Some Issues on Infrastructure Development in India

V. Raghuraman

For attaining accelerated economic growth, the development of world class infrastructure is essential. A number of issues have been identified in the literature on infrastructure development. This paper examines the international experiences with respect to some of these issues and tries to draw appropriate lessons for India.

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"You cannot do today's job with yesterday's tools and be still in business tomorrow"

—A Japanese Saying

With the opening up of its economy, India is poised for a new era of economic development. The key factor impacting the growth process is clearly the infrastructure. Unless the infrastructure facilities by way for adequate power. safe and good roads, efficient port and airport operations are brought up to the requirements, it would not be possible to reap the benefits of the investments made in different segments. Be it heavy industry or consumer durable manufacture, lack of power would make the investments less attractive.

Though the Government has opened up the infrastructure sector for private investments, delays in policy pronouncements and case-by-case approach are making investors weary. At the same time, the needed investments in the public sector have also not been adequate with the result that severe infrastructure bottlenecks are already being experienced.

Infrastructure & Economic Development

The link between infrastructure and economic growth has been studied extensively in the literature, the World Development Report (1994) of the World Bank, for instance. The results show that infrastructure development can have significant impact on economic growth. For low income countries basic infrastructure such as water, irrigation and to a lesser extent transport are more important. As the economies mature into a middle income category, the share of power and telecommunications in infrastructure and investment increases.

Infrastructure is a necessary but not a sufficient precondition for growth. Adequate complements of other resources must be present as well. Also, the im-

participation. Fiscal constraints faced by governments (federal, state and local levels) and technological developments are other factors which have favoured increased private sector participation.

The shift towards greater private involvement has been driven by the need to provide better services to more people at reasonable cost.

Technological developments have reduced natural monopoly characteristics and have allowed unbundling[3] private entry and competition into many infrastructure services. Technological developments in many cases have helped to create more competitive pressures. For example:

* Containerization has facilitated competition in port services.
* Falling costs of wireless telecoms have enabled small operators to complete with wire-based networks.
* Independent power producers can construct and operate relatively small plants at unit costs comparable with larger generators.

Contract-based relationships (e.g. Build-Operate-Transfer, Build-Own-Operate, concessions) have allowed private entry even within the existing regulatory framework but with minor modifications. Also, the private sector entry often sets up pressures for further regulatory changes and sometime competition may mitigate the need for close regulation.

Infrastructure Development in India : Some Issues

Power : Overall Scenario

At the beginning of the Eighth Five Year Plan, the energy shortage was approximately 9% and peak shortage about 20%. The Working Group of Planning Commission had recommended an addition of 48,000 MW in the Eighth Plan : this was scaled down to 30,538 MW because of constraint of resources. According to estimates, given the overall resource crunch, only 20000 MW is likely to be added during the Eighth plan period. The continuous under-investment in transmission and distribution will be another major factor leading to overall power shortage.

The financial position of State Electricity Boards is a factor which constrains public sector investment in power sector. The Government, realising the importance of the importance of power availability for overall economic growth and industry in particular, has taken a number of initiatives for entry of private sector in the field of electricity generation and distribution[4]. This was done through necessary legislative amendments and introducing a policy complementary to these amendments.

Though the private sector has responded reasonably well by submitting a good number of proposals, there has been little progress in terms of implementation of these projects. This is because there are a number of issues that are yet to be resolved. The recent controversy relating to the Enron project illustrates the difficulties and constraints that come in the way of private sector participation in power sector. The success of private sector participation depends upon a number of factors. The role of individual state Governments is a critical factor : different State Governments have adopted different approaches. Also, there are number of approvals to be obtained at the State and local authority levels before the power projects can really take off. Unless State Governments adopt policies which are in tandem with Central Government's unless the policies are made transparent and procedures simplified, the progress in private sector participation in power development will necessarily be slow and tardy.

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3. Unbundling can be broadly categorised into vertical and horizontal unbundling. Example of vertical unbundling is the separation of electricity generation from distribution. Horizontal unbundling separates activities by markets—either geographically or by service categories. Telecommunications is a sector where this type of unbundling is possible. For details see World Development Report 1994.

4. Details of Government initiatives in involving private sector in power development is available in a recent Report of the Standing Committee on Energy 1995-96, Tenth Lok Sabha on Ministry of power (26th Report) published in May 1995.

Telecommunication[5]

Telecommunication and electronic information processing technology touch most aspects of the economy. Poor telecom facilities have serious economic consequences, particularly with respect to foreign trade, industry and business. Despite significant progress made in the telecommunication sector over the last 40 years, the number of telephones per 100 persons in India at 0.8, is one of the lowest in the world. The low telephone density in India has two dimensions:

* Inaccessibility of telecom services to large sections of population, enormous strain on existing facilities.
* This leads to cross connections and low success rate of calls.

There has been increasing use of facilities like Fascimile, E-mail, Electronic Data Interchange (EDI). Nevertheless, large part of telecom service in India is voice oriented. Data and text transmission by telecom is limited only to a few cities and a small segment of population. The basic objective of policies should be to meet the expectations and requirements of users. While in the developed countries these are met, in india this is not so.

Continued and rapid technological change is likely to bring to the developing countries greater opportunities for lower cost and reliable expansion of networks. A recent study of the World Bank[6] has highlighted the technological advancements and increasing importance of software in telecom. As a result, the options are becoming much wider than before. As a result of technological developments, service competition is possible without licensing new physical distribution networks :

* The existing national transmission network (DoT in case of India) can be used by competitive facilities offering value added services.
* Conventional wireline network monopoly does not preclude transmission facilities such as cellular radio, paging and satellite based services.
* Service competition may also be provided if third parties can freely lease and resell the capacity of the existing monopoly carrier.

The new Telecommunication Policy (May 1994) as well as public statements made by Governments have envisaged and independent regulatory agency to oversee telecom development, following the liberalised policies with regard to private sector participation. There is need for regulation mainly because of the public interest involved as also to take care of issues relating to interconnection between the operators and the dominant carrier (DoT). Aspects relating to tariff structure and revisions, dispute settlements mechanism, and revenue sharing arrangements are also important elements of the regulatory policy. While there are a number of alternative frameworks that are available with regard to regulation, the overriding objective should be to create an enabling environment conducive to long term investment and enforcing measures to moderate or prevent the abuse of monopoly power.

The procedures and requirements of regulation, however, should be such that they are not time consuming and are consistent with efficient operation. The most important thing is to create a set of transparent and clearcut guidelines so that there are minimum disputes.

The recent tendering process for private sector participation in both basic and value added services is welcome and shows the importance that the Government attaches to the private sector participation in telecom development. There have been press reports that despite the clarifications by the Government, there are still some misgivings in the minds of potential investors about the transparency in the selection of bidders. Perhaps, when the Telecom Regulatory Authority of India comes into full play these misgivings will get reduced and this will provide a filip to future private sector participation in telecom development.

Road Sector[7]

The expansion in the volume of agricultural and industrial activities together with increased urban population has mainly contributed to the growth in road traffic. The inability of the railways to carry short distance hauls, the preference for bulk commodities (iron ore, coal, fertilizers to give some examples) and the unavailability of railway wagons have led to a shift in the traffic from railways to roadways. The last four decades have also witnessed a phenomenal increase in the motor vehicle population.

5. This section draws extensively on the material from ASSOCHAM'S Background Note for the Workshop on Infrastructure for Accelerating Economic Growth, September 1994, New Delhi.
6. For details, see the World Bank Discussion Papers 192 and 232 on Telecommunication Sector.
7. This section draws heavily on the Background paper on Road Sector prepared for the ASSOCHAM Workshop on Infrastructure for Accelerating Economic Growth.

Focus

Financing Infrastructure Projects & Services : The New Paradigm

Hari Sankaran

The economic reforms currently under way in the industrial arena of India have effectively opened up the Indian economy, exposing the inadequacies of the present infrastructural framework to support and sustain the augmented activities. The article explores the current status and future requirements of this sector and the issues in financing the development of infrastructure projects.

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The macro-economic stabilisation and reform process of the Government of India, since 1991, has signalled a turning point in Indian economic policy with a vigorous focus on competitiveness. Policy initiatives mooted by GoI, have served to open the Indian economy and help achieve a greater degree of integration with the economies of the world. The reform programme marks a bold initiative by the Government, to remove historical barriers and controls, and focus on shaping and directing the Indian economy to achieve greater integration and growth. A focused effort is currently underway to render Indian firms globally competitive, ease the barriers of entry of foreign companies into India, and provide an impetus to exports. One of the key issues in ensuring the success of this reform programme has been developing and enhancing infrastructure levels to match international standards of delivery and performance.

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On a more discrete plane, the unhindered movement of men and materials becomes a factor of critical importance for the economy to achieve its competitive edge. The backbone for such an operation comprises a certain level of infrastructure support systems. Such systems would have, at a minimum, advanced telecommunication facilities, mechanised material handling systems, effective surface transport facilities for movement of cargo, automated port handling facilities, uninterrupted power supply, and the full range of social amenities.

India needs to rapidly accelerate the pace of development of such infrastructure. Historically, there was a tendency to prioritize infrastructure development and implement schemes on schedules dictated by available budgetary resources. In the highly competitive global environment, such an approach is not feasible given the overall requirements of the sector. There is a need to ensure that infrastructure projects are able to access commercial resources, adopt private sector implementation methodology and are managed in an environment that is more responsive to business requirements. Increasingly, therefore, Government has felt the need to adopt a more integrated approach to the infrastructure sector and develop methods and frameworks including policy initiatives such that these projects may be posed to the private sector for development under a commercial format, thereby augmenting the pool of resources.

The infrastructure sector covers a wide spectrum of services *inter-alia* roadways, railways, airways and water transport services, power generation including the transmission and distribution thereof, telecommunications, port handling facilities, water supply and sewage disposal, urban mass transport systems, and other elements of social infrastructure including medical and educational facilities, and other primary services. While some of these sectors have a direct impact on the workings of business enterprises, others are important from a societal point of view and therefore need to be developed on a concurrent basis.

Given the scale and diversity of projects and the attendant benefits, it is critical to achieve greater levels of growth, to prioritize sectors in relation to each other. Equally, it is also important to understand that each sector requires a different approach given the sectoral dynamics and the issues peculiar to it.

Infrastructure projects are by definition capital intensive, have significantly long gestation periods, and more importantly have issues that are specific to the sector.

Thus, if we step back and view each sector in relation to the ability to develop projects on a commercial format, it would appear that the key drivers would be the legal and financial frameworks that would need to be outlined to effectively mobilise resources for investment in such projects. Infrastructure projects are by definition capital intensive, have significantly long gestation periods, and more importantly have issues that are specific to the sector. As projects have to be developed on a concurrent basis while bringing the capital markets to the centerstage of resource flows for infrastructure development, a demarcation in approach is feasible. On this basis, the priority issues have to be outlined in relation to the commercial implementation of infrastructure projects, especially in financing these projects across sectors.

Commercialisation of Infrastructure Projects

Infrastructure projects can be typically classified *vis-a-vis* their characteristics and the nature of their users, as open access projects, from which people cannot be easily excluded and limited access projects, which are typically those that can be provided on the basis of a person's ability to pay. Commercially viable projects are typically those which can be structured as limited access projects, where project cash flows are predicated on the levy of user charges. To the extent that surplus cash flows can be generated from limited access projects, such surpluses could be reinvested in open access projects or other less viable projects, while maintaining the overall viability of the scheme.

A conventional format available for projects that are susceptible to the levy of user charge is the Build, Own, Operate and Transfer (BOOT) and its various other acronyms such as Build Own Operate (BOO), Build Own Lease Transfer (BOLT), etc. Under the BOOT format, the local authority concerned typically remains involved in initial project conceptualisation, preparation and award of tenders, technical specification, etc. In some instances, the private sector contractor is also persuaded to take the initiative in the preparation of a detailed project report. On recovery of investments made at a designated rate of return, through the levy of user fees, the asset in question is usually transferred to the Government or local authority concerned. In the intervening period until such transfer takes place, timely maintenance of the asset would also need to be paid for from the user charges levied.

Conventional BOOT structures have not been an unalloyed success world-wide, but would be relevant in the Indian context, for a range of projects including those with a high foreign currency content. In such projects, problems relating to accessing foreign currency could be resolved by inviting foreign contractors to implement the project. These contractors, in turn, could recover their investment through the levy of user charges on the asset. If costs are compared on a cogent basis, the effective cost of BOOT projects would be less than the total cost incurred under conventional methods of infrastructure financing, with the greatest cost saving

Power Sector and Private Financing in India

Nand Dhameja

Private sector participation in the power sector is being wooed by the government with a set of new industrial policies with higher returns and incentives to the investors. But it has only resulted in high project costs and resultant heavier burden on the consumers. The author analyses the flows in the existing guidelines and presents a few suggestions to set the industry on a firm footing.

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Development of the power sector has been primarily the responsibility of the Government with a relatively small contribution from private sector. However, with a view to augmenting the availability of power and bridging the shortfall from the Eighth Plan target of 38,389 MW of incremental capacity involving an involvement of Rs. 12,000 crore, the Government decided to invite the private sector to supplement the efforts of public sector.

Accordingly guidelines were issued in October 1991 on private sector participation in power generation, supply and distribution and these guidelines have been further liberalised to woo the private sector. However, the norms laid down in the guidelines operate only as ceilings and the states have to negotiate within that, as electricity is a concurrent subject (GOI, May 1995). The guidelines ensured 16 percent post tax return, stability of operations as the licensing period has been enhanced to 30 years and permit a liberal debt-equity ratio of 4:1. In addition, import duties on power equipments were reduced to 20 percent and new power projects enjoy five year tax holiday. The government also pushed through the necessary legislative changes in the Indian Electricity Act 1910 dealing with the supply and use of electrical energy and the rights and obligations of the licensees, and in the Electricity (Supply) Act 1948 dealing with the statutory powers and functions of the Central Electricity Authority (CEA), State Electricity Boards (SEB) and the generating companies. (Dhameja, Jan 1991, & Nov. 1991).

