-	-	-	-	-
Total	165.54	166.94	168.36	169.79	171.23	172.69	174.15	175.63	177.13	178.63

SECTORS *	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80
Agriculture, Forestry & Fishing	129.89	132.49	135.14	137.84	140.60	143.41	146.28	149.20	152.19	155.23
Mining & Quarrying	0.92	0.95	0.99	1.03	1.06	1.10	1.14	1.19	1.23	1.28
Manufacturing	16.91	17.65	18.43	19.24	20.09	20.97	21.90	22.86	23.86	24.91
Electricity, Gas Water Supply	0.54	0.57	0.61	0.65	0.69	0.74	0.79	0.84	0.89	0.95
Construction	2.45	2.56	2.68	2.80	2.93	3.07	3.21	3.36	3.51	3.67
Trade & Commerce	9.03	9.47	9.94	10.42	10.93	11.47	12.03	12.62	13.24	13.89
Transport, storage & Communication	4.40	4.56	4.73	4.91	5.09	5.28	5.47	5.67	5.88	6.10
Other service	16.24	16.61	16.99	17.39	17.80	18.21	18.64	19.10	19.56	20.04
Total	180.37	184.88	189.50	194.24	199.09	204.07	209.17	214.40	219.76	225.26

(Annexure 2. Contd.)

SECTORS	1980-81	1981-82	1982-83	1983-74	1984-85	1985-86	1986-87	1987-88	1988-89
Agriculture, Forestry & Fishing	158.60	162.06	165.58	169.12	172.62	176.08	179.60	183.13	186.84
Mining & Quarrying	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56
Manufacturing **	26.08	26.64	27.22	27.80	28.37	28.94	29.52	30.10	30.70
Electricity, Gas & Water Supply	1.02	1.04	1.06	1.09	1.11	1.13	1.15	1.18	1.20
Construction	3.86	3.94	4.03	4.11	4.20	4.28	4.37	4.45	4.54
Trade & Commerce	14.60	14.92	15.24	15.57	15.89	16.20	16.53	16.85	17.18
Transport, Storage & Communication	6.35	6.49	6.63	6.77	6.91	7.05	7.19	7.33	7.48
Other Services	20.67	21.12	21.58	22.03	22.48	22.93	23.40	23.86	24.34
Total	232.50	237.56	242.72	247.90	253.02	258.08	263.26	268.43	273.84

** This calculation is based on the Compound Growth Rates between 1970-71 and estimated figures of 1980-81 based on the 1981 census as in 1981 census figures for Assam, was not included.*

*** Includes household industries.*

Energy Consumption Norms for Indian Integrated Pulp and Paper Mills

NPC Energy Management Division

The Installed capacity for paper production in India has increased from 0.14 million tonnes in 1952 to 2.7 million tonnes in 1987-88 with projections to about 4.2 million tonnes by the end of the century. Of the 282 paper producing units, 28 are integrated mills with capacities ranging from 24,000 to 80,000 tonnes per annum. Coal requirements of this sector is estimated at about 4 million tonnes and the electricity consumption at about 2 million units of purchased energy. The large integrated mills meet about30% of the power requirements through co-generation. There are large variations in the specific energy consumption per tonne of paper ranging from 7.6 to 13.3 million K.Cal./tonne, comprising 10 to 16 tonnes of steam/tonne and 1200-1700 Kwh/tonne of electricity. Consumption of energy in Indian paper mills is considerably higher than that reported in the developed countries where the range is between 6.5 and 8.5 T of steam/tonne and electricity 1150 to 1250 Kwh/tonne. The difference is attributable to the small plant size, not so modern technology employed and sub-optimal utilisation of secondary resources such as black liquor and co-generation.

As part of the exercises sponsored by the Advisory Board on Energy in 1987, a study on the pattern of section-wise consumption of energy was entrusted to a technical group consisting of representation of the DGTD, NPC, BICP, Paper industry and Advisory Board on Energy. Tables 1 and 2 were derived from the response to the proforma circulated by the ABE and also from NPC'S information based on DSIR sponsored study (1987) on the Norms of Energy Consumption in Indian and Foreign Mills.

Based on the information received from the mills, the factors responsible for variations in the norms of energy consumption at various stages were evaluated. The variations were attributable to the specific characterstics of raw materals, product mix, plant age and scale of operations. The analysis of the data indicated that the

Table1: Steam Consumption per Tonne of Paper

	All figures in Tonnes
Indian Mill	11·0 – 14·0
Mill Abroad	6·5 – 8·5

Details of various sections consuming steam :

	Indian Mills	Mills Abroad
Digester	2·7 – 3·9	1·9 – 2·3
Evaporator	2·5 – 4·0	1·5 – 2·2
Paper Machine	3·0 – 4·0	1·9 – 2·0
Soda Recovery Plant	0·5 – 1·1	0·3 – 0·5
Bleach Plant	0·35 – 0·40	0·2 – 0·25
Generator	0·0 – 1·2	0·45 – 0·70

Table 2 : Electrical Energy Consumption/Tonne of Paper

	(All figures in KWH)
Indian Mill	1500 – 1700
Mill abroad	1150 – 1250

Details of Various Sections/Equipment Consuming Electrical Energy

Description of Section/ Equipment	Mill Indian	Mill abroad
Paper Machine	465–475	410–415
Stock Preparation	275–286	164–172
Utilities and Others	246–252	160–165
Soda Recovery Plant	170–190	127–135
Washing and Screening Section	145–155	116–122
Chippers	112–128	92–98
Bleach Plant	88–92	66–69
Digesters	58–62	43–46

consumption in various sections equipments appeared to have been arrived at based on a notional apportionment of the share of energy consumption at nodal parts of the process activity. It was agreed by the group that indicative norms should be proposed only for substantive sections relating to pulp and paper production, leaving out areas such as water pumping, effluent treatment, utilities for township etc. On the basis of the scrutiny of data presented by NPC, the Group recommended the section-wise range of energy consumption norms both for steam and power for large integrated paper mills (Tables 3 & 4). The upper and lower limits have been indicated as guidelines for the industry to improve their norms from the upper to the lower limit.

Table 3 : Recommended Department/Sectionwise Steam Consumption for large integrated mills (Steam T/T of output *)

Sl. No	Department/ Section	Norm Range	Means to achieve lower norm values
1.	Digester (* Bone dry unbleached pulp)		
	a. Batch	1.6–2.5	i. Controlling bath ratio II. LP Steam (3–4 ata) upto 50% then HP steam (9-12 ata)
	b. Continuous	1.1–1.5	
2.	Evaporator (* Bone dry unbleached pulp)	1.6–2.8	i. Installation of falling film six effect evaporator
3.	Paper Machine (*Machine production)	2.0–3.5	i. Insulation of drying cylinder ends. ii. Improving heat transfer by a. providing thermorings in existing drying cylinders. b. installing cylinders ribbed inside or has spoilerbars.
4.	Recovery boiler (* Bone dry unbleached pulp)	0.7–1.1	Improved operation
5.	Causticising (*Bone dry unbleached pulp)	0.2–0.3	Blow heat recovery to generate hot water.
6.	Conventional bleach plant * Bone dry unbleached pulp)	0.2–0.3	– do –
7.	Deareator (*Machine production)	0.5–0.8	

Table 4: Recommended Department/Sectionwise Steam Consumption for large integrated mills
(Power Kwh/T of output)

Sl. No	Department/ Section	Norm Range	Means to achieve lower norm values
1.	Chipper (* Bone dry unbleached pulp)	30–50	i. Belt conveyor instead of pneumatic conveyor ii. Fall capacity utilisation of chipper
2.	Digester (* Bone dry unbleached pulp)	50–60	i. Replacing over size motor with appropriate size. ii. Variable speed drive for motors where speed is to be regulated
3.	Washing & Screening (* Bone dry unbleached pulp)	80–110	– do –
4.	Bleaching (*Bone dry unbleached pulp)	80–110	– do –
5.	Soda recovery (*Bone dry unbleached pulp)	140–180	– do –
6.	Stock preparation (*Machine production)	150–200	– do –
7.	Paper Machine (*Machine production)	450–475	– do –

Table-1. Wastewater Generation and Specific BOD Load in Selected Small Agro Paper Mills

UNIT NO.	PRODUCTS AND CAPACITY	RAW MATERIAL MIX		WASTEWATER FROM RATE & BOD LOAD (m^3/d & kg/d)				SPEC. POLLUTION LOAD BEFORE ABATEMENT			SPEC. POLLUTION LOAD AFTER ABATEMENT	
				PULP FLOW	MILL BOD	PAPER FLOW	M/C BOD	M^3/T	FIBRE LOSS** kg BOD/T	(%)	M^3/T	kg BOD/T
1.	kraft Paper (18 TPD)	WP	34%	840	2279	2040	938	155	173	9.4	152	165
		Agro	33%									
		Jute	33%									
2.	Prt & Wr Paper (16 TPD)	WP	20%	2700	4523	1280	215	250	330	2.9	182	300
		Rags	20%									
		Agro	60%									
3.	Cotton liner sheet (6 TPD)	Linters	100%	833	1680	1278	22.0	352	284	1.7	262	175
4.	Duplex Board-3 layer (30 TPD)	Imp.pulp	25%	-	-	5280	930	176	34	8.0	176	15
		WP	75%									
5.	kraft Paper (33 TPD)	Bugasse	80%	1625	9090	2310	439	120	274	1.8	110	272
		Jute	10%									
		WP	10%									
6.	Kraft Paper (12 TPD)	Agro	60%	1160	2975	900	270	187	283	8.8	150	250
		Jute	15%									
		WP	25%									
7.	Kraft Paper (48 TPD)	Bagasse	76%	3062	7837	3346	4108	134	216	3.3	85	210
		Jute	10%									
		WP	14%									
8.	Kraft Paper (24 TPD)	Agro	30%	1528	3686	3512	1187	210	203	7.5	157	198
		Jute	25%									
		WP	45%									

** All the characteristics are based on a 24 hours continuous monitoring study*

*** Fibre loss shown is exclusively from paper machine area, i.e. whitewater overflow from fan pump-sump, couch pit etc. The % loss is in terms of total paper production.*

Note:

I) Units 1, 2, 3, 6 and 8 have single stage pulp washing only.

ii) Unit 5 has three stage counter-current vacuum washing system for bagasse pulp stream. The raw bagasse is not depithed before loading into the Digesters.

iii) Unit 7 has two stage counter-current vacuum washing system for bagasse pulp stream. The raw bagasse is depithed before loading to the Digesters.

Table-2. Investment, Operating and Annualised Recurring Costs for Pollution abatement & Control measures

(Rs. Lakhs)

Unit No.	Measures	Pollution abatement Investment cost	Annual savings	Annual op.cost	Weastewater Treatmentt System Investment cost	Annual operating cost	Total investment cost*	Annualised op. cost**	OP. cost a s % Turnover
1.	Fibre Recovery	3.10	10.00	0.65	22.00	9.00	25.10	5.10	3.4
2.	Fibre Recovery bl Serge	13.30	5.13	0.47	15.50	9.00	29.80	10.81	3.6
3.	Fire Recovery Chemical Savings	2.57	6.73	1.47	13.00	5.88	15.57	3.95	2.0
4.	Fibre Recovery	2.80	21.60	1.68	15.50	6.36	18.30	9.58 (savings)	NIL
5.	Fibre Recovery	4.50	7.76	0.84	74.00	46.32	78.50	56.39	4.7
6.	Fibre Recovery	3.60	12.48	3.33	17.65	8.82	21.25	4.24	2.8
7.	Fibre Recovery	6.50	9.85	3.0	52.30	20.34	58.80	26.24	1.8
8.	Fibre Recovery	5.69	15.25	1.68	30.25	16.80	35.94	10.98	2.7

** The total investment cost does not include the land cost Annual depreciation cost by applying straight line method*

*** Annaulised operating cost : (Operating cost + depreciation + Interest) - (Savings) – annual Interest rate at 14% on total investment*

neighbouring Arab countries but an eastward shift followed. Between 1975 and 1979 there was a sharp increase in migrant workers from South Asia and after 1979 they flew in by jumbo jet loads from the Philippines, Thailand and the Republic of Korea. Indonesia was a late-comer. Television sets popped up in remote villages and grass huts were replaced by concrete houses as workers sent home money. The phenomenon peaked in 1981. Then an economic slowdown diminished the flows especially from India and Pakistan. But the study estimates that in 1987 there was still 3.2 million Asian workers in the Middle East.

Given the underemployment and unemployment in almost all the labour sending countries, the migration had no obvious unfavourable impact on economic output or growth. Indeed it acted as a "safety valve" when most faced serious recession in the late 1970s and early 1980s. "At a time when a massive increase in oil imports and international recession put severe pressure on the balance of payments, remittances offered much needed relief," according to the ILO study. During the first half of the 1980s, remittances were large enough to finance as much as 40 per cent of India's massive balance of trade deficit. Pakistan's migrant workers reportedly sent home $ 2.5 billion in remittances during 1982-83. The Republic of Korea gained more than $ 1.9 billion in 1982 from its workers. The Phillippines eventually became the largest Asian labour exporter with some 500,000 of its citizens in the Middle East by 1983 and close to $ 1 billion in annual remittances

Bioenergy Systems

"The extent of utilization of husks is much higher in India than in any other developing country. About 40% of the husks generated in India are used as a boiler fuel in parboiling mills. Some of the older non-parboiling mills in India produce mechanical power with rice husks. The typical husk power system includes a rather inefficient step-grate furnace, an old Lancashir-type boiler, and an old steam engine." These were revealed by a study sponsored by the Agency for International Development (AID) and published by the Winrock International Institute for agricultural Development. The report of the study titled "Bioenergy Systems Report: Energy From Rice Residues", provides information on commercially available systems that are producing energy from rice residues in various countries.

The report reviews the production of several types of energy including industrial process heat in the rice milling industry and other industries, mechanical and electrical power for the grid. The rice residue systems reviewed in the report include furnaces producing direct heat, boiler systems, steam engine systems, steam turbine/generator systems, gasifier/engine systems, and a gas turbine system. The report found that due to the severe energy and fuel shortage in India a wide range of Indian industries use rice husks as fuel. Competition among buyers has driven up the price of rice husks in India. Quoting Indian Institute of Technology (Delhi) resources, the report indicated that in some parts of Northern India husk prices has reached Rs. 500 per tonne.

The report found that in some countries with acute shortages of domestic fuel, notably China and india, rice straw has been widely used for cooking. The straw is also used for livestock feed in areas where other sources of fodder are limited. In some Indian states most of the rice straw is fed to cattle, and there is no substantial surplus of unused straw. In other states, notably Punjab and Haryana, better fodder is available and most of the rice straw is unused. Relatively small quantities of rice straw are used for a number of other purpose including for packing, roof thatching, fuel for brick kilns, growing medium for mushrooms, and feedstock for the production of fibreboard, paper and chemicals. Most of the straw is also burned in Punjab.

A team at Punjab Agricultural University made a comprehensive study in 1985-86 for the Punjab Electricity Board of options for the collection of straw as the exclusive fuel for a proposed 10 MW power plant. The study examined means of collecting approximately about 187,000 tonnes of rice straw annually. Under the plan proposed by the team, loose straw would be collected by farmers and transported by ox carts, trailers pulled by tractors, and trucks to five collection, bailing, and storage centres. Each center would have three 12.5-ton/hour balers; they would operate 10 hours a day for 6 months a year in order to bale and store from 37,000 to 48,000 tonnes of baled straw at each center. Baled straw would be trucked to the power plant as needed in order to permit the operation of the plant for 300 days per year.

Around 50,000 tonnes of baled or unbaled straw will be brought directly to the 3.0 MW plant in the Punjab planned by PRM Energy Systems (Section 4) from farms within a 7-miles radius. Both the methods and costs of transporting straw from farms to the power plant would depend on local conditions including the patterns of rice production, available vehicles, local road networks, seasonal weather variations, and other variables.

Book Review

Wasteland Development: *BY S. P. Singh, Agricole Publishing Academy, New Delhi, 1989, 228p, Rs. 200/-*

The book deals with several indigenous and exotic plant species; both forestry species as well as horticulture plants have been included. The title of the book is misleading as the majority of tree species listed here are not relevant to planting on wastelands. The book deals with the silvicultural notes of about 130 species. The notes are based on a large number of publications which have been listed.

Besides listing the environmental requirements of the species the book also gives the conditions suitable for their growth, the uses of various parts of the tree, methods of propagation and after care, etc. Calorific values for some species are given at the end as well as in the Annexure. The species notes are followed by seven annexures, containing, for instance, the forest area statistics of some countries (the year of FAO publication quoted is not mentioned, however).

The book, contains many mistakes which could have been avoided, with some careful research. The first species mentioned, *Acacia albida*, is listed wrongly as being synonymous with *Acacia jeucophioea*. These are entirely different species. *A. albida* is an exotic while *A. leucophloea* is an indigenous tree of India. The calorific value of this species is reported as 19741. This is absurd. No species has such a high calorific value. *Acacia auriculiformis* is not a wattle as mentioned. The tree species *Acacia mearnsii* and *Acacia mollissima* listed at s. no. 13 and 16 are the two names of the same species. *Ainus nepalensis* is mentioned as a good coppicer. This is not correct. The species only produces root suckers. Again, neem tree is stated, quite erroneously, to be suitable for planting on calcareous soils. The Eucalyptus species has been listed at one place although there are different varieties. It is stated at one place that "Tissue culture may prove the best method for propagation of Eucalyptus (true to type) on a commercial scale". There is no basis for such a statement as nowhere in the world is Eucalyptus planted commercially by this method. *Parkinsonia aculeata* is stated to be a firewood and good for charcoal. Both statements are incorrect. The species smokes badly and is not used for charcoal manufacture. *Pinus roxburghii* is stated to be suitable as an ornamental avenue tree and its leaves are reported to be edible. This species has no leaves. The needles are not fed to animals except as a desperate measure. The local name S. No. 101 of *Polyaithia longiiolla* is reported as Ashok or Deodar. Deodar is the local name of *Cedrus deodara* and not this species.

The book brings together at one place some rudimentary information about most of the plant species occurring in the plains of India. Very few species of the hill region are included. This literature is generally scattered and the author has done a useful work by such a compilation. The author has worked on horticultural plants and has no experience of working on forest species. Finally, the academic value of the book has been diluted by the large number of incorrect statements.

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National Seminar on Water Management-the key to Developing Agriculture: *Edited by J.S. Kanwar, Agricole Publishing Academy, New Delhi, 1988, 790p, Rs. 500/-*

This book is a collection of the proceedings of the seminar held under the auspices of the Indian National Science Academy (INSA), New Delhi, from April 28-30, 1986, and contains a wealth of information, including some case studies (except from Eastern India) on aspects of water management for agriculture. The pro-

ceedings of the seminar are arranged in eight groups covering achievements, issues and strategies, R&D, training, improving water use efficiency, cost benefit analysis and integrated approach to water management.

A total of 36 papers by eminent experts from India and abroad were presented. The findings of each session are summed up with recommendations. In the plenary session chaired by the then Secretary, Ministry of Agriculture, the highlights of the seminar were summarised for follow-up action in the form of recommendations.

Water management is an extremely complex subject and requires interdisciplinary expertise. Studies show that against estimated water in the Indian river systems at $1900 \times 10^9 m^3$, only $830 \times 10^9 m^3$ of water will be utilised by the year 2000. Of this, 93% is for agriculture alone; industries take a bare 2%, while drinking and other domestic uses consume about 4%. And yet millions go thirsty in our cities and villages, and agriculture continues to be subject to the vagaries of the weather.

We have all the water we need. The mean annual rainfall averages about 177 cm, the largest anywhere in the world for a country of 320 million hectares. Hardly 14% of this precious water is harnessed and the rest is allowed to drain out into the oceans. And yet interstate quarrels make water management difficult. The Seminar rightly brings out that water is an extremely valuable national resource and must be managed well to achieve national goals, without barriers of state boundaries. If more rain water is harnessed, that too at a fraction of the cost required for major irrigation projects, additional crops can also be raised and agriculture will get a further boost. Hence serious action plans must be initiated without any further delay.

In the three day seminar the experts brought out a lot of facts, many of which are not palatable—canal irrigation is very inefficient and highly subsidized to the extent of Rs. 1376 crores annually. Despite investment of Rs 15,000 crores, they have yielded marginal results. Irrigation water use efficiency (WUE) is rather low and yields about one quarter of the potential obtainable through efficient management. This situation must be remedied and irrigated areas should be used for high value crops to be cost effective.

The authors have highlighted that tank irrigation, once the main source of irrigation and also much cheaper has, of late, fallen into almost total disuse as most tanks are heavily silted and go dry when needed most. Even our water reservoirs, canals etc. are so badly silted, due to soil erosion, that their water capacity has diminished drastically over the years. In Karnataka about 10,000 water tanks, created at the time of Tipu Sultan for storing rain water and also used for agriculture, have all dried up. The situation is almost the same all over the country. Even lakes supplying drinking water to our cities are silted badly. Many industries had to be closed due to shortage of water and power. A National Desiltation Programme is essential. The commissioning of the Viskhapatnam Steel Plant, on which Rs. 8,000 crores have been invested has been delayed for over two years due to water shortage. Such is the importance of efficient water management. Result-oriented and knowledgeable personnel can make all the difference.

Experts have also begun to debate the benefits of medium/large canal irrigation projects, as the cost benefit analyses show a dismal picture of inefficiency, high national subsidy and adverse environmental effects e.g. Tehri and Narmada Projects. In contrast, the examples of Ralegan Siddhi and other projects involving individual and collective efforts are sharp pointer so our planners and policy makers as better, cheaper and efficient alternatives of water management.

Against an ultimate irrigation potential estimated at 113 million hectares, about 60 million hectares are presently being utilised. The Indian Statistical Institute with the co-operation of the Irrigation and Agricultural ministries plans to carry out sample surveys to authenticate this date base. This must be given priority to generate confidence in the system. India has some of the largest dams and despite having more than one fifth of the world's irrigated area, the experts have concluded that underutilisation of irrigation potential, inadequate field channels and distribution systems and losses have made the overall efficiency of canal irrigation very low. In fact the benefits of canal irrigation have been found to be the lowest compared to other modes. Authors have also shown that increase in food production due to irrigation is rather low compared to the contribution from other factors like fertilizers, area and shift in cropping pattern. Capital costs have now skyrocketed and international funds have become scarce for undertaking big irrigation projects.

India's new challenge today is to improve water management to boost yields and double the irrigated area and to to do this at lower costs, both economically

and environmentally. The Washington-based *Worldwatch Institute* has also brought out gross water mismanagement, degradation of lands, deforestation and the denuding of critical watersheds. These factors upset the natural water cycle causing more rain water to run off in damaging floods, so that less and less water percolates into the ground to recharge acquifiers. The study report concludes that India is in for a major water famine in the 1990s. The Seminar, and the resultant book, are most timely.

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Cost Analysis For Capital Investment Decisions: *Hans J. Lang, Marcel Dekker, 1989, 46 p, $ 150.*

The book deals comprehensively with various aspects of capital investment decisions. It terms the management science concerned with allocating capital among competing investment opportunities as an "engineering economy" as these decisions require engineering inputs such as feasibility studies, design drawings, construction drawings, material specifications, construction specifications, etc.

Capital is defined by the author as any form of wealth capable of producing goods and services. The holders of capital seek opportunities to invest it for an adequate rate of return. The criteria for taking investment decisions fall into two broad categories. One category comprises those criteria which do not discount cash flow and the other category includes those which are based on the time value of money and, therefore, discount cash flow. The application of discounted cash flow criteria requires the preparation of estimates of investment cost and of operating and maintenance expenses which are coupled with revenue forecasts to arrive at estimates of the cash flowing into and out of a proposed project during its life-cycle. The cash flows are converted to their equivalent present value and an estimated rate of return is calculated.

In the category of investment criteria which do not discount cash flow, the author includes payback period method, return on investment (ROI) and return on average investment (ROAI). The other category of criteria that discount cash flow, includes:

Present Worth (PW) or Present Value (PV)

Annual Worth (AW)

Internal Rate of Return (IRR)

Benefit-Cost Ratio (BCR)

The payback period and the two return-on-investment criteria were almost exclusively used for taking investment decisions till the early 1950s when these were largely displaced by the discounted cash flow methodology. The author maintains that the payback period criterion still continues to have importance and would continue to be so as a risk index to measure how fast the initial investment will be recovered. Between two investment opportunities, each expected to yield the same rate of return, investors will favour the investment alternative with a lower payback period.

The author puts forward a remedy to correct one of the deficiencies of the payback period method by suggesting the use of a "Payback period with interest" criterion. This variation, the author maintains, will get rid of one of the major criticisms of the method, that it does not allow for the time value of money by discounting cash flow.

The author classifies capital investment opportunities in accordance with whether these are deterministic or probabilistic. Whereas in a deterministic problem the outcomes are certain, in the case of a probabilistic problem the outcomes are probable. Also, the solution of deterministic problems involves only estimation and cost analysis, but probablistic problems require risk analysis for their solution. The technique of sensitivity analysis is often an adequate substitute for probability analysis. Sensitivity analysis is generally applied to determine the inputs to which the expected rate of return is particularly sensitive. These may, among others, be the unit scales price and the volume of sales so far as capital investment decisions in the private sector are concerned. In the case of public sector projects, these are generally the volume of usage on which the estimates of benefits are based. The author also talks about risk-adjusted discount rates by suggesting the use of a low discount rate for the relatively risk-free alternatives and a high discount rate for the relatively risky alternatives. The author distinguishes uncertainty analysis from risk analysis by stating that in the case of uncertainty analysis it is not possible to assign a probability function to the variables on which the cost analysis depends.

The book mentions a useful classification of cases as these fall within the area of planning or of evaluation. A planning problem typically refers to a 'to do or not to do' situation; for instance, to build or not to build a new facility such as a bridge, dam, power plant, hotel, office building, petroleum refinery, etc. An evaluation problem - also called an optimization problem - is to select the best from among the available alternative projects for achieving a pre-determined objective.