Guidelines for Private Sector Participation

Private participation in power generation as visualised in the guidelines could broadly be placed under four categories: captive power generation plants; generation and distribution of power in specific areas; generation for bulk supply to state electricity boards (SEBs) and additions to existing licences.

Combinations or variations of these four categories were envisaged as follows:

* Private sector units could set up coal/lignite or gas-based thermal, hydel, wind and solar energy projects of any size.
* Private enterprises could set up units, either as Licensees distributing power in a licenced area from own generation or purchased power or as Generating Companies, generating power for supply to the grid.
* Licensee companies holding licence to supply and distribute energy in a specified area under a licence issued by the State Government would function under a liberalised economic and legal environment.
* New licences could be issued by the State Governments to private units willing to enter the Electricity sector.
* Captive Power Plants set up to serve an industrial or other units by the private enterprises would be permitted to sell or distribute the surplus power to SEBs.

Procedurally, any power project has necessarily to be cleared in terms of seventeen major parameters relating to cost estimates, environment and pollution, availability of land and other inputs required, financing etc. Clearances are given by specialist agencies and organisations of the Government. Details of the parameters requiring clearances are given in Annexure-I.

Though the above policy allows private sector participation in generation, transmission as well as distribution, the policy guidelines were issued only for generation. The Electricity (Supply) Act (ESA) 1948 only allows the government to fix tariffs in respect of generation companies and not transmission companies, as there was no concept of an independent transmission company. Private sector entry into transmission is vital to develop adequate transmission channels to evacuate power from one region to another so as to match the evacuation facilities with the generation capacities. Accordingly, it is proposed to amend the Act permitting private sector entry into power transmission and to issue guidelines for the overall policy. The PLF linked equity return structure would be reworked, as against 16 percent return on equity with 68.5 percent PLF base for the generation companies.

To directly interface with prospective private enterprise entrants to the electricity sector Investment Promotion Cell (IPC) was created in the Department of Power to provide complete details of power projects, for which statutory and some non-statutory clearances have already been granted. Thus IPC is a single point reference facility and is intended to help expedite procedural clearance of proposals.

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Further, a High Power Board (HPB) under the chairmanship of Cabinet Secretary to the Government had been formed to monitor the clearance of projects, and to resolve all outstanding issues pertaining to clearances. The Board would decide on all other matters concerning investment from non-resident Indians and foreign sources within a scheduled time-frame. This would ensure that statutory clearances were obtained and any outstanding issues were resolved within a specific time-frame.

Financing Norms

Power being a capital intensive industry involving long gestation period, the financing norms laid down include the following aspects:

- Debt : Equity ratio of 4:1
- Promoters to have a minimum of 11% of the project cost as equity
- Minimum 20 percent of the total outlay through public issues
- Mobilisation of resources from various sources including external commercial borrowings (ECB) limiting the reliance on the financial institutions to 40 percent of cost of the project.

In other words, 49 percent of resources have to be mobilised by the promoters from sources other than financial institutions, besides 11 percent as equity by the promoters. To encourage foreign investment, 100 percent foreign equity participation is also permissible. Various financial issues like limit on banks and financial institutional finance, debt-equity norms and the extent of debt by foreign power promoter have to be visualised in terms of industry expectation, capacity of banks and institutions to extend loans, and the overall debt burden of the country.

Though the norms provide for debt-equity ratio of 4:1, the industry has been demanding a more liberal debt-equity ratio of 6:1. A seminar on Private Sector Participation in Power Generation organised by the FICCI, in January 1991, recommended that 'For an extremely

capital intensive industry like power generation, the debt-equity ratio should be at 6:1 as against 4:1 indicated in the guidelines. Otherwise servicing of equity will be difficult and this would be deterrent to attracting investment into power generation'. (FICCI, Jan 1991)

Banks and financial institutions, a major source of debt finance, have resources for a period ranging normally upto ten years, while they provide loan assistance for a longer period. Further greater exposure of banks and financial institutions to just one industry may endanger their financial health. Accordingly, financial institutions have proposed to limit the debt equity ratio for power projects to a maximum of 2.5:1 and it is reported that a high level committee is to be set up to look into financing norms of power and other infrastructure projects and also to work out alternative financing risk. (ET, April 26, 1995) It may be mentioned that many infrastructure projects have been initiated on Build. Operates, and Transfer (BOT) basis and these projects normally have a debt component of 70% to 90% of the project cost. (Dhameja, August, 1995) Further, State Electricity Boards like Punjab State Electricity Board have a debt equity ratio more than 4:1; and various infrastructural projects have a debt-equity ratio of 3:1; while for other capital intensive units like Shipping Corporation of India, National Hydro Electric Corp. and Tata Power Corp; the debt-equity ratio is 1.5:1.

Is the limit of 40% of project cost to be financed by financial institutions within the overall capacity of the banks and financial institutions? For example, IDBI, an apex financial institution is estimated to have total loan and investment portfolio of Rs. 12,000 crore during 1995-96 and with the current internal norm to limit its exposure to one industry to 15% of its total portfolio, its finances to power industry would thus be limited to Rs. 1800 crore during 1995-96 which is certainly a meagre amount considering the total fund requirements of the power industry. Change is required in the working norms of the financial institutions or devolution of funds by the government and or participation by foreign investors is a necessity.

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As regards financial constraints with the Indian Financial Institutions (IFIs) and the debt market in India, we reproduce below the reply of the Ministry of Power to the Standing Committee on Energy: (GOI, May 1995)

"At present due to the constraint of resources of funds with the Indian Financial Institutions, a maximum of 40% from IFIs has been prescribed. 80,000 MW would require a total investment of Rs. 4 lakh crore which means that IFIs must find Rs.1.6 lakh crores. As against this the presently assessed strength of the IFIs is only Rs.38,000 crore for loans and guarantees during the next five years. It is estimated that hardly Rs.20,000 - 25,000 crore would be available as loans. Thus there is a big shortfall, in the availability of funds even for funding 40% of the requirement of funds for setting up power plants in the private sector. The present policy prescribed 20% as equity and 40% as coming from IFIs. The 40% cannot be met from debt market in India. The market is much too small against the total requirement of Rs.1.60 lakhs crores required during the next 10-12 years. Therefore, foreign participation in the Indian Power Sector has been welcome" (pp. 4-5).

Foreign investment in power projects is welcome and has to be made attractive to the investor promoter. However, an equitable debt-equity mix is essential to limit the external commercial borrowing (ECB) considering the overall debt burden and the sustainability of balance of payment. Ceiling on external credit borrowing (ECB) for the power sector has been estimated at $1.5 billion for the year 1994-95, the corresponding estimates for the year 1995-96 are $2.1 billion (GOI, May 1995, p.S & CT 4-4-95). within the overall debt-equity ratio of 4:1, debt equity ratio of foreign investor has been increased from 2:1 to 3:1. In the recent guidelines annouced by the Finance Ministry regarding ECBs for the year 1995-96, the power sector has got priority in allocation, and has been allowed to use the borrowings for sourcing equipment from Indian companies, while the guidelines forbid corporations from indulging in the practice of borrowing from the overseas market for financing requirements and then swapping the ECBs with another firm in need of foreign funds. (CMIE May 1995).

Negotiation vs Competitive Bidding

As per the current practice, State Electricity Boards and State Governments select the private power developer (PPD) and settle the price on a bilateral basis. Though the price is subject to scrutiny and modifications by the Central Electricity Authority (CEA), and by the Union Power Ministry the Department of Economic Affairs of the Ministry of Finance examines all foreign exchange implications and counter guarantees in case

of projects involving foreign power investors. This negotiation process is characterised by absence of competitive bidding; it lacks transparancy and has resulted in higher costs. Further, lack of competitive bidding makes mustering of finances for a project difficult, the fund provider becoming sceptical about the cost of the project. For example, in the Enron power project negotiated on a non-competitive basis, many questions were raised about the components of finance during the course of project appraisal by the institutions and the IDBI succeeded partially in reducing the cost of the project by insisting that Enron scrap a development fee of Rs. 86.40 crore (almost 3% of the total project cost). (QMM, May-July, 1995)

G.V. Ramakrishna, member of the Planning Commission is critical of the current procedure. To quote Ramakrishna, "There is no competitive bidding and no comprehensive bidding document of international standards has been developed in India. It has been the experience that the cost of power has been lower if a process of competitive bidding is followed" (QMM, May-July 1995). Take the example of NTPC World Bank funded project and the Dabhol one, the former formulated using competitive bidding has a per MW cost of Rs. 2.7 crore, as against the latter finalised on a negotiation basis with the corresponding cost of Rs. 4 crores per MW.

According the Ministry of Power (GOI, May 1995) "limited experience exists in the area of competitive bidding throughout the World. Most of the project developers find this to be a costly and time consuming exercise as preparation of feasibility reports etc. is a prerequisite for bidding involving high costs". Further, at the time private power policy was launched in India in 1991, the Indian Power sector was an unchartered area for potential investors, and looking at the financial health of the State Electricity Boards, there was apprehension about the response from the private sector enterprises, both foreign and domestic. The perception of the investors about India as an investment option had to be carefully borne in mind in the background of the fierce competition in the international market. Negotiations were therefore an inevitable method for awarding of projects. Even in the USA in the initial years of allowing independent power production, the utilities adopted both routes of negotiations (MOUs) and bidding (Competitive bidding) for awarding of projects (GOI, May 1995).

It is reported that about 137 projects identified for private sector participation are at various stages of negotiations, but not a single project has achieved financial closure, only after which it can be finally said that the project has been awarded. Some of the

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projects have gone on the competitive bidding route. However, it has been made mandatory by the Government that all the projects in future will have to go on the competitive bidding route and the Ministry of Power has also circulated to the state governments guidelines in this regard, no doubt only after the matter was taken up by the Standing Committee. Taking advantage of the international experience, we should also establish transparent bidding and lay down evaluation procedures.

Table 1: Difference in the Ministry and CEA Cost Projections

	As per Power Ministry			As per CEA (Oct '93)	
	Project Cost (Rs Cr)	Est. Cost	Unit Cost (Rs Cr/MW)	Est. Cost (Rs Cr)	Unit Cost (Rs Cr/MW)
Bakreswar 5x20 MW	3053	4581	4.33	3025.53	2.91
Rayalseema 2x210 MW	1273	1782	4.24	795.00	1.89
Gandhar CCGT 648 MW	2291	2806	4.33	2185.00	3.37
Kathalguri CCGT 291 MW	1167	1427	4.90	895.77	3.07
Basin Bridge CCGT 120 MW	376	461	3.84	376.13	3.13

(Source E.T. March 21, 1994)

Besides increasing the unit cost of electricity, there have been delays in the selection of private power developer (PPD) and the finalisation of Power Purchase Agreement (PPA), in the existing procedure. A primary reason for the delay was that the procedure for selection of PPDs and settling the price of power was vague, undefined and overelaborate (Sankar, March 1995). The National Working Group on Power Sector comprising economists and power engineers including a former Planning Commission member has alleged that the capital costs by private sector power companies, especially with respect to foreign investments have been inflated and the cost estimates of upcoming power projects given by the Ministry of Power (MOP) and the Central Electricity Authority (CEA) show great disparity.

Varying costs and contradictory figures have been quoted at different instances without giving any basis and such differences in estimated costs vary between 53% and 18%. The varying costs estimates are illustrated in table 1.

For the Bakreshwar Project, estimates are: MOP arrived at Rs. 4.33 crore per MW, while CEA has projected it at Rs.2.91 crore per MW. Estimates for Rayalseema project are: MOP Rs. 4.24 crore per MW and CEA Rs. 1.89 crore per MW. The corresponding figures for Kathalguri project are: Rs. 4.90 crore per MW, & Rs. 3.07 crore per MW respectively.

The increase in the estimated costs are primarily due to unjustified higher projected imports despite recession in the power equipment industry worldwide as well as the lowering of the customs duty in India.

It was felt that the foreign investors were charging the Indian consumer unreasonably high economic rents on capital resources, equipment and fuel in the absence of competitive bidding. The Working Group has demanded a parliamentary enquiry into the alleged escalation of the installed costs as well as the costs of generation (Rs/kwh), and has recommended a transparent competitive bidding system for awarding projects to the private sector. (ET March 21, 1994)

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K. Ashok Rao, President, National Confederation of Officers Association of Central PSUs pointed out in his memorandum submitted to the Sub. Committee of Standing Committee on Energy that the cost of private power projects approved so far is "unreasonably high and stated that whenever competitive bidding was not enforced in the past as in the case of bilateral aided projects, the cost of the power projects was higher". Reacting to this point, the Ministry of Power stated: "The Competitive bidding could result in lower cost than negotiated price with bilateral assistance, however it may be mentioned that international competitive bidding under World Bank has certain concessions such as exemption from Custom Duty and Excise Duty and Cash Compensatory Support to BHEL for deemed export components, absorption of foreign exchange by Government of India and not by the project authorities. However, for bilateral projects the above concessions are not available. Also, the foreign exchange variation liability for repayment of loans is to be absorbed by the project authorities" (May, 1995).