The author has elaborated his discussion of investment criteria by extending it to situations in which the investment by its very nature cannot or will not earn profit. This would be the case with many investments undertaken in the public sector. The investment criteria in such cases are concerned with maximizing differences between benefits and costs. The concept of "shadow prices" — when market prices are no longer the true indices by which to evaluate capital investments — is dealt with in considerable detail. The author points out that whereas the conceptualization of shadow prices is not very difficult, selecting proper shadow prices presents much greater difficulty.

The author makes a welcome recommendation that the benefit-cost analysis should also relate to considerations of equity. The irreducibles that cannot be converted into monetary terms, should be attached due importance, and the redistribution of wealth that a public project can cause should be an important matter to be considered in the analysis of a project.

The book should certainly be of great help to those concerned with capital investment decisions. It provides sufficient material to the analyst to assess whether a project meets sound investment criteria. It is comprehensive and written in a lucid style. A large number of illustrative diagrams and worked out problems have been included in the book, which add to its usefulness. It should prove useful to university students, research scholars, technical managers, engineers, economists, financial experts, and others interested in cost analyses for capital investment decisions.

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Bureaucracy, Organizational Behaviour and Development : *Prayag Mehta, New Delhi, Sage Publications, 1989, p. 188, Rs. 175.*

Bureaucracy occupies an important position in contemporary society. In recent decades its role has expanded. The author has attempted to give a synoptic view of Indian bureaucracy, by highlighting the interface between bureaucracy, organizational behaviour, political behaviour and development performance against the social, economic and political canvas. He points out that "The emerging socio-economic and political situation, including increasing importance being attached to regulatory functions and to the 'generalist' cadres in the bureaucracy, has been marked by a development process benefiting the rich more than the poor. Such a situation is likely to shape the behaviour of bureaucracy in various ways particularly with the formulation and implementation of development programmes. The book makes an attempt to study the role perceptions, values, attitudes, orientations and behaviour of the bureaucrats in India, engaged in the administrative functions for developmental and non-developmental tasks.

As the bureaucracy in India is the principal tool for bringing about socio-economic changes in society, it is also important to examine how far bureaucracy is able to perform the growing development tasks. No study of bureaucracy in India can be complete without an analysis of its behaviour values which relate to rationality in decisions making, impersonality, authority and change/result orientation.

The author in the beginning has rightly raised four important questions related to the senior and middle level bureaucrats :

1. How do the senior bureaucrats working at the central level perceive the situation?
2. How do the middle and lower level bureaucrats working at state and district level perceive the situation?
3. What attitudes and motivation do they exhibit towards their work and work organization?
4. How do they tend to relate to social issues and to the prevailing political culture?

The author suggests that bureaucracy has become an 'integral and inseparable part of the development process' yet it has neither been 'goal oriented' nor 'action-oriented' as far as alleviation of poverty, promotion of social equity and development of people are concerned. Interestingly he has used the terminology 'bureaucratic schizophernia' indicating a split between saying and doing, between verbal and actual behaviour. The total slippage between the individual preferences

McGraw-Hill, New Delhi, 1989

This book is probably the first work to be published

The presentation of conceptual foundations in Chapter 1 seems to be lacking in coherence. The

and the goods actually delivered by the government is called government failure which can again be divided into two kinds - political failure and bureaucratic failure. If the bureaucracy does not achieve the objectives set forth, failure occurs either in the design and functioning

highly quantified with a wide variety of statistics, e.g. multiple correlation, factor analysis and regression analysis. Eighteen items have been included in the development questionnaire which have been coded as V-16 to V-33 (p. 76). These describe development

discussion on the history of computer-generations, procedural and non-procedural languages, enduser computing, 4 GLs, types of managerial decision problems where computers can be useful, structured and unstructured decision problems, MIS in the context of DSS and differences in management style in pages 4-15 is preceded and succeeded by the discussion of DSS components in terms of the Sprague & Carlson architecture for DSS design, in pages 1-3 and 16-21, with a comparison among EDP, MIS and DSS at the end.

The second chapter is exclusively devoted to basic concepts of micro computer hardware and software, with a rather detailed treatment of MS-DOS commands and Lotus 1-2-3. The author introduces DOS, then switches over to 1-2-3 and then reverts to DOS. (The real necessity for including the material on DOS and 1-2-3 as "Foundations" of DSS is questionable. Material of this nature should be included under a part devoted to "Software Environment for DSS Development using PCs", (as said earlier.)

For such a lengthy treatment of DOS and 1-2-3 in the second chapter, chapter 3 gives an extremely sketchy and scanty treatment of DBMS and nothing at all of dBASE III plus – a popular DBMS for microcomputers ! Chapter 4 on MBMS is also sketchy. It is rather curious to ponder why the author chose to treat the question "What is an Electronic spreadsheet?" on page 87, while he chose to cover Lotus 1-2-3 (a popular spreadsheet package for micros) rather extensively in chapter 2 itself!

The sixth chapter on "Yardsticks for Choosing DSS Software" gives some useful material on functional requirements to be satisfied by readymade software products for DSS development. In pages 191-198, capabilities of eight DSS generator products are given. (However, nothing whatever is stated about DSS generators as a level of technology for building DSS, either in the preceding chapters or in the present chapter.)

Chapters 9, 12 and 13 together treat some of the advanced topics in DSS, such as expert systems, group DSS and executive support systems. Of these three chapters only chapter 9 is comprehensive and informative.

Chapters 10 and 11 contain some useful information on recommended strategies for implementing DSS in organisations. Chapter 10 treats the more practically relevant steps for starting DSS development, while chapter 11 treats, on a relatively more theoretical plane, the notions of a multi-level "Information Center", a concept which is yet to take roots.

The first two annexures give useful information on some of the essential hardware and peripheral devices, as well as "do's and don'ts" of acquisition, installation and use of microcomputers. The third annexure is a glossory of technical terms used in the discipline of computing. However, inclusion of such material would benefit more elementary texts on Personal Computers than those on relatively more advanced topics such as DSS.

The overall content of the book is rather lopsided : it is relatively heavier on microcomputer concepts, Lotus 1-2-3, and integrated software such as IFPS, FOCUS, INGRES and ORACCE, and significantly weaker on the very conceptual foundations of DSS per se (which is supposed to be the title of the book). Even the set of cases using IFPS may be of only academic interest to the Indian manager or academics.

This book also abounds in various types of errors in written and printed English - spelling mistakes, improper hyphenation, use of Pickwickian English (in the very "Preface"), etc.

In the final analysis, this book in its present form may not be of any significant and immediate value to either Indian managers, MIS practitioners, academics or students. It looks rather haphazardly organized, hastity written and hurriedly printed. It needs to be cohesively reorganized, thoroughly revised and carefully rewritten and reprinted, if it is to prove to be of any real value.

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Human Side of Tata Steel : *S. N. Pandey, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi, 1989, p. 284*

In India, academics in management still cite the examples of entrepreneurship and management from the U.S. and U.K. Very few Indians know that an Indian enterpreneur practised management just as theories of management were being evolved elsewhere. Not only that, he was far ahead of his times. Though Jamshetji Nusserwanji Tata was not alive to manage the enterprise he founded, his thinking laid down the corporate philosophy of Tata steel and his successors, true to his spirit, made TISCO (Tata Iron & steel Company Limited) a forerunner of labour legislation in India. For every welfare measure TISCO preceded state action. The

author has made a signal contribution to the field of Indian management by penning the history of industrial relations and personnel management in an organisation which is even today an example for others to emulate.

The present work has grown out of a Ph.D. thesis submitted by the author to Ranchi university. Inspired by Dougles McGregor's 'The Human Side of Enterprises', the author undertook explorations in the human side of Tata Steel and traced the orgins of industrial democracy and human resources development in TISCO since its inception. Dr. Pandey's experience of working with Tata Steel for over three decades has provided him useful insights into the operation of the enterprises enabling him to assimilate and handle masses of data.

The questionnaire was basically designed to elicit the following information: personal information; work importance and work/family priority; job satisfaction; union representation; communication; leadership; target realisation; nature of job; need for training; work pressure; technology with particular reference to the man-machine interface; initial expectations; job change desired; job factors; role clarity; and fulfilment of expectations. Computations have been worked out for various departments and for inter-departmental comparisons. An attempt has also been made to test certain hypotheses. Of the thirteen hypotheses tested, six hypotheses have been fully established, six only partly and one hypothesis has been rejected altogether.

The study ascribes the remarkable performance of Tata Steel to continuity in leadership which over a period of time has evolved an egalitarian philosophy emanating from a paternalistic attitude which has gradually transformed itself into a partnership in venture. The organisation has not only been first in introducing many welfare measures but some of them are yet to be a part of the Statute Book. It has built up a team of dedicated professionals possessing the capacity to translate ideas into appropriate organisational ethos and culture. Loyalty, commitment and dedication are the hallmarks of its work force. Institutionalised in 1936, the Tata Workers' Union (TWU) has been the only union at Tata Steel. One wonders that even still the management is subject to the serious criticism that the 'high fliers' among the middle and lower groups are picked up more on the basis of their visibility than performance, favouritism rather than merit, and that worker participation at TISCO is something of a farce. The study regards the organisation structure as top heavy and the middle level as too personality-oriented. It observes low job satisfaction among officers. A surprising finding is that the high job satisfaction among workers does not lead to high involvement in work or to the realisation of higher targets. Interestingly, extrinsic factors of job play an important role in high target realisation, besides higher employee satisfaction. Hypothesis 8 has been refuted, thereby questioning the role of participative leadership for motivating employees to give more importance to work and to make them realise higher targets.

The book is written in a lucid style, and is neatly printed and beautifully bound. The author gives his data a scientific treatment using statistical techniques. Kudos to all three – the writer, the organisation researched and the publisher. It is indeed to the credit of the author that even while being a part of the establishment he is able to make critical evaluation of the organisation and offer some bold suggestions. However, his recommendations seem somewhat perfunctory, more impressionistic than the output of serious research. He praises the organisation on some counts and criticises it on almost the very same counts. For purposes of implementation, there is always a question of "how much". This should not, however, diminish the importance of his research. In a study which embraces such a wide gamut of issues, mostly qualitative in nature, an author is unwittingly tempted to make observations at times, without their being substantiated.

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Productivity Abstract

NPC Doucmentation Section

Advanced agricultural biotechnologies. Some empirical findings on their social impact : Ahmed, Iftikhar, International Labour Review, *128(5), 1989, p. 553-569*

Drawing on country case studies, the article shows that, while advanced agricultural biotechnologies are more easily applied by various farm-size categories than Green Revolution technology, large farmers seem to be pioneering their introduction. It also shows that such biotechnologies could contribute to increased labour intensity, to greater demand for hired labour and to a reduction in seasonal variations in employment. The author analyses their impact on skill requirements and job opportunities, including employment created indirectly through inter-industry linkages, and discusses the significance of small-farm development strategies based on these biotechnologies from the perspectives of both equity and growth.

Biogas option for rural family - economics against other alternatives in Indian Context : Bhatnagar S.S., Mathur A.N., Jain Sudhir, Urja, *27(4), April 1990, p. 30 32.*

According to the authors unless subsidy and concessions are continued to be made available for construction of biogas plants, burning dung and supplementary wood in an improved chulha shall stand most economic. This option is rated lowest from the point of view of user's health and hence governmental subsidy and efforts to promulgate biogas plants must continue with more and more zeal to retain biogas as most economic option in view of its better efficiency, better health of user and supplementary benefit in the form of slurry. Wherever wood is available free of cost, use of improved chulha for cooking is most economic and hence should be promoted. Besides being economic it also ensures good health to the user and considerable saving of wood.

Blending growth with social justice : Ghosal, S.L. Yojana *34(3), February 16-28, 1990, p. 22-23.*

Dwelling on vital problems like ever increasing population and demand for food and shelter, the author has discussed as to how the national growth, and social justice can be ensured. He has pointed that the foremost task is to improve our agricultural performance. To achieve this goal, the author feels, it is imperative to take steps like raising income rather than just self-sufficiency in food, providing this small and margin farmer excess to low cost technology and imposing before' floor for size and holding to avoid further fragmentation.'

Computer Viruses : A threat to the information age : Cohen, Fred, The American Review, *33(4), 1989, p. 10-13.*

The author explains how electronic epidemics resemble their biological counterparts. They use circuitry to replicate in the same way human viruses use a living cell's gentic code to multiply. While the author warns that there may be inherent limits on the effectiveness of any protection system for computers, experts are developing some techniques for thwarting these infections.

Contractual Constrains on labour exchange in rural Kenya : Collier Paul, International Labour Review, *128(6), June 1989, p. 745-768.*

Since independence, the Kenyan economy has witnessed extensive and rapid commercialisation of both the commodity and labour markets (as well as the privatisation of land). Although, there has been much discussion of this process, its impact on the efficiency of resource allocation in peasant agriculture has hither to been neglected. The author argues that efficiency has not been achieved mainly because contractual constrains have prevented market transactions from having the collective effects predicted by economic theory. He concludes that absentee land ownership lies at the root

of this mal function and that a redistribution of land rather than the promotion of tenancy is required to reduce poverty and increase the national outputs.