As regards overcapitalisation of a power, two major elements of the cost estimates of a power project are equipment cost and the cost of financing. The SEBs have to consider carefully the source of equipment and the source of finance so as to arrive at a cost acceptable to them. Further mechanisms exist to see to it that the costs are not unduly inflated by the investors as "the project company is required to publish the estimates of the capital expenditure and the salient features of the project in the official gazette of the State concerned and in local newspapers alongwith a notice that licensees and other persons interested may make representations on such schemes within a period of two months. The cost estimates have also to be endorsed by the concerned SEB and the State Government before examination by CEA. For generating companies, tariff is primarily a function of approved capital cost." How far would the above mechanism check inflation of the project costs?

Cost of Production &Tariff Rates

The tariff rate is determined on the basis of operations, the Plant Load Factor (PLF), depreciation and other factors laid down by the Government from time to time. Power Purchase Agreement (PPA) provides the tariff rates for the sale by the generating company to the SEB for a specific period. For this purpose, tariff rates are based on the cost of electricity generated which in turn is worked out on the basis of operating costs, insurance, managerial and general management charges, and also the share of fixed costs; depreciation to be provided at the rates laid down by the Government, fixed costs are provided for as per the formulae laid down in Schedule IX to the Electricity (Supply) Act 1948, the formulae are based on the plant load factor.

In order words, the concept of split-tariff, also called two-part tariff, has been introduced. It is based on the principles of fixed and variable costs which would be reimbursed to the promoter even if the plant was closed through no fault on his part; fixed costs include capital charges in the form of interest obligation, a reasonable return, and depreciation; and other working costs covering operations, maintenance, management, rates, insurance, etc. In principle, fixed costs were not directly consequent upon the quantity of electricity generated or fuel used in th power station. The second part would be the variable costs i.e, fuel and other related costs depending on the quantity of electricity generated and

sent on. (For concept of Two-part Tariff see Annexure II) (GOI, June, 1990).

Depreciation rates as governed by the Electricity (Supply) Act 1948, prior to 1991 were 3.26 percent to cover 90 percent cost of assets over approximately 28 years. The 1991 guidelines provided for a higher depreciation rate of 5.06 percent which were further extended to 7.5 percent, approximately by 50 percent higher to enable to write off plant and machinery (90 percent of the cost) within a period of 12 years as against 18 years earlier.

The industry claimed a higher depreciation rate of 6.66% to cover 100% value of the assets (and not 90%) over 15 years so as to enable servicing of the debt without resorting to special appropriations. The industry argued that since the normal repayment period for most of the loan is 12 years, the depreciation to service the loan should be adequate to repay for 80% of the asset values (which is financed through borrowings based on debt equity ratio of 4:1) in 12 years. (FICCI, Jan 1991).

The revised rates have little relevance to the life of the assets but are brought in line with the debt repayment obligations of the power projects. Higher depreciation rates expected to enhance internal generation, would be a step towards making power projects financially viable and would increase the rate of return available to investors by about 2%. The higher depreciation rates are expected to increase the tariff rates by about 7%. As a part of further incentives to private sector plants, a new operating and maintenance expenditure is to be computed either at 2.5% of the completed project cost or at 2% of the completed/contracted cost plus actual insurance charges, subject to an overall ceiling of 3%.

Higher depreciation rates expected to enhance internal generation, would be a step towards making power projects financially viable.

Cost of genration, discussed above, on the principle of 'cost plus approach', as per one view, has a tendency to be higher even on the two part-tariff concept. Alternatively, 'Delivered price approach' on the basis of competitive tariff and competitive bidding approach would allow freedom of operation as well as distribution and would not have the need for a guaranteed return. According to the Ministry of Power, both the options are feasible but in the initial phase there are advantages in the cost plus approach because of its compatibility with CEA procedure for project approval and SEBs own experience with this form of pricing through NTPC tariff etc. With the change over to competitive bidding and with SEBs gaining more experience 'delivered price' option can be exploited" (GOI, May 1995).

In short, the method recommended by the World Bank, in the final analysis, determines the cost of power per unit and not the capital costs per megawatt of capacity added. In this regard, the Standing Committee has recommended to examine the "desirability of adopting a standard practice of specifying a single rate at which private investor are asked to sell power." Such single rates will eliminate the need for offering guaranteed PLF linked rate of return.

Return on Investment

The guidelines provide for an assured rate of return of 16 percent on owners' funds on a Plant Load factor (PLF) of 68.5 percent. Infact, the Bill (1991) to amend the Indian Electricity Act 1910 and the Electricity (Supply) Act 1948, proposed to raise the standard rate from the existing 2 percent over the Reserve Bank of India Rate to 5 percent over the RBI rate "to motivate equity investment in the power projects set up by licensee companies", thus assuring a return of 15 percent as against the then existing return of 12% a rate higher than the bank rate probably to mitigate the business risk and the financial risk. (It may be mentioned that the bank rate which till July 1991 was 10 percent, was revised upward to 11 percent in July 1991 and to 12 percent in October 1991).

In addition, there was an incentive of 0.6 percent return on equity for every one percent increase in the PLF, and it has been raised to 0.7 percent. However, penalties have been prescribed if the PLF is below the prescribed limit. For example, for a project having fixed costs of Rs. 100 crore if the plant is operated at 50 percent PLF, the promoter would have to bear a penalty of Rs. 27 crore (viz product of PLF and fixed cost divided by the prescribed PLF of 68.55 percent). It is estimated that the controversial Enron project in Maharashtra would have a rate of return of 31 percent approx. on PLF of 90 percent. (Roy, May 24, 1995). It is argued that the liberalisation of depreciation rates and allowing higher level of operating and maintenance expenditures, as discussed latter, would enhance the real rate of return available to investors.

In one view, liberalisation policy guranteeing return of 16 percent on equity, along with incentives for higher PLF and liberalised depreciation rates puts premium on the policy of 'cost plus' and appears to be more in tune with and carries all the evils of the regime of ad-

ministered pricing. However, the Ministry of Power (GOI, May, 1995) justified it on the ground that "'price regulation for electricity tariff is a common practice followed in many parts of the world. This is normally fixed with the approval of the concerned regulatory authorities. While it is admitted that administered pricing has a number of disadvantages, it is to be remembered that the power sector is yet to operate on free market conditions and until a competitive environment exists, it is difficult to conceive a situation where investors would risk their money in an atmosphere where there is neither any competitive pricing mechanism nor an assured "reasonable return".

Liberalisation policy guranteeing return of 16 percent on equity, along with incentives for higher PLF and liberalised depreciation rates puts premium on the policy of 'cost plus' and carries all the evils of the regime of administered pricing.

A number of experts expressed their views to the Sub-Committee of the Standing Committee on Energy that the guaranteed rate of return on equity was on the high side and in countries like China, there was a ceiling of 12.5 percent. Such a guarantee need not have been given, rather the private investor should have been asked to quote the lowest price per KWH subject to the condition that not less than 68% of the energy generated would be taken by the SEBs. For any higher PLF, the benefit should accrue essentially to the consumer. About 15/20% of the benefit could go as an incentive to the investor.

On the other hand, industrial organisations like PHD Chamber of Commerce and Industry pleaded and justified the need for 16% rate of return, on the ground that the interest rates charged by banks and financial institutions ranged between 15% and 21%. However, considering the tax shield, the interest cost works out to be much cheaper!

Further, the norms laid out in the guidelines provide certain ceilings and leave it open to the state governments to negotiate good deals within the ceiling laid down. The guidelines provide for a return of 16% at 68.5 PLF, and if the performance of the power station is below that level. There is a *pro rata* reduction in the incentive. Since most of the projects cleared so far have guaranteed off-takes of power above PLF, the return would be above 30%. It would be pertinent to refer to the recommendation of the Standing Committee to review the PLF linked equity return in national interest.

It may also be argued that the return of 16 percent will be applied not on plant availability but on energy actually generated also, as energy cannot be stored. As such, will such private generating companies be operating to meet the peak demands of the SEBs, the sole purchaser of electricity? Will there be backing down of the power station in off-peak hours given their higher cost of power? Alternatively, will the private power projects run as base-load station at constant load factor? It may be mentioned that the PPA generally contains a clause that the private power station would operate on a "must run" to arrive at actual PLF. Though it assures a return to investor, the consumer has be bear a heavy burden on costly energy.

Private Participation & Counter Guarantee

When the Power Purchase Agreement (PPA), is executed, the Private Power Developer is on a weak footing as there is only one buyer (namely SEBs) which is not financially strong, and in the absence of a system of credit rating of SEBs, there is a demand for guarantee by the state for the repayment of the loan and the trade credit outstanding. It is argued that once a certain return is assured, the PPD should bear business and financial risks. However, to encourage private participation in power, there has been a system of counter guarantee by the central government in eight power projects, called 'fast track' projects to cover the capacity and energy payment obligations of the SEBs upto a predetermined annual limit. The Government of India is a secondary guarantor, the respective State Government being the primary guarantor; the guarantee is normally limited to a period of ten years and would be constrained by the annual limit. Guarantee by the Government in one view is like a loan and is not financially prudent, and should be treated as a liability in the financial statements of the central government. Accordingly the system of counter guarantee by the central government has been done away with for projects in future. Four alternatives proposed for counter guarantee are as follows:

Firstly, formation of an escrow account to which the entire energy sales revenue of a state electricity board (SEB) is remitted. There will be an arrangement with the bank by which the first charge on the account will be that of the private power generator and there may be an arrangement of guarantee by the bank. This alternative would require a tripartite agreement involving the Bank, the State Government as well as SEB and the private promoter. Secondly, an escrow account in which the power dues of 100 industrial consumers are remitted. The

consumers should be so chosen that their dues total up to more than the estimated outstanding of an SEB's dues to a private power generator. This alternative would involve four parties including that of the consumer. Thirdly, is the direct sale of power to consumers. The private power generator pays the SEB for wheeling charges and takes on the responsibility of collection of dues. Lastly, consumers in a specified geographical area are directly allocated to private power projects for sale of power. Collections are done directly by the developer.

As an extension of the first alternative, in case of default by the SEB, the bank will have the first charge on devolution of central funds to the State through the current account in the Reserve Bank of India.

Why was counter guarantee given for eight projects? Perhaps to attract private foreign investment. The system of guarantee by the Government, in the words of the Standing Committee addresses the symptom and not the disease plaguing the electricity sector, hence the need to make SEBs viable. (GOT, May 1995).

The system of guarantee by the Government, addresses the symptom and not the disease plaguing the electricity sector, hence the need to make SEBs viable.

Private Participation: Procedure & PPA

As per the government policy of involvement of private sector in power generation, more than one hundred letters of intent have been issued or memorandums of understanding have been signed. The Private Power Developer (PPD) arranges all services and brings all parties together by signing necessary agreements and this affects the cost of the project. Such services include equipment procurement, supply of fuel as per the quantity and quality of requirements, labour availability, O&M contractor for the proper functioning of the project and finances. On arrangement of all services, the power purchase agreement (PPA) is signed by the SEB. The PPA is the most important document and serves as a collateral security for the creditors who provide debt. Agreements signed with different agencies for the supply of various services are part of the PPA entered into by the independent power purchaser.

Finances arranged by the PPD are on his financial and managerial standing and are on the basis called non-resource-finance (NRF). Under this arrangement, the developer is under no obligation to repay the project debt if the project revenues are not sufficient to cover the principal and the interest obligations. (This necessitates the need to identify and allot risk to each stake holder of the project) and the lenders have to rely solely on project assets and cashflows for their rights and dues.

In the absence of a system of credit rating of SEBs and other agencies, as mentioned earlier, the PPA provides for guarantees for payment of electricity sold and repayment of the loans. There has been a system of counter guarantee by the government which of late, has been scrapped for the new projects and various alternatives in the form of escrow account have been adopted.

There have been delays in the selection of the PPD and the finalisation of the PPA, "a primary reason for the delay was that the procedure for selection of PPDs and settling the price of power was vague, undefined and overelaborate" (Sankar, 1995). Suggestions in this regard are:

* There should be a proper procedure for selection of a limited number of parties to bid for the project.
* The bid document should contain certain non-negotiable conditions and non-alterable standards and norms.
* Lastly the system of counter-guarantee by the Government should be replaced with any other mode acceptable to the participants.

Privatisation of Power Sector – Some Efforts

As a result of the new policy to invite private investment in the power sector 138 private proposals for creating 58.745 mega watts of capacity with an investment of Rs. 2,19,927 crore were received upto the beginning of 1995 (Economic Survey 1994-95). Of these, 41 proposals are from foreign investors or are joint ventures with foreign partners. However such private sector proposals are subjected to a lengthy processing and clearance process; and dealings with the loss ridden SEBs, distribution agencies.

Further, supply of electricity to agriculture at subsidised rates, particularly when the share of agriculture sector in the total electricity demand has increased from 5% in the fifties to 20% at present; and transmission losses of 23% (as against 10% internationally) are some other deterrents to private participation. According to the Economic Survey (1993-94), "Lack of access to the final market for electricity, the poor finances of SEBs, their poor

records in settling debts and hence their poor credibility, are some of the major obstacles in attracting private investment to this sector." On this aspect the Finance Minister in his Budget Speech of February 28, 1994 stated that the power sector required major changes, in the working of SEBs, rationalisation of tariffs and restructuring responsibilities for generation, transmission and distribution.... and it will be necessary to face up to a number of hard decisions in this sector."

"Lack of access to the final market for electricity, the poor finances of SEBs, their poor records in settling debts and hence their poor credibility, are some of the major obstacles in attracting private investment to this sector."

An action plan has been drawn up to improve the performance of the power sector in a phased manner involving short-term, medium and long term measures covering both physical and financial aspects of generation, transmission and distribution of power, so as to have a significant increase in PLF. The PLF is an important indicator of the operational efficiency of thermal power plants, as every one per cent improvement in national average PLF makes available an additional 450 MW of installed generating capacity.

Power is an essential infrastructure having a direct bearing on the development of the economy. According to one power expert, "if economy picks up, demand (for power) is going to go crazy, as 6% economic growth requires an extra 9% of power capacity a year." The problems of power sector, particularly the SEBs in India are succinctly summarised by the Economist (London) in the Survey on India (Jan 21-27, 1995 issue) as follows:

> "Cost of producing electricity in India is 1.61 rupee per unit, and the price is 1.31 rupee. Prices are low because state governments want to bribe voters especially farmers. In Tamilnadu farmers get electricity free, in other states they pay nominal charges. Industry normally pays over the odds, to help make up losses. Officially, 22 per cent of power is lost in course of transmission and distribution. Unofficially, the figure is 48 per cent. This is a partly because of shoddy equipment, but is more because of the man from the electricity company who says that he can reduce your bill and freelance basis and because of the jumpers that people attach to powerlines. The SEBs have also been job-creation centres for friends and relatives of politicians. Andhra Pradesh's SEB has 5000 MW of installed capacity and 80,000 employees; 150 times as many as would be employed to generate and distribute a similar amount of power in America. Foreigners thinking of investing in power generation in India find the SEBs off-putting. "Would you want these people as customers"? asks one.

A recent study on sectoral variations in electricity pricing concludes that:

- Cost of supply at low tension (LT) is 1.66 times the cost of supply at high tension (H.T.) and 1.96 times the cost of supply at EHV.
- In India during 1993, the average realisation (121p/kwh) met only 80 percent of the average cost (150p/kwh)
- The ratio of the residential to the industrial electricity tariff for Maharashtra in India was greater than one in 1981 but has subsequently decreased to less than 0.5, while the ratio for other countries like US, UK, Brazil, France has been greater than one and has increased over the years.
- The sectoral industrial tariffs in various other countries are falling in real terms between 1981-93; while Maharashtra SEB industrial tariff has increased during the period. (Banerjee and Shanthag, May 1995)

One strategy would be to hand over distribution to private generating companies, as has been done in Greater Noida or is being planned for Delhi. There can be direct sale to bulk consumers like SAIL, BHEL, railways etc.

Restoration of the financial health of SEBs, and improvement in their operational performance by implementing a minimum agricultural tariff of 50 paise per unit as agreed in the Power Ministers' Conference in 1991, is necessary to earn a minimum rate of return of 3 per cent on net fixed assets (after providing for depreciation and interest charges) as required in the Electricity (Supply) Act, 1948.

It would be pertinent to mention the Government decision to set up a National Power Tariff Board (NPTB) at the Centre and Regional Power Tariff Boards in Delhi, Bombay, Calcutta and Shillong. The main function of the NPTB will be to evolve broad principles and guidelines to ensure uniform approach by all regional boards in the matter of fixation of tariffs and to work out inter-state and inter-regional exchange of power. However, the implementation

would depend upon the respective state governments, which do not seem to follow a policy different from the one in the past.

The new policy on private sector involvement in power sector is not comprehensive. It has resulted in high cost project, has given undue incentives, and higher return to investors. But it has not resulted in the addition of a single MW capacity.

The new policy on private sector involvement in power sector is not comprehensive and has been further liberalised a number of times. It has resulted in high cost project, has given undue incentives, and higher return to investors. But it has not resulted in the addition of a single MW capacity, while there has been an 'on-rush' of transfer of public sector power units to private sector. Thus the objective to supplement power capacity by the private sector has not yet materialised despite a number of applications and signing of MOUs, no single project has yet been completed. Attempts have been made to restructure SEBs and make them viable. Some of the attempts include:

* Meghalaya State Government has decided to do away with the State Electricity Board (SEB) and handover generation to a foreign consortium of three companies and transmission and distribution to a UK based power concern. It would require vetting by CEA and FIPB. Dismantling of state monopoly and replacing it with private sector player would call for regulatory agency to monitor power generation and distribution in the state. (ET Jan 23, 1995)

* There is the talk of restructuring DESU so as to allow raising of resources to meet its replacement and modernisation needs. Such restructuring would involve private agencies. (ET June 6, 1995)

* UP State Government has initiated steps to invite private sector participation to meet the demand supply gap of power generation. Noida Power Company with major participation by the RP Goenka Group with a generation capacity of 400 MW has been set up to distribute power in the Greater Noida area. It is planned to privatise loss-making power units in the State.

* World Bank study has suggested privatisation of UPSEB after its restructuring into separate saleable business units. (ET, March 31, 1995)

A study by the Government has recommended that State Electricity Boards power units with a plant load factor of less than the national average of 50% be handed over to the private sector on a lease, rehabilitate, operate and transfer basis. It has been recommended recently that power stations in all regions have to be ranked as per their efficiency based on two parameters-cost of generation and plant load factor. (BS, September 7, 1994) It is proposed that inefficient genrating units should step down and eventually shut their operations.

Conclusion

Through guidelines, private sector participation in power generation has been liberalised time and again to woo the private sector. Such piece meal changes indicate the lack of firmness and comprehensiveness in the policy. Project costs have been inflated resulting in higher cost per unit. The system of PLF linked return, liberal depreciation rates, and other factors have offered undue incentives to private sector, without any addition to power generating capacity.

Further there is a pressing need to look into and safeguard the interests of the consumers including industrial consumers. The interests of the private entrepreneur in electricity generation has been safeguarded with the assured return, higher depreciation rates and incentives of higher return on higher PLF. What benefits would be ensuing to the customers? Would the customers be entitled to share the benefits of reduction in costs over the years, as has been the privatisation experience in other countries? On the otherhand, it is viewed that privatisation would make electricity costlier for consumers, by at least three times. Due to high estimated capital cost, as discussed, the cost per unit of electricity generation purchased by SEBs would be Rs. 2.50 as against Rs. 1.30 per unit at present. In addition, there would be a transmission cost of Rs.1 per unit. Given the supply of electricity to agriculture sector at a much subsidised rate, and transmission losses of 23%. SEBs which at present are having high operating losses, would be left with the alternative to increase price to the customer. Though a decision by SEBs to introduce time-of-day-pricing, under which consumers would be charged enhanced rates during peak hours is a right strategy in the interest of consumers as well as SEBs, it needs to be operationalised soon. Thus there is a need to examine the 'cost plus', approach of tariff fixation; and to shift to 'delivered cost' approach having the system of competitive bidding.

Power generation, being capital intensive, requires a developed capital market and private sector participation in power generation is linked with the growth of the financial and capital market. Some electricity projects have been proposed on the principle of BOOT (Build, Own, Operate and Transfer). Recently, Rajasthan State Government invited private participation including that on BOOM basis (Build, Own, Operate and Maintain) a system similar to BOOT. Further, of the financial structure of the new entraints, 70 percent of the project debt is being sourced from overseas, and it is indicative of the constraints of an immature domestic debt market. (ET March 31, 1994).

Generating companies are expected to follow all the directions of the Regional Electricity Boards; power purchase agreement (PPA) between SEB and private promoters provides for a penalty clause in case of default of plant load factor, but what would be the relationship between the SEB and the private promoter? Or who will monitor the penalty clause—CEA or SEB? Clarification on such aspects would attract the interest of private promoters and also would be a step towards safeguarding of consumer interest. There is also a need to thwart any attempt to convert private generating companies into sick entrepreneurs which later would require pumping in more funds or be thrown into the lap of the government and thus would defeat the very purpose of private participation.

It is more than three years since India started on the process of liberalisation in the power sector but there is a need to have an integrated policy and to lay down comprehensive guidelines and procedures regarding private sector involvement in power generation, distribution and transmission considering the interests of investors, particularly foreign investors, and also customers. The integrated policy has been tersely described as an organic chain having a number of important links, private sector involvement being merely one of the links. The first link is obviously addition to existing capacity, which is perhaps the easiest thing. The organic chain has a policy to ensure what is installed is available for generation, what is available is fully utilised for generation, what is generated is efficiently transmitted and distributed to consumers, what is distributed is correctly metered, what is metered is correctly billed, and what is billed is promptly collected. (GOI, May, 1995) Above all, what is required is the 'political will' to implement the policy without much delay, and its utilisation by following the principle of 'commercialisation'.

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Annexure I

Details of Major Clearances Required

For setting up a project in the Electricity Sector, the following clearances will be required:

Statutory Clearances	Clearing Authority
Cost Estimate Section 29(1)	CEA
Techno-Economic Clearance	CEA
Publication/Sec.29(2)	State Government
Water Availability	CWC/State Govt.
SEB Clearance	SEB/State Govt.
Pollution Clearance (Water & Air)	State/Central Pollution Control Board
Forest Clearance	Min. of E&F/State Govt.
Environment & Forest Clearance	Min. of E&F/State Govt.
Civil Aviation Clearance for Chimney Height	National Airport Authority
Company Registration	Registrar of Companies
Rehabilitation & Resettlement of Displaced Families by Land Acquisition	Min. of E&F/State Govt.
Hydel Projects	Min. of Water Resources
Equipment of Procurement	DGTD, CCI&E
Non-Statutory Clearances	**Clearing Authority**
Land Availability	State Govt.
Fuel Linkage	Deptt. of Coal, Deptt. of Petroleum & Natural Gas
Financing	CEA/DOP/Dept. of Economic Affairs/Financial Institutions
Transportation of Fuel	Depts. of Coal/Petroleum & Natural Gas/Min. of Railways, Shipping & Surface Transport

Annexure II

Concept of Two-part Tariff and Return-on-Investment

In order to ensure an attractive return on capital investment in a power project, careful planning has gone into ensuring that cash-flow is secured and liquidity is maintained, through the formulation of a two-part tariff system which guarantees returns.

The system provides for the signing of a Contractual Agreement, laying down rates for the bulk sale of power by a generating company to an SEB, for a specified period. The first part of the rate ensures recovery of fixed costs (including returns) based on performance at normative parameters. The second part ensures meeting of variable expenses, based on units of electricity actually supplied. Incentives will be provided for the achievement of efficiency levels, higher than the normative parameters.

The sale rate is calculated with reference to operational and load factor norms, as well as on pragmatic rates of depreciation notified by the Central Government.

Once the sale rate is fixed, no limits of any sort will be put on actual profits earned by a generating company.

Under the noval two-part sale rate, fixed costs will cover:

- Interest on Loan Capital
- Depreciation
- O&M Expenses
- Taxes on Income, if any
- Return on Equity component; and
- Interest on Working Capital

Variable costs will comprise:

- Cost of Primary Fuel such as coal, oil or gas; and
- Cost of Secondary Fuel

The two-part sale rate is justified on the ground that fixed charges cover sunk costs and do not vary with levels of generation. On the other hand, variable charges and additional costs related to actual generation varying directly with levels of generation achieved.

On the other hand, for a Licensee, the new policy brings in a return of 16 percent on investment, which is 5 percent above the Reserve Bank of India rate. Since tax is treated as 'expenditure' while fixing the tariff for a Licensee, the return is actually higher, being in effect, post-tax.

We reproduce below relevant provisions of the March 31, 1992 notification regarding Two-Part-Tariff.

> "Full fixed charges shall be recoverable at generation level of 5500-6000 hours/KW/Year. Payment of fixed charges below the level of 5500 kwh/KW/Year shall be on a *pro-rata* basis. There shall not be any payment of fixed charges for generation level above 6000 hours/KW/Year. However, generation above 6000 hours/KW/Year shall be at negotiated rates between the generating companies and the Board, which shall not include the fixed cost element. While computing the level of generation, the extent of backing down, as ordered by the Regional Electricity Board shall be reckoned as generation achieved. The payment of fixed charges shall be on a monthly basis, proportionate to the electricity drawn by the respective Boards. Necessary adjustments based on actual sales and deemed sales shall be made at the end of the year."

The Counter-Guarantee Debate & SEB Reform

Ronald Somers

Given the Pressures on the Indian power sector by the increasing demands made on it on the domestic and industrial fronts, private sector participation has become imperative. In this context, the counter guarantees offered by the Government to invite and bolster confidence have attracted many comments. The author analyses the pros and cons of the issue and offers alternatives.

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Much hue and cry has been generated about private investment in India's power sector, and about the various contractual and financial mechanisms that have made private power possible in India and around the world. An issue that has attracted the most attention has been India's debate about extending Central "counter-guarantees" to support private power project finance. Given the importance of developing adequate supplies of much-needed power to secure India's future, it is essential to understand the reasoning behind these credit support mechanisms and to address the ground realities of this debate.

What is a Counter-Guarantee?

For the first eight "fast track" private power projects being proposed in India, the Central Government has agreed to provide a "backstop" performance guarantee to assure investors that in a power sales transaction the amount due from the power purchasing State Electricity Board (SEB) will be paid. This assurance was to have been a transitional measure to bolster lender confidence and to "kick start" the private power program in India. Under this scenario, eight "fast track" projects amounting to 4000 MWs of power at a cost of $5 billion are nearing financial closure within a timeframe of only 30 months, proving India to be the most aggressive of all Asian developing countries in attracting massive private sector investment into the power sector.

The Central Government has agreed to provide a "backstop" performance guarantee to assure investors that the amount due from (SEB) will be paid. This assurance was to bolster lender confidence and "kick start" the private power program in India.

The reasoning behind counter-guarantees are not far to seek. As proposed power purchasers of private power, State Electricity Boards (SEBs) have a poor credit history unsatisfactory to lenders. Investors and lenders require assurances that, in fact, they will be paid for power sold, so that project loans can be amortized and returns can be realized on the original investment. SEBs, for example, owe India's National Thermal Power Corporation (NTPC) more than Rs. 5000 crores ($1.6 billion) for power consumed but not paid for. Lenders and investors accordingly require some credit support to ensure recoupment of investment and regular revenue stream sufficient to retire project debt.