Corporations, culture and commitment – Motivation and social control in organisations : O'reilly, Charles, California Management Review, *31(4), Summer 1989, p.9–25.*

The notion of "corporate culture" has received widespread attention in the past several years. But what is meant by the term and why should managers be concerned with it? Culture can be thought of as a mechanism for social control. As such, culture is important for both the implementation of strategy and as a mechanism for generating commitment among organizational members. Based on a comparison of strong culture organizations, ranging from cults and religious organizations to strong culture firms, this article argues that culture and commitment result from : systems of participation that rely on processes of incremental commitment ; management as symbolic action that helps employees interpret their reasons for working ; strong and consistent cues from fellow workers that focus attention and shape attitudes and behaviour ; and comprehensive reward systems that use recognition and approval. These techniques characterize "strong culture" organizations

Employment and livelihood – The rural labour process and the formulation of development policy : Bhaduri Amit, International Labour Review ; *128(6), 1989/6. p.685-700.*

The industrialisation drive of the 1960s in developing countries failed to absorb either the urban unemployed or the new wave of rural–urban migrants it triggered off. The author argues that an effective industrialisation strategy must therefore include measures to improve the lot of rural workers and keep them in the countryside. Otherwise, peasants unable to migrate will continue to become involved in "forced commerce" (ex change relations that trap them in poverty). He suggests a combination of measures to increase the flexibility of real urban industrial wages and to create income-generating opportunities for the rural poor. In the absence of redistribution which would meet with strong opposition commercial reform (rural-credit and marketing) offers better prospects politically.

Functional Form of Import Demand Function : Sundararajan.S, Bhola, Margin, *21(3), April-June 1989. Page-52-57.*

The authors have tried to provide an estimate of import demand function for developing countries like India, and to test the hypothesis whether the conventional functional forms are significantly different from the generalised functional forms. The results demonstrate that the simple formulation of the demand for imports is not sufficient to explain the true dynamics of the demand and the conventional forms are not free from functional mis-specification.

The available literature on this subject is replete with theoretical and empirical works for developed countries, attempts to prove the same for the developing countries have been few. The imposition of a particular functional form on the date may well lead to functional mis-specification and give misleading inferences.

The authors have tried to tackle this aspect as well as fill the lacuna which exists in the literature.

Imperatives of women's uplift : Joshi Uma, Yojana, *34(4), March 1-15, 1990, p. 21-22.*

Inspite of constitutional safeguards and other administrative measures, women continue to be the single largest exploited citizens in India. Illiteracy, lack of training and the general socio-economic milieu have all contributed to this situation. The author, therefore, advocates for opening up of opportunities for independent employment and income for women and a total war on female illiteracy.

Information technology a significant factor in productivity : Muir FMS, Andrew P. & Shaw MMS W Nigel, Management Services, *33(12), December, 1989, p. 12-17.*

Reorganisation in local government in Scotland in 1975 required the development of an appropriate information technology strategy for the councils. This paper reviews both the take up of information technology in Fife Regional Council and the impact of information technology on Productivity improvement. The authors have presented this as a case study.

Outstanding manufacturing in the coming decade : Edmondson, Harold E & Wheelwright, Steven C, California Management Review, *31(4), Summer 1989, p. 70-90.*

The topic of manufacturing competitiveness has become a major concern of government, business, and academicians in the U.S. over the past few years. While much has been written about the need for U.S. manufacturing firms to address current and future challenges,

most of that has focused on prescriptions for "closing the gap" that has developed over the past several decades. Based on field studies at Hewlett Packard, Chaparral Steel, and several other U.S. companies, this article describes three modes or patterns of response that appear to cover the majority of U.S. firms. It explores in detail the actions taken by firms that have sought to exhibit leadership in manufacturing in the coming decade. The article outlines the management processes and steps being followed as firms seek to do much more than simply "close the gap" and then specifies what will be required of a manufacturing based firm desiring to be at the forefront of manufacturing competitiveness in the mid-1990s.

Productivity Planning and Strategy in Retailing.: Samiee, Saeed, California Management Review, *Winter 1990, 32(2), p. 54-76.*

This article examines the management of productivity among high-performing retailers in Europe, Japan and the U.S. While the majority of the foreign firms interviewed for this study followed a formal productivity planning process, successful U.S. retailers did not follow an elaborate productivity plan and were instead frequently guided by their strategic plans. The activities of these retailing firms have been classified into three major categories ; management of technology and physical resources ; market driven strategies including product development and sourcing ; and human resources management. In addition, most firms that follow a plan, audit their productivity to assess their level of success.

Reliability of Nominal Data Based on Qualitative Judgements : Perreault D. William, JR. and Leigh E. Laurence, *26(2), May 1989, P. 135 - 148.*

Most research related to the reliability and validity of marketing measures has focused on multi-item quantitative scales. In contrast, little attention has been given to the quality of nominal scale data developed from qualitative judgements. Judgement-based ("coded") nominal scale data are important and frequently used in marketing research–for example in analysis of consumer responses to open-ended survey questions, in cognitive response research, in meta-analysis, and in content analysis. The authors address opportunities and challenges involved in evaluating and improving the quality of judgement-based nominal scale data, with specific emphasis on the use of multiple judges. They review approaches commonly used in other disciplines, then develop a new index of reliability that is more appropriate for the type of interjudge data typically found in marketing studies. Data from a cognitive response experiment are used to illustrate the new index and compare it with other common measures. The authors conclude with suggestions on how to improve the design of studies that rely on judgment-coded data.

Selecting an IT system – as hierachical approach : Sugg, Reggie Von Zugbach De & Wilson, James, Management Services, *33(10), Oct. 1989, P.12-15.*

IT systems selection in large organisations is often dominated more by political factors than by considerations of systems performance. This paper describes how one British Government agency improved IT selection process by the adoption of a structured approach which took account of the management and political interests within the organisation. The result of the changes made were a demonstrably faster and better decision making process.

The effects of 1992 on European Business: Delachaux B. Francois, Business Horizons,*33(1), January–February 1990, P.33-36.*

The author has tried to highlight the problems that are likely to come to the forefront when the European Community opens in 1992. The opening of the European market will bring changes to both the internal and external firms dealing in the markets. According to the author this would be a very interesting period, where future will no longer be a repeat of the past ; where innovation, adaptability and quick response will be the key factors, and a tremendous challenge to every person involved in a business. Thus it will be the survival of the fittest.

The innovator and the mandarin : A study of motivational patterns of creative individuals : Shukla, Madhukar, ASCI Journal of Management, *19(1), Sept. 1989, P.16-27.*

This study conceptualises the innovative ability as consisting of two independent factors : Creative temperament, and idea-selling ability. Taking these as two independent factors, a four-fold typology of how people respond to ideas was construed. These were Mandarins (Low creative temperament-low idea selling ability), Mavericks (Low creative temperament-high idea-selling ability), Dreamers (High creative temperament-high idea-selling ability), and innovators (High creative temperament-high idea-selling ability). These four groups, drawn

from a total sample of 215 executives, were administered a motivational factor check list. The results showed that the mandarins preferred extrinsic motivations while the innovators preferred intrinsic factors. It was also found that for the innovators participative culture, independence, autonomy, and opportunity to learn were major motivating factors which distinguished them from others. These findings and their implications for management are discussed.

Training strategies for effective computerisation : Singh, S.K., Vikalpa, *14(3), July-September, 1989, P.37-42.*

Information systems–related training has multiple objectives and multiple constituents. It has to be imparted in stages and must use appropriate tools for the particular objective-constituent confugeration. The author has taken a total-system view of information systems related training, and proposes a comprehensive framework to enhance the effectiveness of computerisation in organisations.

When does union-management cooperation work? A look at NUMMI and GM-Van Nuys. Brown, Clair & Reich, Michael, California Management Review, *31(4), Summer 1989, p.26-37.*

Spurred by the Japanese model, the U.S. automobile industry has been restructuring its industrial relations practices along lines that aim to build upon union-management cooperation. This new organization of work changes local work rules by replacing numerous detailed job classifications with only one to three broad classifications. Team work, job rotation, and continuous improvement programs are introduced to replace direct supervision as the mechanism for obtaining high productivity and quality. Greater employee involvement in decision making is supposed to improve worker satisfaction and increase productivity. This article examines the advantages and problems of implementing union-management cooperation by comparing the experiences of the NUMMI (Toyota-General Motors joint venture) automobile assembly plant in Fremont, CA, with that of the GM plant in Van Nuys, CA. The article identifies the factors that facilitated cooperation in one case (NUMMI) and that seemed to block it in the other (GM-Van Nuys) and discusses the policy instruments that might enhance cooperative outcomes.

Who needs a boss ? Dumaine Brian : Fortune ; *May 7, 1990 , No. 10; p. 40-47.*

Employees in self-managed teams do not require bosses. They arrange schedules, buy equipment fuss over quality-and dramatically boost the productivity of their companies. These superteams work as well in service and financial businesses as they do in manufacturing. The innovation has taken hold at such corporations as Procter & Gamble, General Mills, Digital Equipments, Federal Express, and 3M-by class and the phenomenon is spreading. It may be the productivity breakthrough of the 1990s.

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Books in Brief

NPC Documentation Section

Achieving Managerial Excellence - Insights from Indian Organisations : *S.K. Bhattacharya. New Delhi, Macmillan, 1989, 170p. Rs. 80.00*

This publication outlines the findings of a study sponsored by the Industrial Development Bank of India (IDBI). The study identifies the distinctive managerial characteristics of those Indian corporate enterprises which consistently perform better than others in the same industry. The author uses the McKinsey 7 – 5 model to do an incisive organisational analysis of the ten companies, and distills insights which make them consistently achieve excellent results.

Agricultural Mechanization Policy and Strategy : *A. G. Rijk. Tokyo, Asian Productivity Organisation, 1989, 283p, $ 18.50*

This book emphasises the need to formulate sound mechanization strategies and policies for developing countries to ensure that the objectives of mechanization achieved at minimal social and economic costs. It reviews the agricultural mechanization process in a historical context, and discusses the main developmental issues associated with mechanization. The main developmental issues associated with mechanization. The formulation of a model for mechanization policy and strategy formulation and its applications to the central region of Thailand is described in detail.

Beyond Multinationalism – Management Policy and Bargaining Relationships in International Companies : *Jairus Banaji & Rohini Hensman. New Delhi, Sage Publications, 1990, 232p. Rs. 190*

The study demonstrates that foreign companies in Bombay have created a section of the labour force whose combative and self-reliant styles of unionism are rested in their consciousness of working for international firms. On the other hand, it also shows that conditions in the European and Indian plants of the same companies diverge considerably. This is related to a headquarters management strategy (which the authors call 'multinationalism') of insulating crucial decisions on restructuring and investment (which are internationally centralised) from collective bargaining (which continues to be fragmented). The authors argue that while multinationals have created the basis for an international trade union movement, their way of handling the labour relations function prevents this potential from being realised; hence the importance of trade union responses which attempt to go beyond multinationalism.

Concise Encylopedia of Building & Construction Materials : *Fred Meavenzadeh (Ed). Oxford, Pargamen Press, 1989, 650p, $ 175.*

This volume contains the work of numerous specialists in the field of building and construction materials. There are over 100 articles covering general building materials, their mechanical properties, and economic and historical aspects, as well as those dealing specifically with the use of materials such as clays, cermics, cement, sand, gravels, glass metals, woods, polymers, plastics and composites. It is extensively illustrated and indexed throughout. This is intended primarily for all those interested in having a useful reference source in building and construction materials at hand.

Consumer Price Indices – An ILO Manual : *Ralph Turvey. Geneva, International Labour Office, 1989, 196p. SF 27.50*

This manual covers all the important steps in constructing a consumer price index steps. It reflects different national practices and provides numerous concrete examples and diagrams.

Distributed Data Bases : Plan for Interaction and Online Search : *S. Nagarajan, et al. New Delhi, Informatics Publications, 1989, 165p.*

This book provides a collection of papers of a national seminar on distributed data bases. It focuses on the importance of the Data Base Management System (DBMS) in India because of the scattered information centres and the diverse kind of languages which ought to be linked. The paper presented in the book could be grouped into three themes. The first theme relates to the description of the existing databases, secondly the need for more data-bases in certain vital areas is stressed and lastly the importance of computers networking and on line services for these databases is discussed.

Dry Farming Technology in India : A study of its profitability in selected areas : *P. Rangaswamy. New Delhi, Agricole Publishing Academy, 1990, 204p. Rs. 200*

This study deals with the problems of achieving a breakthrough in dryland agriculture with which the planners have been seriously concerned for quite sometime. It makes an economic evaluation of the dry farming technology developed by the All India Coordinated Research Project for Dryland Agriculture in two selected project areas, viz. Kovilpatti and Hyderabad. Based on the results of the study, the author draws certain policy inferences which will raise the profitability of the dry farming technology, reduce its risk, save on the scare resources and thereby facilitate its adoption.