A Temporary Solution

The International Monetary Fund (IMF) has advised the Government of India (GOI) that such counter-guarantees must be treated from an accounting standpoint as a "contingent liability" for the entire projected revenue stream for the term provided – or for ten years of projected project revenue as stipulated in the PPA. This significant liability is treated as "red ink" against the GOI's balance sheet.

Standard and Poors has recently advised India that it risks a lowering of its credit rating. This will cost India millions of dollars as a lower credit rating will make external borrowings more expensive. The Ministry of Finance (MOF) has therefore resisted issuing any additional counter-guarantees beyond the first eight which were promised.

Some also view the counter-guarantees as "counterproductive" to SEB reform, as such a "backstop" provided by the Centre could diminish the incentive for the State to initiate SEB reform, while setting a dangerous precedent where all States will demand equal treatment in obtaining a counter-guarantee. Accordingly, those projects that have received counter-guarantees have gone through stringent negotiations with the Ministry of Finance to minimize the GOI's exposure, resulting in increases in developer risk and in most cases reducing the developer's expected return on investment.

The MOF has definitively stated that no more counter-guarantees will be forthcoming, except for those originally promised to the "fast track" eight projects, which include the first-phase Dabhol Project in Maharashtra (695 MW), the Ib Valley Project in Orissa (420 MW), the Jergurapadu and Kakinada Projects in Andhra Pradesh (225 MW each), the Vizag Project in Andhra Pradesh (1000 MW), the Mangalore Project in Karnataka (1000 MW), the 0 Unit Neyvelli Lignite Project in Tamil Nadu (250 MW), and the Bhadravati Project in Maharashtra (1000 MW).

Alternatives

Industrial Consumer or Prime Distribution Area Escrow Accounts

Without a counter-guarantee provided by the GOI if State Governments hope to attract private sector capital, State Governments will be forced to dedicate their best industrial accounts or prime distribution areas to attract new capacity additions. Under this scenario, if a developer is setting-up a 100 MW combined-cycle power plant, the State Government would set aside, say, 150 MWs of "creditworthy" industrial consumers who would pay their dues directly into an escrow account managed by a neutral party, rather than to the SEB. According to the "escrow instructions", the lender and then the equity investors would hold first rights against the escrowed funds before excess funds would be turned over to the SEB.

The flaw in this scenario is that SEBs would end up losing their best paying customers to private power, leaving the SEB with non-paying customers, i.e. farmers, domestic users, etc. Unless reforms are keeping pace, SEBs would sink into insolvency at a quicker pace under this "cherry-picking" scenario.

SEBs would end up losing their best paying customers to private power, leaving the SEB with non-paying customers.

SEBs with limited industrial consumers would also be restricted as to how much private power investment could be supported, i.e. in Andhra Pradesh, for example, out of a total installed capacity of 5000 MW, fewer than 1500 MW are industrial consumers, against a projected need for new capacity addition of 8000 MW by the end of the century. Common sense tells us that 1500 MW of paying customers cannot support 8000 MWs of new capacity.

Escrow of State's Devolutions

Rather than allow the "cherry picking" of the SEB's best customers off the grid to support private power, some States are considering the creation of an escrow mechanism that attaches the State's projected devolutions (plan assistance) issued by the

Center. Under this scenario, a portion of the State's plan allocation or budget would flow through an escrow account, thereby providing private power developers/ lenders first rights to recover their debt and investment.

The limitations of this approach are mostly political and possibly constitutional. If an SEB defaults in payment and the lender/developer is forced to draw-down plan assistance funds, this would mean that other State projects, such as roads or schools, would remain unfunded. Questions would inevitably arise as to whether foreign-sponsored power projects should take priority of plan funds over competing socially-important infrastructure projects such as water purification, sanitation, roads, and schools.

Indian Financial Institutions provide only Limited guarantees

The Indian banks, including ICICI and IDBI, are sanctioned to lend or guarantee a specific amount to power sector projects on an annual basis. Unfortunately, only $2 billion is available annually to lend directly to private power projects or guarantee power investments, which falls woefully short of the $10 billion per year that is needed.

At a preliminary stage of planning, the World Bank (WB) has floated the idea of providing a limited debt guarantee to cover private power lenders, but at a significant monetary cost to SEBs, while also requiring a sovereign guarantee from the Center. This scheme has met with universal disapproval—the developers/investors are unhappy because the WB guarantee would fail to protect their equity investment. States are unhappy because of the cost of the guarantee. GOI remains unhappy because the guarantee must be "backstopped" by the Sovereign Exchequer, which ultimately lowers GOI's credit rating.

Privatize Distribution/Generation/Transmission

GOI has toyed with the idea of offering projects available for private sector investment, together with a proposed distribution area that ultimately would be privatized by the developer and made commercially viable. Although in theory this encourages a commercially viable solution to redress poor SEB performance, lenders will not and can not fund projects in the hope that the restructuring experiment will succeed. Furthermore, this raises a question as to what would happen to displaced SEB employees. Additionally, foreign investors may find it difficult to recover dues from rural and domestic consumers.

The Indian States of Orissa and Meghalaya have initiated progressive restructuring by corporatizing their respective SEBs into privately controlled generation, transmission, distribution companies. Andhra Pradesh has also embraced this idea.

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The "Orissa Model" of restructuring is commendable and should be replicated country-wide. The efforts undertaken by the leadership of the tiny (1,000,000 population) state of Meghalaya is exemplary and will generate an additional model for reform.

Power Grid As "Creditworthy" Power Purchaser

India's national grid, held by the public sector Power Grid Corporation which is only 3 years old, has been approached by private developers to become purchasers of bulk private power to "on-sell" to high tension consumers, including power-hungry SEBs. So long as the Power Grid could employ a mechanism to attach state monies (RBI Account or plan devolutions) in the event of SEB default in payment, then the government-owned power purchaser (Power Grid) would forever remain solvent, and thus enjoy the same credit rating as the Sovereign. This would enable developers to access international capital markets to raise debt on the creditworthiness of Power Grid Corporation.

GOI/MOF should be encouraged to accelerate interconnection of India's five regional grids, so the northern states' Himalayan hydro can be tapped, infrastructure in the rural Northeast can be developed, and coal-fired power can be generated at the pithead instead of transporting coal on India's over-burdened railways.

Under all scenarios, the GOI/MOF should be encouraged to accelerate interconnection of India's five regional grids, so the northern states' Himalayan

hydro can be trapped, infrastructure in the rural Northeast can be developed, and coal-fired power can be generated at the pithead (Bihar, West Bengal, Orissa) instead of transporting 47% high-ash coal on India's overburdened railways. There is no question that it is more efficient to transmit kilowatts than it is to transport high-ash coal.

"Balance Sheet" Financing

In the absence of counter-guarantees a trend has emerged whereby Indian developers are willing to pledge their company's balance sheet in order to raise financing for private power. This freezes out foreign investors, who are unwilling to risk corporate assets, and, more importantly, fails to meet the challenge of developing 142,000 MW of additional capacity by 2007, which is India's projected energy need. Perhaps as much as 10,000 MW of additional capacity could be brought online within a ten year period, but this falls woefully short of the 140,000 MW needed. "Balance sheet" financing will, no doubt, be required in some development scenarios, but as soon as one SEB fails to make payment and an Indian industrial house finds its "balance sheet" in jeopardy, it will become evident that this type of financing is not sustainable over the long term.

Establishment of a Multilateral Guarantee Fund

The concept has been floated about the establishment of a "closed end" guarantee fund that could be leveraged many times over to enable private power investments. EXIM Banks and others could pool monies in a "limited liability" guarantee fund that could be leveraged time and again to support private power investment. This proposed fund would provide lenders and investors the adequate level of "comfort" to foster project development, and provide the necessary bridge to enable private power development while SEBs get their houses in order. The approach is valid and worthy of consideration. Drawbacks to this approach include lack of political support, lack of available resources, and lack of an effective lever to ensure SEB performance and eventual SEB reform.

Power Sector Trends

Given the fact that no additional GOI counter-guarantees are likely to be issued beyond the eight that have been promised, project finance will be difficult to obtain for large-scale projects. Hence, smaller projects (50-120 MW) will dominate the next development trend. More captive stations will be developed that sell electricity directly to industrial consumers and not into the SEB grid. SEB transmission lines will be utilized for wheeling. Because local Indian investors can more adequately assess SEB payment risk, and are therefore more willing to pledge their corporate balance sheet to raise project funding, more joint ventures between foreign collaborators and local Indian industrial houses will become the norm.

Power Grid Corporation will begin to play an increasing role as private power purchaser and reformer in that the Central grid will only "on sell" power to those consumers willing to pay. Those with a bad credit history will not be delivered power; Reform and the development of a credit history indicating prompt payment for power will become the only way an SEB will attract power from the Central grid.

Power Grid Corporation will begin to play an increasing role as private power purchaser and reformer in that the Central grid will only "on sell" power to those consumers willing to pay.

Private power developed according to the "fast track" counter-guarantee approach will serve to spur SEB reform by establishing competitive operational models that cannot be ignored by the consuming public, the politicians, or poorly run SEBs. Private power will operate more efficiently and set a standard for SEB performance. States that reform their SEBs most quickly will attract the bulk of private sector investment thereby fueling economic expansion and job creation.

DSM and cogeneration will become attractive options for industrial consumers as tariff increases are levied and as the burden of agriculture subsidies continue to be borne by high-tension industrial consumers. However, without sufficient credit support or progressive SEB reform, lenders will be loathe to invest monies that may not be repaid, and much-needed energy development in India will be hindered.

Conclusion

SEB reform is the ultimate solution. In the absence of Central Government "counter-guarantees" the only sustainable alternative is for India's utilities to operate on a commercially viable basis.

Examples of where SEBs require immediate redress include transmission and distribution (T&D). Experts estimate that on average India's SEBs lose as

much as 40% of all power generated through commercial and technical T&D losses. SEBs operate existing stations at low efficiencies @ 60% availability (against an industry average of 80%), and fail to collect or receive payment for approximately 40% of all energy generated.

State Governments must move quickly to expedite SEB reform and restructuring. To accomplish reform and restructuring, political influence must be divorced from day to day utility operations, so the SEB can operate on a purely commercial basis. Currently, SEBs are unable to set tariff rates that are remunerative, as SEBs must now bear the burden of subsidizing agriculture. Compounding the issue, SEBs are not entirely free to enforce vigilance in billing and collections.

It is common knowledge that SEBs are utilized as political vote banks with little or no opportunity to operate along commercial lines. The establishment of politically-autonomous regulatory commissions that will set tariff rates transparently and fairly, enforce billing and collection, monitor utility performance, and settle labour disputes so that Indian utilities can be delinked from politics and become creditworthy is, accordingly, the need of the hour.

With "private power" now launched in India, the second phase of policy formulation must focus on consumer protection, grid integration and SEB reform. By all accounts, India's renaissance has successfully begun. The opening of the power sector has yielded many lessons and has paved the way for the liberalization of the entire economy.

Without competitors there would be no need for strategy.

— KENICHI OHMAE

There are techniques of being intelligent. It is not easy to acquire the proper use of the mental tools which we have thoughtlessly inherited or which are implicit in the construction of our brains. Severe effort and long practice are required.

— PERCY W. BRIDGMAN

Telecommunications in India

K.R.G. Nair

This paper examines the development of telecommunications in India enquiring also into the policy of the Government towards this sector. The author briefly indicates the different facets of telecommunications in to-day's world. He enumerates the importance of telecommunications particularly from the point of view of economic development and presents the telecom scenario in India. A brief critical review of telecom policy in India over time is also included.

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Telecommunications are associated in the minds of most, with Plain Old Telephone Services (POTS). It is, of course, apparent that lots of physical infrastructure in terms of network and other equipment are required to provide even POTS. Besides, it has also to be borne in mind that telecommunication can be by means other than the POTS. Actually, telephones were invented only in 1870 by Alexander Graham Bell. But three decades earlier, in 1840, Samuel F.B. Morse and Alfred Vail had already produced the electric telegraph. The 20th century has witnessed the development of wireless communication from simple wireless telegraph to radio and now even to television and that too with intercontinental satellites. In recent years, the innumerable technological improvements in the fields of micro-electronics, computer software and optics, have had their impact on telecommunications. In view of all this, the term telecommunication sector in today's world encompasses the service of communication over distance by electrical, electronic and optical devices as well as the requisite physical infrastructure for this purpose.

The term telecommunication sector in today's world encompasses the service of communication over distance by electrical, electronic and optical devices as well as the requisite physical infrastructure for this purpose.

Telecommunication services have these days expanded much beyond mere POTS.[1] We live in the age of wired video text or view data and even of video-conferencing. The OECD Committee for Information, Computer and Communication Policy (ICCP), in 1989, looked upon telephone net-work based services (VANS) as those that combine the production, manipulation, storage and/or distribution of information with the use of telecommunication facilities and software functions.

1. For details see Vijeta Vij et. al. (1994).

Telecommunication services can hence be split into two parts. Firstly, there are basic services provided by POTS which allow for the making of local, national and international calls and secondly, there are also VANS. These include enhanced horizontal services like voice messaging, electronic mail, fascimile (fax) etc. and also vertical services specific to particular industries or situations involving data processing procedures, graphics etc. and requiring interaction between the service provider and the user, besides the telecom carrier, an example of this being the computerised reservation system.

Importance

Telecommunication was looked upon in the early 60's as a superfluous status symbol of the affluent few. The last three and a half decades have, however, witnessed a sea change in such a view. It is being increasingly recognised that telecommunication services help considerably in the efficient production and distribution of goods in any economy. As a result of this and also due to the enabling of speedier and more efficient discharge of social services and of Government administration, it is universally agreed that telecommunications lead to a definite improvement in the quality of human life. Telecommunication is hence looked upon as an essential infrastructure for economic development.[2]

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A good deal of evidence can easily be produced to substantiate such a view. In the 90's, the developing countries with around three-quarters of the world population had only around one-nineth of the main telecommunication lines of the world. India with around $ 300 G.N.P. per capita, possessed one of the lowest amount of main lines per 100 persons, the figure being as low as 0.5. USA had a GNP per capita 600 times higher, but the number of main lines per 100 persons was as much as 120 times higher compared to our country. Even a small European nation like Sweden had main lines per 100 persons, 151 times as high as India, which is not surprising because it had a per capita GNP 51 times that of India. As for India, it has been estimated by the International Telecom Union of Geneva that each additional telephone in India will add Rs. 1,12,200 to India's GNP.

Three additional factors have made the development of the telecommunication sector the *sine qua non* for economic growth not only for developing economies, but also for the industrially advanced ones. Firstly, the considerable globalisation of capital flows, trade, manufacturing and other activities the world over, makes it imperative for any country to have less costly and better and more varied communication facilities to participate in the globalisation process while maintaining and increasing its competitive edge. Secondly, rapid changes in telecommunication technology, brought about by changes in micro-electronics, software and optics, have made the adoption of these technologies an essential pre-requisite for the growth of any economy. Thirdly, the information sector has assumed not only greater relative importance in the industrial structure of all economies in terms of % share in GDP and in total employment, but it has also come to be looked upon as a basic input like labour and capital.

The Indian Scenario

India did not lag behind the developed nations of the world as regards the introduction of telecommunications. Being a British Colony, both telegraph and telephone were introduced into India almost contemporaneously with the United Kingdom. Electric telegraph made its appearance in India as early as in 1854. Telephone followed a little later and came to India in the year 1882. Over the period of 140 years since inception in this country, telecommunications have indeed grown by leaps and bounds to occupy an important position in the Indian economy today. We have at present around 7 million telephones operating in India, bringing in a revenue of Rs. 6000 crores per annum. Capital assets of the sector come to around Rs. 25,000 crores and about four lakhs of workers are engaged in the telecommunication sector in India.

There have been achievements to be proud of on a number of aspects of telecom development in India over time.[3] For instance, since our independence in 1947, telephone lines have increased more than 87 fold from 80,000 to 70,00,000. The number of villages and towns having telegraphs went up from 500 to 4500. Exchanges have gone up from 400 to over 18,000. Our country has been able to provide national and international direct dialling to almost all countries of the world, to 80% of our subscribers. Our international telephone circuits

2. A detailed discussion along these lines is contained, among others, in Saunders. et. al (1994).

3. Amit Jain et. al (1994), among others, make interesting comparisons of the pros and cons of Indian telecom with those of other countries.

increased almost seven- fold – from 1000 to 6600 – in just seven years from 1986 to 1993. Forther, we have successfully crossed the one million new line barrier already in 1993. To crown it all, our achievements extend also to manufacturing of equipment. We have, in fact, indigenously designed and competitively produced switches of more than 2000 lines capacity. We even have surplus manufacturing capacity in all but the SPC digital exchanges of 10,000 lines and above.

It has, however, to be admitted that all is not well with telecom development in India, particularly if we consider our progress with that of many other countries.[4] It is apparent that there are not enough telephones in India – there being just 7 million phones for a population of around 900 million people. In fact, telephone density, defined as main line availability for 100 persons, was as low as 0.54 in India as compared to 50.58 in USA and 2.09 even in Thailand in the 90's. Further, though we are providing larger number of new connections per year over time, both the waiting list in terms of people registered and waiting for new telephone connections as well as the period of waiting for such people are both going up. Actually, the waiting list has increased 120 fold since 1947 to reach the figure of 3 million in the 90's. The waiting period for getting a telephone connection after registration has doubled from under 3 years to over 7 years in some important Indian towns over the past few years. On top of all this, it has also to be remembered that 80% of our telephone main lines are limited to the six metropolitan cities of India. Only 32,000 of the 600,000 Indian villages had any kind of telephone connection in the 90's. Moreover even after the successful completion of the ambitious programmes launched by the Government in this regard, only 100,000 of our villages will have some sort of telephone connection even by the end of this year.

All is not well with telecom development in India, particularly if we consider our progress with that of many other countries.

The quality of telecom service in India also leaves a lot to be desired. It still consists mainly of POTS. In newly developing areas, in remote areas like mines and power plants, and in big metropolitan cities, the absence of high speed telecoms, technologies for which exist and are being used in the rest of the world, is very much felt. Further, because of obsolete equipment, our fault rate is extremely high – 20 per 100 telephones as compared to 2 per 100 telephones in developed countries. Our long distance network has not expanded commensurate with the expansion of local networks. This results in heavy congestion and leads to very poor call completion rates. It has also to be remembered that our cable network for subscribers is mostly of poor quality, disruption – prone and unsuitable for digital data transmission even at medium speeds. Moreover, in rural areas, most of whatever little network exists is sub-standard and unsuitable for direct dialing for long distance communication. Nor is this poor quality service being made available at reasonable charges.[5] Installation charges per telephone in India are higher than those even in the United States. It may, of course, be claimed that local call charges are very low in India. But there is evidence to show that while in a few countries, the telephone price index has been kept below the whole-sale price index, in the case of India this has not been so in the past decade.

Telcom Policy in India

A bird's eye-view : Telegraphs have, since inception been run in India by the Government as a Departmental Undertaking. Telephones in India were, however, initially in the private sector, this being true even of international telephone connections. But problems mostly of co-ordination, necessitated the confining of telephones also in Government hands and the Government declined to renew the licenses granted in this regard to the private sector. Telecommunications in India continued to be governed till recently by the Indian Telegraph Act of 1885 which gave the Government the exclusive right to establish and operate telecom. This coupled with the Indian Telegraph Rules of 1951 and the Industrial Policy Resolution of 1956 resulted in telecom being the exclusive domain of the public sector from at least the 60's to the 80's. The Department of Posts and Telegraphs was given the ultimate and exclusive responsibility for policy-making, net-work establishment, manufacturing of equipment and regulation which included price-fixing, licensing, grievance settlement, inter-connections etc., during this period.

The increasing importance of telecommunications, nationally and internationally for India over time, made it apparent that the entire gamut of issues connected with telecom cannot be handled any longer by a Department dealing with Posts and Telegraph together. In 1978, Telecom Consultants India was set up to discharge the responsibility of providing telecom services in foreign

4. See, in this regard, among others Meghna Modi et. al (1994).

5. See, Satya Sundaram (1995) for further details.

countries. The Centre for the Development of Telematics, C-DoT, was established in 1984, to promote research and development of indigenous technology in the field of telecom. The year 1985 saw the creation of a separate Department of Telecom – the DoT. A separate Telecom Board, later named the Telecom Commission was also set up mainly to decide matters of policy, but this again composed mainly of the officers of the DoT. The fact that Telephones in big cities are too difficult to be run as mere Departmental Undertakings, necessitated the setting up of the Mahanagar Telephone Nigam Limited (MTNL) in 1986 to look after telephones in Bombay and Delhi. The year 1986 also witnessed the setting up of the Videsh Sanchar Nigam Limited (VSNL) to take care of India's overseas communications.

Along with these organisational changes, there were also straws in the wind, since the early 80's about the opening up of the telecom to the private sector.[6] The Department of Electronics interpreted the Indian Telegraphs Act differently from other Departments and threw open the production of a large variety of telecom equipment like RPABX's, cables and telephone instruments to the private sector, including foreign companies. This resulted in public sector units like the Indian Telephone Industries and the Hindustan Cables Limited losing their monopoly positions. by mid-80's, C-DoT also gave production rights for their RAX's upon payment of substantial fees to the private sector. With the new economic policy of the early 90's in India, this pace quickened. A seven-member committee headed by Dr. M. Athreya submitted a detailed report about restructuring telecom in India in 1991. The report stressed the need to separate operation from regulation, to take out operations from the Government, to make operations pluralistic to be first corporatised and then ultimately privatised in a phased manner.[7] These recommendations aroused a good deal of controversy. Though the report was not accepted in toto by the Government, it took favourable note of most of the recommendations. As a result, in March, 92, tenders were invited for VANS in the form of mobile telephones in four metropolitan cities. After considerable legal wrangling, characteristics of the transitionary phase in policy, licences were granted to 8 private companies, two in each of the 4 metropolitan cities of Bombay, Calcutta, Delhi and Madras, and these services are expected to be operative from July, 1995. A new telecom policy (NTP) was, in fact, adopted by the Government in May, 1995 and the main hall-marks of the policy were the decisions to set up a Telephone Regulatory Authority of India (TRAI) and to throw open basic telephone services also to the private sector. In pursuance of this policy, the country has been classified into three groups of 20 regions or circles A, B and C, on the basis of revenue potential from telephones. Tenders have been invited for the provision of basic ad cellular telephone services in these regions and licenses are expected to be issued soon on the basis of these tenders received.

6. See Telecom Employees Union (1991).

7. See, among others, Saunders et. al (1994), Meghna Modi et al (1994) and Agarwal (1993).

Caution Warranted

The confining of all activities related to telecom in the hands of Government Departments did help bring about considerable co-ordinated development of the telecom sector in India with many an achievement to write home about. These, however, pale into insignificance if we compare our position internationally, both in terms of quantity and quality. Further, with rapid changes in technology, telecom has come to mean much more than POTS. In this telecom scenario of the modern world, there are serious doubts about undertakings of Government departments delivering the goods for the telecom sector. It would, however, be fallacious to let the pendulum swing to the other extreme and look upon mere privatisation as the panacea for all the woes afflicting the telecom sector in India.

The confining of all activities related to telecom in the hands of Government Departments did bring about considerable co-ordinated development. These, however, pale into insignificance if we compare our position internationally, both in terms of quantity and quality.

Such an argument chooses to conveniently ignore certain simple facts based on the telecom development experiences of some other countries of the world. The privilege of occupying the two top positions in telephone density belongs to Sweden and Switzerland and in both these countries, telecoms have developed essentially as state departmental undertakings. USA, where telecom services have since the beginning been in private hands, does not enjoy such a position, despite being one of the richest nations of the world. On top of it, the US Government had to intervene to get the telecom services extended to the rural areas. Philippines is another country where telecom services have been provided by the private sector. The unhappy results include a multiplicity of services, 85% of the lines concentrated in the capital and one of the lowest telephone densities among ASEAN countries. In the case of Mexico, the Government had to impose a fine of

$ 19.2 million on Telemexo, the private company that took over Mexico's telephones for non-fulfillment of stipulated targets within the prescribed time-span.

The experience of Mexico clearly indicates the need for extra care on the part of the TRAI, as and when it is formed. Conditions of licensing have to be carefully considered and penalty clauses included and effectively imposed whenever necessary. Further, it has to be remembered that the purpose of liberalisation and privatisation is to instill the spur of competition to the sector to make it diversify and improve quantitatively and qualitatively. If privatisation of the telecom sector merely results in the replacement of a state monopoly by a private one, it will not bring any benefit to the consumer. TRAI has thus to ensure that the dominant producer does not abuse his monopoly power to charge high prices or prevent new entrants by indulging in predatory pricing. Special care has also to be taken to see that the dominant supplier does not thwart competition by refusing to inter-connect a new entrant to an existing network. Considerable objectivity is also called for on the part of the TRAI in arbitration and conflict resolution particularly in the context of inter-connection of private/rural telecom with DoT/MTNL/VSNL networks. A good deal of co-ordination is also called for to ensure smooth functioning in a given area, since as per the present policy, more than one service provider may function in a given area in India.

If privatisation of the telecom sector merely results in the replacement of a state monopoly by a private one, it will not bring any benefit to the consumer.

Our performance on these fronts is, however, far from praiseworthy, particularly in our dealings with multinational corporations (MNCs). The Enron Power Project in Maharashtra seems to be a shining example of how not to negotiate with an MNC. The Pepsi story is a glaring instance of our inability and/or unwillingness to impose penalty and other clauses in an agreement with an MNC. In the telecom sector, tender conditions, imposed possibly with a view to ensuring quality service, which usually stems from experience in running a telecom network, force collaboration of local producers with the MNCs. In view of their greater experience in the field, and considerable share in equity, the MNCs are likely to have a large say not only in the running of the collaborating Indian company but also even in the conditions of licensing. Two instances of this kind got highlighted in the recent five-day strike by telecom workers. Firstly, the the original tender terms stated that half the uncovered villages in each circle will have to be shared by the DoT and the operator, whereas in the amended terms, the latter's obligation got reduced to just 10%. Secondly, the access charges have been reduced considerably for the bidding involving a loss, according to some, of thousands of crores of rupees to DoT, as a result of lobbying and with no reference to TRAI being set up.

The mere provision of finance, will be no substitute for proper and effective management and regulation overcome impediments.