Excellence through Human Resource Development : *M.R.R. NAIR & T.V. Rao Eds. New Delhi, Tata McGraw-Hill, 1990, 148p, Rs. 75*

This publication is a collection of the conference papers for National HRD Network Symposium held in Madras in February, 1990. The papers closely look at various roles of HRD to contribute to organisation effectiveness in terms of higher productivity and better competitiveness. This book has been divided into four parts. The first part deals with Chief Executives' views and experiences of HRD. The second part deals with the expectations of the line managers and workers from HRD. The third part deals with the role of HRD Managers. The fourth part deals with the making of the HRD facilitators. Taken together, it covers exhaustively the role of HRD and of HRD Manager in industry.

Financial Accounting for Management : *Subhash Sharma & M. P. Vithal. New Delhi, Macmillan India Ltd., 1989, 342p, Rs. 48.*

This book provides the underlying principles of an accounting system. A number of cases and exercises drawn from the Indian scene are included for understanding the relevance and implications of such principles both for preparation and analysis of financial statements. It also covers some of the recent practices and contemporary issues in accounting for Price-Level Changes, Human Resource Accounting and Social Accounting.

Hand Book of Construction Management : *P. K. Roy. New Delhi, Macmillan India Ltd., 1990, 406p, Rs. 220*

This book contains relevant details of various aspects of management practice necessary for the engineering construction business. It is based on the author's extensive research and varied practical experience of over a quarter of a century in multifacted national and international construction projects.

India's Information Revolution : *Arvind Singhal & Everett M. Rogers. New Delhi, Sage Publications, 1988, 220p, Rs. 165.*

This book reviews the all pervasive processes of the communication revoluation in India with fascinating case studies. . . with topics like the telecom and computer revoluation discussed in a large social context, this book is bound to attract wide attention and provoke scholars. In collaboration with Arvind Singhal, Professor Everett Rogers (with insights in the Indian scene spanning three decades) offers a new frame work to study and analyze the expiosion and impact of information technologies.

Infra-structure and Economic Development in India : *B. M. Joshi. New Delhi, Ashish Publishing House, 1990, 248p, Rs. 200.*

The author examined in depth the development of infra structure in Uttar Pradesh with particular focus on inter-regional and inter-district disparities. He finds that infrastructure facilities are clustered together over space and have contributed to the disparities in economic development across regions and districts. It also presents a policy frame work for infra structure development.

Low-cost Ways of Improving Working Conditions – 100 examples from Asia : *K. Kogi, W. Phoon and J. E. Thurman. Geneva, International Labour Office 1989, 179p, SF 12.50*

This book demonstrates that significant improvement can be made in conditions of work and occupational safety and health at very low cost. Many of the

ideas described are appropriate for widespread applications.

Management Dynamism in State-owned Enterprises in Asia : *Asia Productivity Organisation, Tokyo, APO 1989, 45p.*

This publication is the outcome of a survey conducted in nine countries during 1987 and 1988. Following the survey, a five-days, symposium was organised in Colombo in October 1988 in collaboration with Asian Development Bank as well as the National Institute of Business Management, Sri Lanka. The present publication includes the integrated survey report of the Chief Expert Dr.Vudichai Chamnnong and selected national survey reports with the report of the symposium.

Microelectronics and Change at Work : *John Besant. Geneva, International Labour Office, 1989, 117p, SF 17.50*

This report provides broad guide-lines on how the use of microelectronics affects employment and skill requirements. It aims to inform its audience of changes that have occurred and those likely to come; to identify the key employment related policy issues of those changes ; and to indicate the range of policy adoptions available to firms, trade unions and governments. Much of the analysis has been drawn from the experience of industrialised countries, but illustrative examples from a selected number of developing countries have also been included.

New Challenges in Management : *A.S. Menon & K.Shamanna. Trivandrum, CBH Publication, 1990, 250p. Rs. 200*

This book is a collection of 19 original articles on some of the important issues in Human Resource Management in work organisations. The contents are classified and presented under 6 thematic sections' Managing in a challenging environment; Work motivation; Communication; Group Dynamics; Human Resource Development and Industrial Relations. The material for these articles have been generated from largely Indian context and are very much particular to Indian Industry and Organisations. Management Academics and students should find in this book a systematic presentation of information enriching their knowledge with much needed insight into Indian context.

Planning for the Million - Promise and Performance : *Anand Sarup & Sulabha Brahme. New Delhi, Wiley Eastern, 1990, 184p, Rs. 30*

This is a book about planning in India. It looks at the process of planning and its impact in relation to the objectives laid down in the aspirations of the millions living in this country. In this book, an attempt has been made to look critically at the promises and performance of Indian planning. The outcome of this evaluation has been presented in a manner which would enable the people to participate widely in the debate on the orientation and priorities for the next plan.

Population Explosion - A Contemporary Concern : *Arti Laroia. New Delhi, Agricole Publishing Academy, 1990, 58p, Rs. 100.*

This publication highlights the importance of creating awareness about the current population explosion through population education. It also provides a history of population education in the united States, as well as approaches, goals and objectives of population education with application for India. It enumerates the population problems and the consequences of over population in India.

Population Growth and Poverty in Rural South Asia : *Gerry Rogers (Ed). New Delhi, Sage Publications, 1989, 249p, Rs. 195.*

This volume consists of five emperical studies and an overview by the editor which serves as an introduction to these selected studies. All the five studies deal with population and poverty in four countries of South Asia: India, Pakistan Bangladesh and Nepal and the data were mainly drawn from secondary sources like sample surveys, census etc. The publication provides sample data in socio-economic correlates of population growth on the rural South Asian countries.

Practical Guide to Research on Commerce and Management : *Dipak Kr. Bhattacharyya. New Delhi, Kitab Mahal, 1989, Rs. 25*

This book gives a broad outline into different methodologies of a research project from the selection of research topic, defining the objective of research - both general and specific, survey of existing literatures, development of hypothesis, collection of survey data, testing of hypothesis and finally drawing of conclusion. It is written in a simple language and lucid style in the form of lectures. It is laying due emphasis on practical difficulties to be faced by the researchers.

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Organisational Commitment : A Test of Predictor Models

Chandra Shekhar Sharma

This article attempts to investigate three sets of predictors of organisational commitment, with a view to developing a comprehensive model, which may be utilised for further research and organisational design. Organisations must assign equal importance to task characteristics as well as extrinsic rewards. To enhance and maintain the employee commitment at high levels, the jobs should be redesigned to make them challenging and interesting, according to the author.

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Results from previous studies have shown that organisational commitment is significantly related to important performance indicators like job performance (Amsa and Punekar, 1981, 1988; Gupta, 1983; Larson and Fukami, 1984; Van Maanen, 1975; Porter, Crampom and Smith, 1976; Steers, 1977), turnover (Srivastava, 1977; Marsh, and Mannari, 1977; Singh and Das, 1978; Angle and Perry, 1981; Chelte and Tausky, 1986; Koch and Steers, 1978; Arnold and Feldman, 1982), absenteeism (Smith, 1977; Steers, 1977; Koch and Steers, 1978), tardiness (Angle and Perry, 1981) and adaptability (Salanick 1977; Angle and Perry, 1981). Given these behavioural outcomes, organisational commitment may have serious consequences for organisational performance.

A number of studies, therefore, have investigated the antecedents of organisational commitment (Mottaz, 1988; Angle & Perry, 1983; Buchanan, 1974, Flynn and Solomon, 1985; Marsh and Mannari, 1977). In general the determinants studied in the available literature may be classified into three broad categories, namely, individual characteristics, task characteristics and organisational characteristics. However, studies have reported inconsistent results as far as the relative significance of these sets of characteristics in explaining variance in commitment is concerned. Certain studies have suggested that all the three factors are significantly related to organisational commitment with the latter two exerting greater influence (Angle, 1983; Stevens, Beyer and Trice, 1978; Angle and Perry, 1983; Hrebiniak and Alutto, 1972; Flynn and Solomon, 1985).

There are others who report that these factors have more or less equal degree of significance in explaining the organisational commitment (Buchanan, 1974; Marsh and Mannari, 1977; Brief and Aldag, 1980). Koch and Steers (1978) found that individual characteristics take precedence over other factors in predicting commitment. But Mottaz (1988) has found that while individual factors explain significant variance in organisational commitment when considered alone, in the face of task related characteristics these recede into insignificance. Similar findings have been reported with respect to organisational factors,

ment does not provide answer to the question why persons with higher age have greater organisational commitment. The answer must be sought elsewhere, in task characteristics or organisational characteristics. It is possible that a person with higher age occupies better position, has higher salary, strong group membership, more important work assignments etc. Therefore, he/she is more commited than a person with lower age. Similarly, female employees have been found to have stronger commitment than males. Again, it would not appear quite logical that sex alone as a sidebet is responsible for greater commitment. It may be because females have better leave facilities, medical benefits, work group support and therefore have expressed greater commitment towards their organisation. Thus, individual characteristics per se may not explain the variance in organisational commitment. Rather, the key to commitment seems to lie in the task and other organisational features that an organisation offers to its members. Therefore, it seems axiomatically logical that individual characteristics like age, sex, marital status, education etc. operate through organisational and task characteristics; these do not influence commitment directly. Individual characteristics are features which individuals bring to an organisation. These variables may have high correlation with commitment but are not associated causally. The present research aims at examining relative importance of individual characteristics, task characteristics and organisational characteristics. While we hypothesize that task and organisational characteristics will render individual characteristics insignificant, there is little *a priori* basis to frame a hypothesis on the superiority of task features over organisational features or vice-versa in explaining commitment. Therefore, no directional hypothesis is offered in this regard though the issue will be addressed by the present research.

In addition, the study also examines explanatory power of the variables in the three models when these are combined or made to interact.

Sample

Data were gathered from fifteen manufacturing and ten service (advertisers, banks and consultants) firms. Within each firm simple random and stratified random sampling procedures were followed to ensure adequate representation of employees from different levels of the organisation. The composition of the sample was (1) blue collar and clerical staff (N = 62), (2) first line supervisors (N = 59), (3) middle level managers (N = 59), and (4) departmental heads (N = 61).

Mean age of the sample was 42.5 yrs with two-thirds in the age-group of 35 to 50.

Qrganisational Commitment: Organisational commitment was measured by a 15 items Organisational Commitment Questionnaire developed by Porter et. al.(1974). The instrument measures the extent of acceptance of organisational goals and values, willingness to extent effort and to stay in the organisation. Mowday et al. (1979) found satisfactory test retest and internal consistency reliabilities of the meausure.

Individual Characteristics: Data on individual characteristics was obtained through self report items. These demographic variables included age, sex, marital status, length of tenure in the organisation and education level. Family responsibilities were measured by an index consisting of two questions on a five point scale. One question measured the extent of burden of family responsibilities and the other the number of dependents. Perceived job alternative and perceived skill transferability were measured by items given by Angle and Perry (1983). Uncertainty avoidance index developed by Hofstede (1980) was used. The measure has five items relating to the clarity of organisational structure, conflict avoidance, precision of rules and requirements of job.

Task Characteristics: Four task characteristics examined in this study viz. autonomy, skill variety, significance and feedback were measured with the help of a Job Diagnostic Survey Questionnaire developed by Hackman and Oldham (1976; 1980). The items on role conflict and role ambiguity included the ones developed by House and Rizzo (1972) and Rizzo et. al (1970).

Organisational Characteristics: Group cohesiveness was assessed by the nine bipolar adjective pairs comprising, "My fellow worker" components of Scott's (1967) semantic differential. These nine items provide a measure of within group harmony and interpersonal attraction which Stogdill (1972) and Lott and Lott (1965) respectively equate with group cohesion.

Group attitude towards organisation was measured by three questions on a five point scale, asking whether most members of the work group expressed positive or negative views towards organisation, were proud of their organisational association, tolerated or defended the criticism of the organisation.

Satisfaction with supervision and perceived leader competence were assessed by one item each, asking the extent to which the respondent was satisfied with supervision and also immediate supervisor had the work related skills. Self image reinforcement was measured by a three item index asking whether the respondent was accepted as he was, felt free to be himself and felt encouraged to do what he wants to do. Promotional opportunity was assessed as the extent to which the job provided opportunity for advancement and the promotion criteria were related to performance.

Table 1 contains Cronbach alpha of each scale and interscale correlations.

Table -1Reliability Estimates (Cronbach Alpha) of Variables and Zero Order Correlations among Them (N = 251)

Variables	Cronbach Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. Age	–	–																										
2. Sex	–	.21	–																									
3. Tenure	–	.61	.18	–																								
4. Education	–	.29	.11	-.09	–																							
5. Martial Status	–	.32	.21	–.00	.01	–																						
6. Family Responsibilities	.89	.14	.30	.02	.03	.01	–																					
7. Perceived Job Alternatives	.91	–.12	.10	.20	.41	.03	–.16	–																				
8. Perceived Skill Transferability	.85	.12	.09	–.13	–.11	.03	.08	.26	–																			
9. Uncertainty Avoidance	.92	.18	.04	–.03	–.13	.00	–.13	.16	.15	–																		
10. Autonomy	.79	.06	.00	.12	.14	.02	.03	.13	.18	.14	–																	
11. Challenge	.82	.08	.03	.00	.02	.01	.04	.18	.21	.16	.09	–																
12. Significance	.88	.10	.12	.08	.21	.02	.02	.15	.25	.18	.08	.21	–															
13. Feed Back	.75	–.12	.02	.05	.07	.01	.00	.11	.20	.34	.07	.19	.16	–														
14. Skill Variety	.87	.01	.03	.08	.04	.04	.03	.07	.13	.19	.12	.26	.11	.16	–													
15. Role Ambiguity	.74	-.17	.00	.03	.06	.00	.06	.12	.19	.18	.21	.24	.21	.21	.36	–												
16. Role Conflict	.94	.21	.30	-.06	–.07	.00	.07	.06	–.18	.25	–.22	.31	.22	.18	.28	.24	–											
17. Group Attitude Towards Organisation	.71	.03	.02	.07	–.17	.03	.06	.07	.19	.16	.12	.18	.09	.16	.06	.23	.07	–										
18. Group Cohesiveness	.85	.01	.03	.03	.03	.04	.02	.07	.11	.26	.05	.16	.16	.39	.05	.17	.09	.33	–									
19. Satisfaction with Supervision	.88	.04	.06	.03	.02	.06	.06	.04	.05	.03	.03	.15	.10	.25	.19	–.15	–.21	.28	.33	–								
20. Perceived Leader Competence	.76	.21	.00	.09	.05	.01	.04	.05	.06	.05	.08	–.06	.18	.31	.08	–.22	–.19	.19	.21	.61	–							
21. Self Image Reinforcement	.71	.16	.02	.03	.06	.07	.00	.09	.09	–.18	.57	.23	.21	.08	.62	–.16	–.53	.28	.23	.28	.11	–						
22. Promotion Policy	.84	–.08	.13	.08	.07	.01	.01	.08	.03	.10	.05	.06	.13	.13	.29	.05	.16	.24	.15	.17	.09	.06	–					
23. Salary Group Norms :	-	–.11	.11	.05	.06	.02	.02	.04	.10	.05	.13	.08	.12	.09	.15	.07	.02	.25	.12	.13	.07	.21	.15	–				
24. Encouragement	.89	.00	.05	.10	.11	.00	.02	.17	.13	.15	.13	.16	.20	.14	.21	.11	–.18	.16	.31	.15	.09	.56	.08	.05	–			
25. Competition	.91	.12	.06	.13	.15	.03	.04	.19	.12	.16	.08	.13	.16	.15	.20	.13	.22	.19	.16	.16	.06	.21	.03	.02	.34	–		
26. Isolate Slow Co-workers	.87	–.03	.07	–.12	.16	.01	.05	.08	.13	–.18	.19	.07	–.06	.12	.15	.07	.13	.00	–.22	.08	.03	–.28	.03	.06	–.38	.24	–	
27. Isolate Fast Co-workers	.79	–.09	–.02	.01	.08	.04	.02	.06	.00	–.13	.02	.08	–.09	.08	.13	.12	.05	.07	–.28	.07	.00	–.39	.04	.05	–.48	–.21	.03	–

It can be seen from the table that Cronbach alpha of each scale is satisfactory. Except 5 correlations all others are below 0.50. The interscale reliability estimate, Cronbach alpha is substantially higher than the interscale zero order correlations. This indicates that various measurement scales used in the present study have a reasonable degree of discriminant validity. The conclusion is substantiated by the fact that many of these scales such as group cohesion and self image reinforcement or group attitude etc. may be expected to be highly correlated due to their conceptual content. The high correlations observed among scales may be due to common method variance. Such variance is likely to occur when questionnaires are lengthy and use the same format for most items. Despite this limitation the evidence regarding discriminant validity and internal consistency is quite encouraging.

Analysis

Different models of commitment were examined using multiple regression analysis. Standardized beta coefficients are reported to demonstrate the relative importance and predictive power and direction of association of each variable in a model with organisational commitment. In addition partial r^2 were also computed, to find the contribution of each variable after the variance contributed by other variables has been eliminated. The reason for doing so is that ordinarily the r^2 belonging to each independent variable may change with different orders of entry of the variables in the regression equation unlike Multiple R^2 and beta weights which remain unaffected by such change. Partial r^2 may help overcome this problem (Cohen and Cohen, 1975).

Results

Table 2 summarizes the results of multiple regression analysis with report to impact of individual characteristics on organisational commitment.

Table 2. Multiple Regression Results of Organisational Commitment on Individual Characteristics : Model 1

Variables	Standardized Coefficient	Partial r^2
Age	.187	.015 **
Sex	.002	.012
Tenure	.201	.016 **
Education	(—) .221	.016 **
Marital Status	.102	.014 **
Family Responsibilities	.123	.015 **
Perceived Job Alternatives	.312	.031 *
Perceived Skill Transferability	.267	.022 **
Uncertainty Avoidance	.198	.015 **

Adjusted multiple R^2 = .099, F = 3.32 P < .01

* P < .01 ** P < .05

The eight individual characteristics together explain 9.9% of the variance in organisational commitment. Of these variables while sex failed to emerge as significant explanatory variable, age, tenure, family responsibility and marital status appear to have positive and significant relationship with organisational commitment. As such Hypothesis 1 has received only partial support. Other individual characteristics namely, education, perceived skill transferability, uncertainty avoidance and perceived job alternatives, all contribute significantly to the variance in organisational commitment. Education has negative relationship as hypothesised. But uncertainty avoidance, perceived skill transferability and perceived job alternatives have positive association with organisational commitment, which is in a direction opposite to what was expected. Thus the more an individual wants to avoid uncertainty, the more he/she is likely to be commited to the organisation. Similarly, the more an individual believes that his/her skills can be used fruitfully in other organisations the more committed he/she is to the present organisation. The finding seems to be in agreement with the theory behind individual characteristics model. If a job incumbent has transferable job-skills, his commitment to the focal organisation would be the result of his own choice to stay in the organisation on the volitional side bets. Possessing the skills and knowledge that might be sought else where raises the issue of volition; the exercise of choice in favour of the focal organisation would commit one to one's choice. Such interpretation receives further support from the fact that availability of alternative jobs are also positively related to commitment. Table 2 also shows that in the individual characteristics based model of commitment the variable having highest relative significance is perceived job alternatives followed by perceived skill transferability, uncertainty avoidance, education tenure, age, family responsibilities and marital status in that order. However, taken together individual characteristics account for a small proportion of the variance in organisational commitment.

Within individual characteristics, the demographic variables are relatively less important than the other variables such as available job alternatives, use of individual's skills elsewhere and preference regarding uncertainty. It implies the involuntary sidebets acquired by default through accident of birth, structure of the family and inevitable passage of time exercise less influence than those sidebets under the volitional control of the individual like job alternatives, education and skill transferability which depend on individual's personal efforts and motivation in this regard.

Results relating to task based model of organisational commitment are summarised in Table 3.

Table 3. Multiple Regression Analysis Results of Organisational Commitment on Task Characteristics : Model 2

Variables	Standardized Coefficient	Partial r^2
Autonomy	.284	.097 *
Challenge	.432	.102 *
Significance	.231	.100 *
Feed back	.102	.061 *
Skill Variety	.175	.065 *
Role Ambiguity	(—) .320	.090 *
Role Conflict	(—) .296	.107 *
Adjusted multiple R^2 = .486, F = 32.8 P < .01		

* P < .01

The task characteristics explain 48.6% variance in organisational commitment. As such work rewards seem in account for a substantially larger variance than individual characteristics. All the seven variables were found to be explaining significant amount of variance in the dependent variable.

However, work rewards as manifest in task characteristics differ in their relative impact on organisational commitment. Challenge seems to account for largest amount of variance followed by role ambiguity, role conflict, autonomy, significance, variety and feedback. It implies that commitment to the organisation is enhanced if tasks are well defined, challenging, meaningful and employees have autonomy and feedback on their performance.

As hypothesised role ambiguity and role conflict have negative association with commitment while others' relationship is in positive direction. Thus hypotheses 3 & 4 are supported by the present data.

Results pertaining to Model 3 based on organisational characteristics are presented in Table 4.

Table 4. Multiple Regression Analysis Results of Organisational Commitment on Organisational Characteristics : Model 3.

Variables	Standardized Coefficient	Partial r^2
Group Attitude Towards Organisation	.15	.031 *
Group Cohesiveness	.21	.021 *
Satisfaction with Supervision	.12	.018 **
Perceived Leader Competence	(—) .03	-.000
Self Image Reinforcement	.23	.032 *
Promotion Policy	.31	.027 **
Salary	.22	.027 **
Group Norms : Encouragement	.19	.041 *
Competition	(—) .18	.032 *
Isolate Slow Co-workers	.06	.002
Isolate Fast Co-workers	.04	.001
Adjusted Multiple R^2 - .323,	F = 12.51	P < .01

* P < .01 ** P < .05

The model consisting of eleven variables explains 32.3 percent of the variance in organisational commitment. Of these variables, perceived leader competence and the norms relating to isolating fast as well as slow coworkers have failed to emerge as significant variables explaining variance in organisational commitment. Thus, while hypothesis 7 is rejected, hypotheses 5 & 6 received only parital support. Promotion policy is the most important organisational characteristic followed closely by self image reinforcement, salary and group cohesiveness. Other variables in rank order are the norm of encouragement, norms of competition, group attitude towards organisation and satisfaction with supervision. The association of competition norm appears to have negative relationship rather than positive as was expected.

That promotion policy, self image reinforcement and salary are more important than other organisational characteristics, shows that among extrinsic rewards employees give higher relative importance to treatment by the organisation than to the social rewards to be committed to the organisation. Therefore, good pay package, performance based objective promotion criteria and opportunity for self-expression are considered more important than group cohesiveness and group norms.

It was also hypothesised that individual characteristics operate through intrinsic rewards or task characteristics and/or extrinsic rewards as manifest in organisational characteristics. To examine this issue individual characteristics were entered into the regression equation first with task characteristics and then with organisational characteristics because if individual characteristics operate through other models, their effect should become insignificant when the variables belonging to other models are held costant. The results are summarised in Table 5. When individual characteristics are run with task characteristics the multiple R^2 is .501 which is only marginally larger than the value it obtained when organisational commitment was regressed on task related variables only (R^2 = .486). Similarly, addition of individual characteristics to organisational characteristics failed to make any substantial change in the multiple R^2 obtained with organisational characteristics alone. With organisational characteristics model alone the multiple R^2 was .323. It increased to .331 when these were run with individual charactertistics. It indicates that individual characteristics model does not seem to significantly influence organisational commitment independent of task based and organisational features based models.

Table 5 also shows that when individual characteristics model is entered with intrinsic rewards (task characteristics), extrinsic rewards (organisational characteristics)

Table 5. Multiple Regression Analysis Results of Organisational Commitment on Individual, Task and Organisational Characteristics : Combined Models

Variables	B	r^2	B	r^2	B	r^2	B	r^2
Individual Characteristics								
Age	.002	.001 *	.002	.000 *			.001	.000 *
Sex	.011	.003 *	.061	.001 *			.003	.001 *
Tenure	,151	.001 *	.009	.001 *			.001	.000 *
Education	(—) .161	.001 *	(—) .010	.000 *			.002	.001 *
Marital Status	.021	.000 *	.013	.001 *			.007	.001 *
Family Responsibilities	.130	.001 *	.100	.000 *			.009	.000 *
Perceived Job Alternatives	(—) .210	.036	(—) .224	.030			(—) .182	.024
Perceived Skill Transferability	(—) .089	.024	(—) .109	.025			(—) .084	.020
Uncertainty Avoidance	(—) .077	.022	(—) .167	.018			(—) .094	.027
Task Characteristics								
Autonomy	.186	.063			.252	.089	.258	.077
Challenge	.321	.081			.261	.092	.267	.082
Significance	.230	.041			.188	.058	.181	.050
Feedback	.075	.032			.083	.006	.061	.005
Skill Variety	.091	.012			.041	.001 *	.002	.000 *
Role Ambiguity	(—) .295	.071			(—) .187	.051	(—) .162	.050
Role Conflict	(—) .271	.088			(—) .183	.048	(—) .161	.045
Organisational Characteristics								
Group Attitude towards Organisation			.124	.008	.091	.008	.087	.006
Group Cohesiveness			.165	.021	.152	.018	.095	.008
Satisfaction with Supervision			.091	.006	.085	.006	.077	.005
Perceived Leader Competence			.010	.000 *	.008	.001 *	.006	.000 *
Self Image Reinforcement			.263	.095	.225	.072	.216	.067
Promotion Policy			.230	.075	.223	.068	.205	.065
Salary			.198	.070	.211	.063	.198	.061
Group Norms :								
Encouragement			.091	.011	.092	.010	.093	.006
Competition			(—) .068	.006	(—) .075	.005	(—) .075	.005
Isolate Slow Co-workers			.010	.001 *	.005	.000 *	.002	.000 *
Isolate Fast Co-workers			.006	.000 *	.138	.000 *	.086	.000 *
Adjusted Multiple R^2	.501, P<.01		.333, P<.01		.689, P<.01		.710, P<.01	

* P > .05, Others, P < .01 or better

B = Standardized Coefficient

or both, demographic factors like age, sex, tenure, marital status and education fail to emerge statistically significant variables. While sex did not emerge as a significant variable even in the absence of intrinsic and extrinsic rewards (table 2), tenure, education, family responsibility, marital status and age were pushed into insignificance when either task or organisational characteristics or both were present in the regression equation. Thus the demographic variables seem to exercise their influence on organisational commitment through intrinsic and extrinsic rewards. However, with respect to perceived job alternatives, uncertainty avoidance and perceived skill transferability, this inference does not hold good fully. These variables remain statistically significant even when task characteristics or organisational characteristics or both are held constant. However, direction of influence exercised by these variables has been reversed when task and/or organisational characteristics were not constant. The association of uncertainty avoidance, skill transferability and possibility of getting alternative employment with

commitment was positive (Table 2). But as the extrinsic and intrinsic rewards were held constant, their impact became negative. It implies that the direction of influence of these variables is contingent upon the extent of intrinsic and extrinsic rewards provided by the organisation. If these rewards are held constant, skill transferability, uncertainty avoidance and availability of alternative jobs have a negative impact on commitment. If on the other hand, these rewards vary, they have a positive impact on commitment. As such the direction of influence of these three individual characteristics depends on task and organisational characteristics models.