As a result of all this, strong doubts exist about the success of raising Rs. 70,000 crores as a result of liberalisation and privatisation in the telecom sector. Most people agree that lack of finance has been the most important obstacle in the way of expanding, modernising and improving the quality of telecom services in India. In fact, NTP categorically mentions a resource gap of Rs. 23,000 crores in the Rs. 90,000 crores of investment required to fulfil the demand for telephones generated by liberalisation.[8] There is, of course, another view that it is not finance, which has constrained proper development of the telecom sector in India. This is contained in the VI report of the Standing Committee on Communication of the Xth Lok Sabha. According to this report, the major reasons for the lack of adequate development of telecom in India have been the lack of co-ordination with the state and civil authority, hold-ups due to inability to procure equipment on time and lack of supervision and monitoring of such projects. Such impediments will continue to loom large in the telecom scenario in a liberalised set-up with more than one service-provider in each circle. The mere provision of finance, however considerable the amount is, will be no substitute for proper and effective management and regulation to overcome these impediments. The argument that the MNCs will help upgrade technology also needs to be taken with a pinch of salt. Firstly, one wonders whether the MNCs will deem it necessary to bring in their latest technologies to India. Nor are they likely to contribute to R and D to promote

8. It has to be noted that a reduction in the financial requirements is possible if an increase in the capacity utilisation of the DoT exchanges takes place. Similarly, there can be an increase in the finances of the DoT, if there is a level playing field for the DoT in comparison to the Railways, in terms of non-inclusion of non-profit making lines in the calculation and also if the rate of dividend is reduced from 10% to 7% of capital used, as is being done in the case of railways.

the development of Indigenous technology, either directly or through contributing such funds to DoT, whose funding for this purpose from Government sources may not continue to be the same extent as before in this liberalised set-up and with a major crunch in resources. Further, the concentration of recent tender bids to category A and B circles does not augur well for the development for telecom in the less developed regions with less potential for telecom revenue, defeating one of the avowed goals of our NTP.

Main Findings

As a result of the rapid changes in technology in the fields of micro-electronics, software and fibre optics, telecom in modern world means much more than POTS. Besides the basic national and international telephone facility provided by the POTS, it involves innumerable VANS. As a result, some die-hards still hold the pre-'60 view that telecom is a useless toy for conspicuous consumption mainly by the spoilt nouveau riche. However, considerable evidence can, in fact, be produced to substantiate the view that telecom is an essential infrastructure for economic development and hence for the improvement of the quality of human life.

With the whirlwind of liberalisation and globalisation sweeping most countries, including India, off their feet, it is not surprising to attribute the strange telecom scenario of excess production capacity co-existing with considerable excess demand, to the exclusive domination of the field by the Government till recently. The review here of the telecom policy in India over time indicates that the pendulum is swinging slowly to the other extreme. The findings here, on the basis of international telecom development experience and at least a few not so happy lessons in dealing with MNCs in India, sound a note of caution on this count. Unless the proposed TRAI is formed soon and it evolves appropriate measures and enforces them effectively, there are doubts as to whether the NTP will result in telecom spreading to the remotest corners of India and providing modernised quality service in adequate quantity to our country's ever-increasing number of people in need of telecom.

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Urban Growth & Infrastructural Development in India

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Major urban growth in India has taken place in Class I towns but the provision of basic urban infrastructure—viz., water, electricity and sanitation—has fallen woefully short of the target. The author recommends a concerted effort by public-private joint ventures to fill the yawning gap between the supply and demand of basic infrastructural facilities.

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Since the Third Five Year Plan (1961-65) period, the Indian government aimed at the decentralisation of growth and development away from the four largest cities, viz., Delhi, Bombay, Calcutta and Madras. This policy gave impetus to the emergence of medium-size cities having more than one-million population (million-cities). However, though such 'million-cities' in India might have detracted some of the migrants from not going to the largest cities, the former do not have adequate 'shelter', 'employment opportunities' and 'infrastructure' to cater to the needs of their migrants. As most human beings are capable of designing their own survival strategies, most economically depressed urban residents in the 'million-cities' in India meet their shelter needs in squatters and slums. Their earning in both the formal and informal sector of the urban economy is too little to enable them to even think of basic urban services. They mainly depend upon the provisions of the state urban development agencies for public utilities such as tap-water, electricity, sanitation and sewerage, street light, roads in residential areas and solid waste collection and disposal, which could be referred to as basic urban infrastructure and/or basic urban services.

The short supply of urban infrastructure in Third World cities is by and large a function of the increasing population growth, the widening gap in the distribution of urban income and an increasing reliance on the public sector to meet the rising demands on urban infrastructure. Some of the urban infrastructure such as drinking water, electricity and sanitation are marginally available in both rural and urban areas in the Third World. We occasionally come across remarks that 'in 1980, over half of the peoples of the Third World had no safe drinking water to drink. Three-quarters had no sanitation at all—not even a simple bucket latrine. ...At least 100 million more Third World people are drinking dirty water today than in 1975. And 400 million more than in 1975 have no sanitation. Diarrhoea, often caused by bad water, kills

25 million people in the Third World annually. Some 16,000 children die every day' (Agarwal; et al, 1981: 1). Considering this plight the United Nations launched massive schemes in various Third World nations and formally declared the previous decade as "International Drinking Water Supply and Sanitation Decade (1981-90)" with a target to provide 'Clean Water and Adequate Sanitation for All by 1990'. The decade of Water and Sanitation has passed by nearly five years ago and still 'nearly one billion people in the developing world are without access to clean water for drinking, and 1.7 billion must contend with inadequate sanitation conditions' (Briscoe, 1992: 16). Furthermore, about '25% to 30% of urban residents in Latin America, Africa and the Middle East lack access to drinking water. More than 33% of urban residents in Asia and the Caribbean are not served. Only 25% to 55% of the waste generated in large cities is collected by municipal authorities, and often no refuse disposal service is provided to slums and squatter settlements' (IRC, 1995). World Development Report 1994 – Infrastructure – reviewed the infrastructure developments that have taken place during the last decade in the Third World. It is evident from the Report that almost none of the Third World countries have been able to attain 'Clean Water and Sanitation' for all of their residents by 1990. Even in countries like Indonesia, Nigeria and Kenya only 34%, 42% and 49% of their total population respectively had access to safe drinking water in 1990. These countries did make a progress over the 1980s, but could not achieve hundred percent success. The story of achievements in the infrastructure sector is not much different in the Indian context either.

The short supply of urban infrastructure in Third World cities is a function of the increasing population growth, the widening gap in the distribution of urban income and an increasing reliance on the public sector to meet the rising demands on urban infrastructure.

Urban Growth in India

It is evident from the available literature on Indian urbanisation that the growth rates of India's urban population have for many decades been greater than the growth rates of the country's total population (Bose, 1978; Rajan, 1986; Nath, 1991; Singh, 1988). The average annual urban population growth rate in 1961-71 was 3.2% and increased to 3.8% in 1971-81. However, in 1981-91 it decreased to 3.1%, but similarly the average annual rate of growth of India's total population also decreased to less than 2.2%.

Table 1: Urbanisation Levels in the Selected Indian States in 1991

States with Metros.	As per the 1991 Census		As revised after excluding Metors and Class I towns			
	Proportion of urban population (p.) to the total (p.)	Rank	Propotion of Urban p. to total p. excluding Metros	Rank	Proportion of urban p. to total p. excluding Class I towns	Rank
Andhra Pradesh	.27	5	.20	6	.12	5
Bihar	.13	9	.12	9	.07	8
Gujarat	.34	2	.23	3	.15	2
Karnataka	.31	3	.24	2	.14	3
Kerala	.26	6	.23	3	.11	6
M.P.	.23	7	.21	5	.13	4
Maharashtra	.39	1	.22	4	.12	5
Punjab	.30	4	.26	1	.16	1
Rajasthan	.23	.7	.20	6	.13	4
Tamil Nadu	.34	3	.24	2	.15	2
U.P.	.20	8	.17	7	.10	7
West Bengal	.27	5	.14	8	.06	9
India	.26	–	.19	–	.11	–

Source : Cited in Misra et al (1995).

The growth rates of India's urban population have for many decades been greater than the growth rates of the country's total population.

The proportion of urban population to total population in India in 1951 was 17% and increased to 20% in 1971 and 26% in 1991. With so much urban population India emerges as the second largest urbanised country in South Asia i.e., after Pakistan. But, in terms of absolute numbers, India ranks on top among South Asian countries with its 217 million persons in 1991. Among the major states[1] in India Maharashtra ranks first and Bihar ranks at the bottom in respect of 1991 urban population. Although Maharashtra ranks first at face value, when we take out the metro-population city, its rank comes down to number four. Further, it loses its ranking and goes to number five, when we take out Class I towns (table 1). In this process of discounting/re-classification of States where we take out Metros and Class I towns, it is interesting to note that Maharashtra lost its top ranking in urbanisation and was replaced by Punjab followed Tamil Nadu and Gujarat. It can be inferred that the major urban growth is taking place at an exceeding rate in Class I towns and million-cities in India (Mishra et al., Forthcoming). We shall analyse the changes that have taken place in the structuring of Class I towns and Million plus cities.

It is apparent from table 2 that the proportion of Class I towns has increased from 45% to 65% between 1951 and 1991 which is more than the increase observed in the case of Class II towns, as the latter increased from 10 to 11% during the last four decades. Unfortunately, other size classes could not do well. This indicates that somehow the Class I towns in India have been growing at the cost of small and intermediate towns which clearly shows the 'overgrowth' of Class I towns. It seems probable that under the given urban development policies in India, it is unlikely that smaller towns (Class size VI & V) will be able to attain the status of Class II or Class I towns. In an interesting study of 1981-1991 Indian urbanisation, Mishra et al. (Forthcoming), using 'Class Progression Ratio' for their analysis, revealed that the probability of movement of Class VI or V towns to higher size class towns (e.g., VI to V, V to IV or III) is always higher. But, it is less probable that these smaller size class towns will ever reach the status of Class I or II towns.

On the contrary, the probability of Class II towns becoming Class I town is always higher. This is mainly because when Class III towns move to II or from II to I, the required population for the former is about 30,000, while it is 50,000 for the latter. In contrast, movement from class VI to V or V to IV or even IV to III requires 10,000, 5,000 or even less than 5,000 persons respectively (Mishra et al., Forthcoming).

It is obvious from the structure of the Indian urbanisation that the urban growth in India is largely concentrated in a few towns – mainly Class I towns. However, if we examine the growth of cities which have more than one million population ('million-cities'), though they belong to Class I towns, we find that, in 1991, 51% of the population of Class I towns lived in just 23- million-cities in India. Furthermore, among the 23-million-cities the four largest metropolis – Delhi, Bombay, Calcutta and Madras – shared 53% of the total population (70.7 million) of 23-million cities in 1991. This indicates the hierarchical dominance of some cities or towns in the structure of Indian urbanisation. The 23-million-cities also covered a considerable amount of India's urban population. In 1991,

Table 2: Percentage Distribution of Urban Population by Urban Size-class Units in India, 1951-91

Size-class (Population)	1951	1961	1971	1981	1991
I – (100000 and above)	44.63	51.42	57.24	60.42	65.20
II – (50000 - 99999)	9.96	11.25	10.92	11.63	10.95
III – (20000 - 49999)	15.72	16.92	16.01	14.33	13.19
IV – (10000 - 19999)	13.63	12.77	10.94	9.54	7.77
V – (5000 - 9999)	12.97	6.87	4.45	3.58	2.60
VI – (Less than 5000)	3.09	0.77	0.44	0.50	0.29
All Sizes	100.00	100.00	100.00	100.00	100.00

Source : Census of India 1991, Series-1, Paper 2 of 1991, Provisional Population Totals: Rural-Urban Distribution. (Also cited in Amitabh, 1994).

1. 'Major' states are those which have 10 million or more population. There were 15 'major' states in India in 1991.

these cities accounted for 33% of the country's urban population and 8% of the country's total population. Further, we note from table 3 that the number of million-cities in India have increased from 5 in 1951 to 23 in 1991. Such a 'proliferation of million-cities in India since 1951 demonstrates that urban development in the country has not been diversified regionally, but mainly to certain specified cities which have locational, administrative and economic advantages. It is the growth of population in already existing towns and cities which contributes most to the demographic and territorial expansions of towns and cities in India' (Amitabh, 1994:41). Of the top twelve-million cities, the decadal population growth during 1981-1991 in Calcutta, Delhi, Madras, Ahmedabad, Bangalore and Nagpur has declined, whereas Hyderabad followed by Greater Bombay and Lucknow registered a phenomenal population growth during the last decade i.e., 68%, 63% and 53% respectively. Further, among the 1970s million-cities, the decadal population growth in Bangalore was the highest (76%) followed by Delhi (46%) (table 4). But, the population growth in these two cities declined during the 1980s which suggests that there has been some diversification in respect of population growth in bigger cities. This is further evident from the fact that among the 1980s million-cities the newcomers accounted for more decadal population growth during 1981-1991 decade than most of the old 12-million cities. Among the 23-million-cities, Vishakhapatnam registered the highest decadal

Table 3: Population in Million-cities of India (in millions)

Sl.No.	Million-cities	Urban Status	1951	1961	1971	1981	1991
1	Calcutta	U.A.	4.67	5.98	7.42	9.19	10.92
2	Gr. Bombay	U.A.	2.97	4.15	5.97	8.24	12.57
3	Delhi	U.A.	1.44	2.36	3.65	5.73	8.38
4	Madras	U.A.	1.54	1.94	3.17	4.29	5.36
5	Hyderabad	U.A.	1.13	1.25	1.80	2.55	4.28
6	Ahmedabad	U.A.	0.88	1.21	1.75	2.55	3.30
7	Bangalore	U.A.	0.79	1.21	1.66	2.92	4.09
8	Kanpur	U.A.	0.71	0.97	1.28	1.64	2.11
9	Pune	U.A.	0.61	0.79	1.14	1.69	2.49
10	Nagpur	U.A.	0.49	0.69	0.93	1.30	1.66
11	Lucknow	U.A.	0.50	0.66	0.81	1.01	1.64
12	Jaipur	U.A.	0.30	0.41	0.64	1.02	1.51
13	Surat	U.A.	0.24	0.32	0.49	0.91	1.52
14	Coimbatore	U.A.	0.29	0.45	0.74	0.92	1.14
15	Vadodara	U.A.	0.21	0.31	0.47	0.75	1.12
16	Indore	U.A.	0.31	0.39	0.56	0.83	1.10
17	Patna	U.A.	0.33	0.41	0.55	0.92	1.10
18	Madurai	U.A.	0.37	0.49	0.71	0.91	1.09
19	Bhopal	M.C.	0.10	0.22	0.38	0.67	1.06
20	Varanasi	U.A.	0.37	0.51	0.64	0.80	1.03
21	Vishakhapatnam	U.A.	0.11	0.21	0.36	0.60	1.05
22	Kochi	U.A.	0.18	0.29	0.51	0.69	1.14
23	Ludhiyana	M.C.	0.15	0.24	0.40	0.61	1.01
Total Population of Million-cities			11.74	18.10	27.83	42.12	70.67
% of Million cities population to the country's urban population			18.97	22.85	25.58	26.37	32.57
% of Million cities population to the country's total population			3.29	4.15	5.09	6.15	8.37