The conclusion that appears to emerge from the above findings is that in general individual characteristics operate largely through intrinsic and extrinsic rewards. While demographic characteristics or the involuntary sidebets are wholly dependent upon task and organisational features, the voluntary sidebets take their direction of influence from these features.

In addition, to examine the combined effect of organisational and task characteristics, organisational commitment was regressed on the two models simultaneously (Table 5). The two models together explain 68.9% variance. The beta weights and r^2s shows that the most important variable is challenge, followed, in rank order, by autonomy, self image reinforcement, promotion policy, salary, significance, role ambiguity, role conflict, group cohesiveness, group norm of encouragement, group attitude towards organisation, satisfaction with supervision, feedback and competition norm. Skill variety is not a significant variable. These results indicate that there is no evidence to show the superiority of one model over the other. While the first two most important variables belong to task-model, next three in rank order belong to organisational characteristics, next three variables again belong to task characteristics followed by organisational model variables. That is, there is no specific pattern to indicate that variables in one model are relatively more important than those of the other.

If one compares the results of regression analysis containing task and organisational characteristics with the one containing all the three models, we observe that addition of individual characteristics to the other two models does not alter the multiple R^2 substantially. Rather it increases only marginally from .689 to .710. Besides, the order of relative significance of these variables continues the same as observed in two model regression equation. Only feedback and competition have exchanged their ranks at the last two places.

These results confirm the observation made earlier regarding the limited capability of individual characteristics in explaining variation in organisational commitment in the face of intrinsic and extrinsic rewards. However, the r^2 of many rewards has increased as a result of addition of individual characteristics. It indicates that perhaps, individual characteristics moderate the relationship between task characteristics and organisational characteristics and commitment.

Discussion

The chief objective of the present research was to test and compare the three models of antecedents of organisational commitment suggested in the available literature and propose another integrated model. One model comprising the individual characteristics was based on the theory that locus of commitment lies within the individual and is a result of one's past actions and/or circumstances created by the environment. The other two models had their genesis in the view that commitment was the result of a process of exchange between the person and his/her organisation. In return for certain rewards the individual offered his skills and commitment to the organisation. One such model, called task characteristics model, consisted of intrinsic rewards; the other, organisational characteristics model comprised extrinsic rewards.

The results showed that when the models are considered separately, each emerged to be explaining significant proportion of variance in organisation commitment. But task characteristics model received greater empirical support than the other two. The task features explained largest amount variance (48.6%) followed by organisational features (32.3%). Individual characteristics accounted for a relatively low proportion of the variance. Specifically, the data showed that individual characteristics influence commitment indirectly through task and organisational characteristics. Thus, the theory that commitment is a passive, accrual phenomenon, result of prior actions and defaults, does not find support from the present data. Rather the data seem to indicate that commitment is a result of active exchange between the individual and the organisation. This inference is testified further by the fact that among individual characteristics only those side bets had direct effect on commitment which were under the volitional control of the individual and provided an opportunity to exercise choice, that is which raised the issue of volition. Normally choice is exercised in favour of something which has greater returns than cost (Dewey, 1953), that is towards favourable exchange. Notwithstanding the fact that these sidebets were dependent on task and organisational characteristics for the determination of direction of their influence, their direct effect shows that even among sidebets those that had an element of exchange were significant. It is quite likely therefore that the association observed between demographic variables like age, sex,

education, tenure, family responsibilities and marital status, and organisational commitment in previous studies was spurious. It, however, does not imply that individual characteristics do not have any importance in the analysis of organisational commitment. Rather these variables represent the background factors which an individual brings with him to the organisation and which interact with the job and treatment by the organisation in the determination of commitment. The present data also provide evidence to indicate the possibility of the existence of such interaction effects. For instance, it was observed earlier that value of r^2 of most variables in task and organisational characteristics models showed a tendency to decline when individual characteristics model was added to these two models (Table 5). It is possible therefore that individual characteristics moderate the influence of task and organisation features on organisational commitment. The identification of such interaction effects requires detailed exploration and may be undertaken in future research.

Another important finding is that intrinsic and extrinsic rewards explain a substantial proportion of organisational commitment. But the data doesn't show that intrinsic rewards are the more important determinants of commitment or *vice versa*. There doesn't seem to be a clearly classifiable hierarchy of rewards influencing the variation in commitment to the organisation.[1] Thus, it appears that the contents of the job as well as treatment by the organisation have to be reckoned with more or less to the same extent to elicit commitment from the managerial personnel. Studies in the past have indicated that intrinsic and extrinsic rewards are complimentary to each other (Herzberg, 1966; Kalleberg, 1977; Katz and Van Maanan, 1977). If an organisation offers intrinsic rewards while extrinsic rewards like pay, working conditions, opportunity for promotion and fringe benefits, remain deficient, the personnel is not likely to stay with the organisation for long. Inadequacy of extrinsic rewards has been found to have deleterious effect on work performance (Herzberg, 1966). The effectiveness of intrinsic rewards in affecting the performance of organisational member is also influenced by extrinsic rewards through interaction effect (Hirst, 1988 : Deci, 1971) Similarly, intrinsic work rewards also exert their influence on performance, preference for the organisation, and efficacy of extrinsic rewards (Hackman and Oldham, 1976; Van de Ven and Ferry, 1980; Gruenberg, 1980). Thus, both sets of rewards or characteristics seem to be relevant for explaining variation in organisational commitment.

These results are in sharp contrast with those of earlier studies which have either demonstrated the superiority of intrinsic work rewards over the extrinsic ones (Kissler and Sakamura, 1966; Mottaz, 1985; Angle, 1983) or of extrinsic rewards over the former (Brown, 1969; O'Reilly and Caldwell, 1980). The contradictory results obtained in the previous research were perhaps because, in the context of organisational commitment there was in reality no specific hierarchy of work rewards. May be different type of work rewards are relevant for inducing different dimensions of commitment construct. Angle and Perry (1981) and Amsa and Punekar (1981, 1988) have reported that organisational commitment consists of two dimensions, 'value commitment' and 'commitment to stay'[2]. It is possible that one set of rewards or characteristics is relevant for the former and the other for the latter. Therefore, when combined, organisational commitment construct was regresed on two set of rewards simultaneously mixed results were obtained. The results of earlier studies got loaded in favour of one set of rewards presumably due to some sort of bias in the data, sample, statistical method or measuring instrument, etc. which often creeps in the empirical research. It is quite likely that the present results indicate the 'correct' trend. Further research, however, is required to establish this inference in view of the limited sample and other limitations, stated later in this section, of the present study.

The composite model that seems to emerge from the examination of 27 variables hypothesized to be influencing organisational behaviour is that job content or intrinsic rewards and organisational characteristics comprising organisational extrinsic and social extrinsic rewards affect organisational commitment directly. The nature of their influence however appears to be affected by volitional side bets, while involuntary side bets operate through task and organisational characteristics. A figurative view of the model is presented in Exhibit 1.

The findings of the study imply that organisations must assign equal importance to task characteristics as well as extrinsic rewards. An individual enters the organisation with certain needs and aspirations. If the organisation is found to be fulfilling these needs, the individual is likely to

1. When these rewards are run separately, intrinsic rewards explain a much larger variance in commitment than extrinsic rewards. However, making inference regarding the superiority of one model over the other on this basis would not be desirable because separate regressions do not consider interactive influence among the variables of the two models. For this purpose a better alternative is provided by the combined regression analysis (Kerlinger and Pedhazur, 1973) as reported in Table 5. Therefore, the present analysis use information contained in Table 5 for the purpose.

2. Amsa and Punekar approach the two dimensions of commitment differently, and consider it to comprise 'performance value' and discipline value'. However, the meaning assigned to these dimensions appears to be quite similar to that of Angle's (1981) 'value commitment' and 'commitment to stay'.

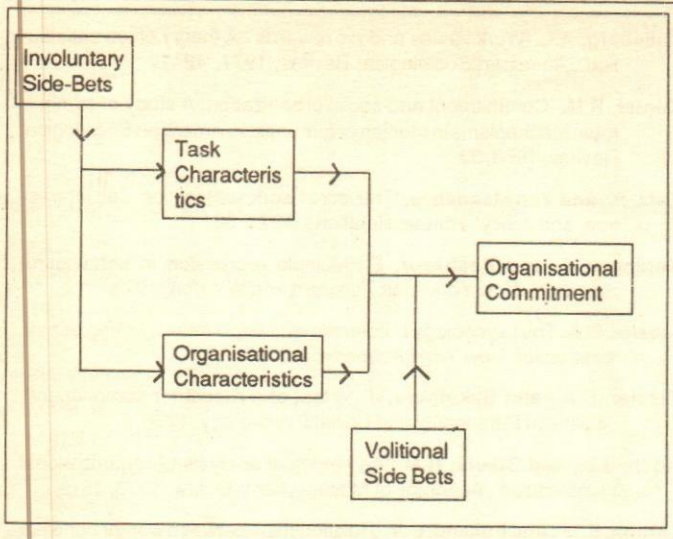

Exhibit - 1 Model of Organisational Commitment

be more committed to it. To enhance and maintain the employee commitment at high levels the jobs should be redesigned to make them challenging, and interesting. At the same time organisational policy towards pay, fringe benefits and promotion etc. should be encouraging. To incorporate social intrinsic rewards the work teams should be so designed that group climate becomes supportive. It has been found that organisations concentrate largely on organisational extrinsic rewards like salary, promotion etc. to win employee loyalty because these are easier to manage and control; design of jobs and work teams is often not given required degree of significance for these are relatively more difficult to effect (Hackman, 1987). But the work group redesign and improving the contents of the job must necessarily be considered to make organisational extrinsic rewards effective.

In the end one must state the conventional caveat that the results reported here should be interpreted with caution, for the study is not without limitations. First, the study had a relatively small sample which might have led to systematic exclusion of any subset of the universe causing bias in the results. Ideally, the sample should have been large enough to incorporate different occupations, industries, regions, etc. Unfortunately, the resource constraint problem prevented data collection from a large sample. This problem is common with most research in organisation behaviour. There is one consolation, however, that the results of the present research are similar to those of several recent studies in several ways. Yet one does not know the degree of bias in the results reported here. Therefore, the results should be interpreted as suggestive rather than substantive awaiting confirmation by future replications using different samples and populations, and/or longitudinal field experiments. Secondly, the study has indicated that there is absence of a hierarchy of rewards affecting organisational commitment. This inference is based on data collected through the instrument to measure commitment, developed by Porter, et al. (1974). It is not clear whether similar results will be obtained if a different instrument developed by say, Balaji (1986) or Ritzer and Trice (1969 a; 1969 b) is used. The caution is relevant because each instrument is based on a certain theory. The results are regarded generalizable if these remain consistent across constructs with different theoretical thrust.

Despite these limitations this research has provided a basis for further analysis of the antecedents of organisational commitment. It will be useful to examine and compare the pattern of relationship between various work rewards and a commitment across different levels of management, and occupational groups like managers and specialists. Further research may also test the generalizability of results presented here, and study the impact of other variables not included in the present research like leadership style and decision making methods. It would also be of much interest to explore the role of organisational commitment in explaining industrial sickness which has become a serious blot on the industrial scene of our country in recent years.

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"You will never find the unexpected unless you are looking for it."	**"Computers are useless. They can only give you answers."**
—Heracleitus	*—Pablo Picasso*

Better Management : Workers' Perceptions

A. Gani

There is a strong conviction that if the expectations of the workers are known and if the management is able to comprehend them, it would certainly result in reducing the conflicts in labour management relations improving the workers' job performance. This will help the management in designing its personnel policies. This study which is a part of the doctoral dissertation by the author attempts to probe into the characteristics that make the management best or worst from the workers viewpoint.

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Harmonious labour-management relationship is a prerequisite for efficient running of a business operation and also for overall socio-economic progress. Establishing and maintaining cordial and constructive relationships between labour and management is of utmost importance, particularly in India today, when, our industrial relations system is crumbling and heading towards a militant confrontation, the economy is caught in the coils of a crisis due to its uneven socio-economic structure, population is growing at an alarming rate, resources are limited and the industrial progress is the prime need. "Employer-employee relations", it is recognised, "are to a great extent founded on a sense of reciprocity which shapes and reshapes them". (Monga, 1978 : 350). It has been established that "management without labour would be sterile and labour without management will be disorganised, ill-equipped and insufficient" (Richardson, 1965 : 429). From workers, no cooperation is possible if they feel that the management is not inerested in their problems.

The interest in the relationship between workers' needs and their job behaviour dates back to the early part of the 20th century, when with the emergence of Human Relations Movement (which sprang up after the famous Howthorne Studies of 1920's and 1930's). With its emphasis on good inter-personal relations, conducive work climate and job satisfaction, an important initial stimulous was provided for the study of workers' wants, job attitudes, expectations and aspirations and their relation to human behaviour in organisations. Since then substantial amount of research has been conducted and a number of theories and models have been offered to explain what the workers expect from their management/employers in order to extend their cooperation.

The best known earlier reviews of research studies (Brayfield and Crockett, 1955; Herzberg, et. al, 1957; Vroom, 1964) have made it possible to see what the workers in the West want from their management. But no such extensive compilation of Indian studies is available. However, the research available on the subject, of whatever nature and magnitude (for example, Ganguli, 1954; Mehtra, 1978; Singh, 1971; Srivastava and Srivastava, 1983) corroborates the fact that the most persistent desire

of an average Indian worker is for adequate financial return from his job, besides, the desire for job security and opportunity for advancement. Lending a confirmation to these findings some recent studies (for example Kathiroson, 1987; Mukerjee, 1985; Srivastava, 1985) suggest that the Indian poverty striken workers are more concerned with immediate and personal economic gains and that the economic conditions appear to be the central source of life satisfaction. It is so because our level of development and socio-cultural values tend to monotonise our motives.

Now, with the growing complexities of business, increased awareness among workers of their rights and responsibilities, rapidly increasing proportions of workforce and fast social changes, the employees' attitude and expectations have started escalating more than ever before. The growing popularity of what is called 'humanistic psychology' which emphasises fulfilment and self actualisation and the growing cultural emphasis on personal satisfaction has contributed to this 'revolution of rising expectations (Strauss and Sayles, 1984 : 653). As against this, inspite of the significant improvements in some sectors, the nature and conditions of work have not changed correspondingly. This widening gap between what workers expect and what they get is often the reason for the rejection of work manifested in high rate of absenteeism, labour turnover, poor job performance and deteriorating industrial relations.

The review of the existing research, on human behaviour reveals that there is not sufficient empirical evidence to show as to what workers expect from their management in India, particularly in the present day context, to draw reliable inference about what makes the management 'best' or 'worst'. Results of the empirical studies on the subject, while hardly lending a ringing confirmation, are sufficiently equivocal to justify an open mind on the issue. There is a strong conviction that if the amount of expectations of the workers are known and if the management is able to comprehend these expectations, it would, certainly yield rewarding results in reducing the conflicts in labour-management relations, improving the workers' job performance and will prove to be of considerable help to management in designing its personnel policies.

The above points clearly indicate the importance of studying the workers' expectations, through attitude surveys, in order to enable the management to effectively achieve its objectives, while simultaneously meeting the expectations and aspirations of its workers. With this backdrop in view the present study has been undertaken to ascertain the expectations[1] of workers from the management in an attempt to probe objectively into the characteristics that make the management 'best' or 'worst'.

Material and Method

The study was conducted on a total sample of 250 workers selected from 5 large and medium sized textile units in Jammu and Kashmir State. The textile industry of J&K was selected for the purpose of the present investigation because of its being the oldest, largest, highly dispute-prone and most unionised industry in the state. The sample included different kinds of operatives and office bearers of the trade unions and bipartite committees. The technique of stratified proportionate representative sampling was used for drawing the sample, using 'job' as the criterion of stratification.

The information was obtained directly through personal interviews, using a well structured interview schedule. The respondents were given two sets of multiple characteristics of the 'best' and 'worst' management, separately[2]. These pertained, in each case, (a) salary and service conditions, (b) physical and psychological work environment, and (c) welfare amenities. They were asked to rank five characteristics, in each case, in order of preference which they felt make the management 'best' or 'worst'.

The technique of choice scoring was used to assess the order of preference or in other words the degree of popularity of a particular characteristic. If for instance, the respondents ranked a certain specimen as number one at the top of five given specimens he evidently preferred that to other four and so on. Weight of 5 to the Ist, 4 to the 2nd, 3 to the 3rd, 2 to the 4th and 1 to the 5th preference was given on a five-point continuum. Some respondents could mention only three or four characteristics, as a result of which the scoring scale had to be changed to three-point or four-point continuum, as per the situation. Overall ranking was done on the basis of the percentage of maximum possible score. The maximum possible score = Nx5.

Empirical Results : The 'Best' Management

The results of the study regarding the characteristics of the 'best' management, as perceived by the workers are adduced hereunder, separately with regard to the workers' salary and service conditions, physical and psychological work environment and welfare facilities.

[1] In the present study the term 'expectations' is used in 'evaluative sense' and not in an 'anticipatory sense'. It refers to what the management should do and not to what the management 'would do' in a particular work situation.

[2] It is based on the assumption that the characteristics of the 'best' and 'worst' management are not the opposite poles of the same continuum. Persons who perceive certain factors as good qualities of management may not perceive the absence of some factors as bad qualities of management.

Table 1. Characteristics of the 'Best' Management Pertaining to Salary and Service Conditions

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Attractive Wages	1092	87.36
II	Good Service Conditions (Promotion, Permanency, Provident Fund, Gratuity, etc)	892	71.36
III	Profit Sharing and Bonus	742	59.36
IV	Consistent and Objective Personnel Policies	718	57.44
V	Good Fringe Benefits	512	40.96

Table 2. Characteristics of the 'Best' Management Pertaining to Physical and Psychological Work Environment

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Harmonious relations with working class	1022	81.76
II	Ideal and Hygenic conditions of work	792	63.36
III	Participative work culture	754	60.32
IV	Proper tools and equipments	556	44.48
V	Good and understanding Supervisors	347	27.76

Table 3. Characteristics of 'Best' Management Pertaining to Welfare Amenities

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Proper Implementation of Statutory Provisions regarding welfare amenities	942	75.36
II	Proper Accommodation Facilities	764	61.12
III	Good Recreational and educational facilities	668	53.44
IV	Proper and adequate medical facilities	570	45.60
V	Clean and Subsidised canteen facilities	502	40.16

The detailed analysis of the responses pertaining to the salary and service conditions of workers (Table 1) reveals that paying good salary is the most important characteristic of the 'best' management. The other good characteristics that followed in order of importance include adequate profit sharing and bonus, consistent and objective personnel policies, attractive fringe benefits etc.

Alongwith the adequte salary and service conditions, workers expect a congenial physical and psychological work environment at the work place, where they toil for their 'only remuneration'. The results of the study in this regard (Table 2) make it clear that maintaining cordial relations with workers, providing ideal and hygenic working conditions, encouraging workers' involvement in decisions, supplying proper tools and equipments ;and providing good and understanding supervisors are regarded as the desirable aspects of management.

The data (Table 3) also indicates that the workers' expectations from management vis-a-vis welfare facilities include proper accommodation facilities near work place, adequate and attractive recreational, educational, medical and canteen facilities. These findings expose that the workers are conscious of their rights to these necessities and their presence or absence would certainly have a marked influence on the workers' attitude towards management.

The 'Worst' Management

Painting the other side of the picture, the detailed break-down of the responses concerning the characteristics of the 'worst' management as perceived by the workers, is presented below.

Table 4. Characteristics of 'Worst' Management Pertaining to Salary and Service Conditions

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Inadequate wages, Heavy Wage differentials	1055	84.40
II	Absence of various social security measures and fringe benefits	926	74.08
III	Slow and partiality in promotions	690	55.20
IV	Apathetic attitude towards Unions	595	47.60
V	Does not recognise and reward outstanding performance	357	28.50

Table 5. Characteristics of the 'worst' Management pertaining to physical and psychological work environment

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Poor working (physical) conditions	1015	81.20
II	No consideration for workers' victimisation	776	62.08
III	Absence of training facilities, no chance to improve on the job	655	52.40
IV	Partial and harrassing supervisors	538	43.04
V	Absence of proper tools and equipments	451	36.08

Table 6. Characteristics of the 'Worst' Management pertaining to welfare amenities

Rank	Characteristics	Total Score	%age of Maximum possible score
I	Inadequate safety measures	990	79.20
II	Absence of Medical facilities	695	55.60
III	Lack of Recreational and Educational Facilities	635	50.80
IV	Lack of proper accommodation near work place	497	39.76
V	Non-implementation of the provisions relating to welfare facilities	412	32.96

The data reflecting the characteristics of the 'worst' management vis-a-vis workers' salary and service conditions (Table 4) makes it obvious that inadequate wages and heavy wage differentials, absence of social security measures and fringe benefits followed in that order by the presence of a system of slow and partial promotions, apathetic attitude towards workers' associations and the unhealthy policy of not recognising the merits of the workers and rewarding them for their outstanding performance are the worst possible characteristics of the management as identified by the workers.

Regarding the characteristics of the 'worst' management relating to physical and psychological work environment of workers, the results (Table 5) reveal that a management is considered to be the 'worst' if it does not provide for conducive working (physical) conditions at the work place. Workers also do not appreciate a management which lacks consideration for workers' problems, does not provide adequate training facilities necessary for job improvement, employs supervisors having partial, harrassing, fault finding and revengeful nature and does not make available proper tools and equipments which are fundamental to perform a job.

The proper welfare facilities, though not a substitute for wage increase but having socio-economic and civic impact, keep to a greater extent employees contended with their jobs. The responses of the employees (Table 6) depict that workers' dislike a management if it does not take proper measures for workers' safety, does not provide adequate medical, recreational, educational and accommodation facilities- all having a significant impact on the workers' mental make up. The practice of not implementing the statutory provisions regarding the welfare facilities has also been ascertained as the quality of 'worst' management.

Conclusion

The present study, the findings of which are to a great extent in confirmity with those of most of the earlier studies (Monga, 1978; Richardson, 1965; Sharma, 1974; Zecharia, 1980), probed the workers to diagnose their expectations from management in order to identify the characteristics which make the management 'best' or 'worst'. On the basis of the study it may be concluded that adequate salary and good service conditions are the most important expectations of an industrial worker. Workers consider their jobs as a means through which they can satisfy their basic needs and they look favourable to the management so long as these needs are not threatened. It is logical because most of the other socio-economic and psychological expectations centre around what an employee earns from the job. It indicates the amount of social prestige and social status that an employee can command in society.

The study, however, does not support the myth that wages constitute the only source of satisfaction for workers. Workers value their dignity, rights and privileges and expect a congenial work environment, recognition of their jobs from the higher as well as immediate officials, objective, fair and consistent promotions and other personal policies, attractive profit sharing and fringe benefits.

Realising their responsibility towards the organisations; the workers appreciate to get involved and participate actively in the tasks assigned to them. Their desire for proper tools, equipment and training and participating in decision making is a pointer towards this fact. Scholars almost unanimously agree that people act more responsibly when they are involved in setting their own goals, are accountable for their own behaviour and share the responsibility and rewards for accomplishing organisational goals.

The workers rate a management as worst if it overlooks their safety and security needs and is not considerate of their victimisation. There appears to be a gap between expectations and reality in the sphere of welfare facilities, which have been considered to be "the company commitment to the workers". The gap needs to be bridged up by the management. Even in the case of off-the-job life issues of the workers, though exclusively the concern of the state, society and the union, the management has the responsibility of bringing about a match between workers' felt needs and facilities of whatever sort provided by the state and the society. Workers express a strong desire for understanding and considerate supervisors and as such the study falls in line with the conclusion of the other investigation of the author (Gani, 1989) that "an employee oriented supervisor plays a constructive role as the `king pin' and `link pin' in shaping the relations between labour and management".

Workers feel somewhat dissatisfied with the managements' way of handling industrial relations problems. This kind of dissatisfaction is reflected in workers' perception that management has apathetic attitude towards workers and their unions and that it does not recognise and reward their merits. Much of the Indian management is not yet convinced of the importance of managements' responsibility for developing good industrial relations. They tend to blame government, labour legislation and unions for the trouble without realising their own fault. The failure of present institutions to produce harmonious industrial relations is also the failure to understand one fundamental fact that most of the industrial relations problems are attributed to what Karl Marx rightly called "alienation of the modern industrial worker". While managing human resources,