Source: Census of India, Series-1, Paper-2 of 1991, Provisional Population Totals: Rural – Urban Distribution. (Also cited in Amitabh, 1994).
U.A. = Urban Agglomeration; M.C. = Municipal Corporation

Table 4: Percentage decadal population growth in million-cities in India

Sl. No.	Million-Cities	1951-61	1961-71	1971-81	1981-91
1	Calcutta	28.14	24.02	23.85	18.82
2	Gr. Bombay	39.95	43.80	38.06	52.49
3	Delhi	64.16	54.60	57.09	46.27
4	Madras	26.07	63.01	35.34	24.97
5	Hyderabad	10.53	43.80	41.76	68.11
6	Ahmedabad	37.51	45.27	45.43	29.51
7	Bangalore	53.49	37.87	75.60	39.97
8	Kanpur	37.73	31.31	28.55	28.74
9	Pune	29.92	43.54	48.55	47.69
10	Nagpur	42.21	34.78	40.00	27.50
11	Lucknow	31.95	24.15	23.85	62.70
12	Jaipur	34.83	55.18	59.42	48.77
13	Surat	33.80	55.28	84.58	67.03
14	Coimbatore	55.93	64.33	24.97	23.91
15	Vadodara	46.50	50.92	60.46	49.33
16	Indore	27.02	42.04	47.98	32.53
17	Patna	27.18	32.88	66.91	19.57
18	Madurai	32.42	44.94	27.90	19.78
19	Bhopal	117.93	72.62	74.09	58.21
20	Varanasi	37.49	25.53	25.96	28.75
21	Vishakhapatnam	95.55	72.10	65.08	75.00
22	Kochi	64.94	73.16	36.42	65.22
23	Ludhiyana	58.66	64.42	52.05	65.57

Source : Census of India, Series-1, Paper-2 of 1991, Provisional Population Totals: Rural-Urban Distribution. (Also cited in Amitabh, 1994).

population growth in the 1981-1991 decade, followed by Hyderabad (68%), Ludhiyana(66%), Kochi (65%) and Lucknow (63%) (table 4). Although the diversification of population growth seems to be evident between bigger towns in India, it does not mean that the urban problems such as of housing, employment and infrastructure would be less important in the mega-cities such as Delhi, Bombay, Calcutta and Madras or in the growing-metropolis such as Vishakhapatnam, Hyderabad, Ludhiyana, Kochi and Lucknow. At this point, it seems appropriate to give more attention to the upcoming urban problems of growing metropolis than exclusively addressing the problems of the four mega-cities in India. It is surprising to note that Lucknow City housed more than 39% of its total population in slums in 1981 which was the second highest slum population after Kanpur. Grater Bombay comes on the third place.[2]

A study was attempted on the availability of infrastructure facilities in Lucknow City such as tap-water, electricity, sewerage, street light, link-roads and sanitation in 14 selected peripheral urban residential areas. The data for this study were collected in 1990/1991 by the first author when he conducted a 521-households-survey in Lucknow City (Amitabh, 1994). The main purpose of that survey was to collect household data on urban land prices and other housing related variables.[3]

Basic Urban Infrastructure Conditions in India: Past & Present

Since the early 1980s, the urban infrastructure sector gained increasing attention of policy makers in India, and at the same time it became an interesting area of research for various scholars because of the investments made or promised on different elements. (Agarwal et al., 1981; NIUA, 1986, NIUA, 1988; Mathur, 1990 & 1994; Sharma, 1993; Kundu, 1993; Paul, 1993). Geared by the UN's declaration of 1981-1990 as a decade of Drinking Water Supply and Sanitation, India launched a country-wide rural drinking water scheme under the banner of 'Rajiv Gandhi National Drinking Water Mission'. The aim was to cover as many villages as possible within the reach of drinking water sources provided by the government.[4] However, it is evident from various studies that the quantity of urban services has not much improved in both rural and urban areas. The focus of most policies on the provision of basic urban services, whether that was implemented by the Central Government or by municipal governments, was to increase the quantity of provision than paying attention to the quality, standard and utility of the services provided. One off-hand example could be the location of a hand-pump for village residents or for squatters. In most cases, residents have to walk a long distance to reach the source of water provided by the government which eventually develops a sense of frustration among the users and finally the source of water becomes unused or vandalised. Maintenance and management of such basic urban infrastructure by the state are almost missing in most schemes. Lack of attention from the existing institutional arrangements is partly

2. For more details see, Handbook of Housing Statistics (1982-1983), NBO, Delhi.

3. For a detailed methodology of the survey conducted and the data collected see, Amitabh, 1994.

4. As there were some discrepancies in the reporting of the villages covered under the scheme, the Indian government gave the task of re-enumerating the villages covered or not by a drinking water source to various institutions in India. For details see, Pushpangadan, K. et. al. (1995).

responsible for inadequate and unmatched supply of basic urban Infrastructure to the real needs of urban or rural residents. The World Bank (1994) rightly indicates the core of the problem when it passes on the 'main message' of its Development Report, 1994.

The focus of most policies on the provision of basic urban services, was to increase the quantity of provision than paying attention to the quality, standard and utility of the services provided.

'The causes of past poor performance, and the source of improved performance, lie in the incentives facing providers. To ensure efficient, responsive delivery of infrastructure services, incentives need to be changed through the application of three instruments – commercial management, competition and stakeholder involvement. The roles of government and the private sector must be transformed as well. Technological innovation and experiments with alternative ways of providing infrastructure in future indicate the following principles for reform. (i) Manage infrastructure like a business, not a bureaucracy. (ii) Introduce competition. (iii) Give users and other stakeholders a strong voice and responsibility. (iv) Public-private partnership in financing have promise. (v) Governments will have a continuing, if changed, role in infrastructure' (World Bank, 1994:2).

The major responsibility of providing basic urban infrastructure in a Third World country lies with public sector institutions. However, these institutions do not always have strong financial basis to provide the basic urban services demanded; and to continue the maintenance of these services, if provided. It is even difficult for municipal bodies to meet the demand from residents of those areas of a city which are old, already built-up and congested. In such a situation, augmentation and provision of 'basic urban services in the rapidly growing fringe areas call for lump investments that are beyond the means of local bodies' in India (Mathur, 1994: 18).

Drinking Water Supply Conditions in Urban India

Availability of water is a basic necessity for the survival of human beings in both rural and urban areas. However, the provision of water for daily use is always not to the tune of the demand. Over the last three decades, India has been able to provide access to drinking water to more and more of its population. In 1970, only 17% of the population in the country had access to drinking water. But, by the World Bank estimates, the coverage of population under safe drinking water in India has gone up by more than four times in 1990 (73%) (table 5). Between 1980 and 1990 much progress has been achieved in rural areas than in urban areas. In 1990, 86% of the urban population in the country and 69% of the rural population had access to safe drinking water. This, indirectly indicates that much of the focus during the 1980s – the International Drinking Water Supply and Sanitation Decade – has been on providing safe drinking water to the rural population than to the urban population in India. When we look at the 1991 Indian Census data, we note that only 62% of the total population has access to safe drinking water by 1991. (The figures provided by the World Bank and the Indian Census do not match, but we do not have means to find out the reasons behind such a discrepancy.) Considering the Indian Census data of 1991, we also note that among the states, Punjab ranked on top in providing access to drinking water to its population (93%), followed by West Bengal (82%), Haryana (74%), Karanataka (72%) and Gujarat (70%). Kerala has done very badly, as only 19% of its total population had access to drinking water by the year 1991 (table 6). It is, thus, apparent that the target set by the UN to provide drinking water for all by 1990 has not been reached by the Indians. We do not have enough data to show the quality of such achievements among the Indian states which we have just observed. But, it is evident from various studies that though drinking water sources may appear to be satisfactory in terms of their numbers, the real utility and functioning of such provisions are in doubt in many cases. The NIUA (1988) survey showed that as many as 31% of the sample households had to walk between 50 to 100 feet to collect the water for their daily requirement. 'During the field survey in Ahmedabad, it was observed that in the eastern part of the city – which has been recently included in the municipal corporation – the poor had to walk more than half a kilometre to get one bucket of water from the roadside taps where the water supply system is very erratic and is available only for a short period of time. In Delhi, 37% of the population surveyed identified the water source

Table 5: Access of Safe Drinking Water and Sanitation in India (% of population)

	Total			Urban		Rural	
	1970	1980	1990	1980	1990	1980	1990
Access of safe drinking water	17	42	73	77	86	31	69
Access to sanitation	18	7	14	27	44	1	3

Source : World Development Report, 1994, Table A.2, p-146.

Table 6: Percentage of Households with Different Public Utilities in Some Selected States in India, 1991.

States	Toilet facility, 1991	Electricity, 1991	Safe drinking water, 1991
Andhra Pradesh	54.60	46.30	55.08
Bihar	56.54	42.57	58.76
Gujarat	55.71	65.93	69.78
Haryana	64.25	**70.35**	**74.32**
Karnataka	62.52	52.47	71.68
Kerala	**72.66**	48.43	**18.89**
Madhya Pradesh	53.00	43.30	53.41
Maharashtra	64.45	40.65	68.49
Orissa	**49.27**	**17.75**	**39.07**
Punjab	73.23	60.90	**92.74**
Rajasthan	62.27	20.54	58.96
Tamil Nadu	57.47	37.21	67.42
Uttar Pradesh	66.54	**12.91**	62.24
West Bengal	**78.75**	21.09	**81.98**
INDIA	**63.85**	42.37	62.30

Source : Census of India, 1991.

being away from their houses as the major difficulty in getting water. Another important factor affecting the access of the poor to water is low pressure and short duration of supply in public stand posts. They have to wait in long queues for their turn and in Delhi more than 80% of the people surveyed complained of this' (Kundu, 1993: 247-248).

Though drinking water sources may appear to be satisfactory in terms of their numbers, the real utility and functioning of such provisions are in doubt in many cases.

Wide gaps are also observed in the supply and demand of drinking water in million-cities too, where the household consumption of water is on the higher side than rural households. As the supply of water is limited in many cities in India, we face rationing of water which is enforced by public sector institutions such as Water Corporation (*Jal Nigam*). Such a rationing of water would vary according to the geographic location and size of a city. However, the demand for daily-use-water in million cities is too high to outstrip the supply. For instance, in Delhi, the demand supply gap stands at 695 mld in 1993. Further, about 87% of the total water requirement of the city is met by the river Yamuna, while the rest (13%) is met by the ground-sources. Almost similar demand-supply gap for water supply has been noted for other cities—Bombay, Ahmedabad and Vadodara (Sharma, 1993:5).

A major characteristic of water crisis in Indian cities (rural areas too) is that urban residents do not always rely on the public water supply systems mainly because tap water is not available or if available, the supply is highly erratic and limited; greatly unreliable. This calls for some alternative arrangements to meet the demand for water by urban households. When we look at people's access to major sources of drinking water in Urban India in 1986-87, we note that 71% of the urban population in India access water from government agencies, 25% gets water through individual and private efforts while community and charitable institutions' water sources cover only 3.3% of population. This clearly implies the inadequacy of the public water supply system in India (Kundu, 1983:202). In this respect, it is a common sight to find hand-pumps and boreholes attached with an electric motor set in U.P. And, most households in Kerala have their own water-supply arrangements by digging a well at their house-site. In a study undertaken in Jamshedpur (Bihar) in 1991, it is revealed that ' despite the existence of a piped water system, at least 17 percent of the population meets 90% of its water needs from wells and handpumps' (World Bank, 1994:30). Further, in Bangalore city, of a total sample of 807 households, 28% households had sumps, 48% had overhead tanks, 33% were using water pumps and 9% households were relying on their boreholes (Paul, 1993: 2903). Not only this, it is distressing to note the prevailing situtation in the 1980s. As Kundu (1993) writes, in 1981 38% of the 3,790 towns (of which data are available) in the country, did not have taps while 17% did not have either taps or a tubewell. This suggests that a considerable number of urban residents has to fall back for drinking water upon sources that are neither reliable nor hygienic. Another important point noticeable from the town-level data is that the percentage of towns not covered is inversely related to the size class of towns. While 18% of Class I towns are not covered by tap water, the figure is as high as 19% for Class II, 30% for Class III and 46% for the other classes of towns (Kundu, 1993; 198-201).

India is not the only country in the developing world which faces the crisis of safe-drinking water. This is a characteristic of most developing countries where some are relatively better off than others. If we compare, for instance, the access to safe drinking water for urban population in India, Kenya, Nigeria, Pakistan, Indonesia, Thailand and Sri Lanka, we would find that 77% of the Indian urban population in 1980 had access to safe drinking water, while it was 85% for Kenya, 60% for

Nigeria, 72% for Pakistan, 65% for Thailand and Sri Lanka and the lowest figures (35%) were noted for Indonesia. However, over a period of ten years, i.e., in 1990, these countries improved upon the provision of safe-drinking water to their urban residents. Indonesia is the only country where the 1980s' situation remained the same for the 1990s. Nigeria claimed to be providing its full urban population with safe drinking water in 1990.[5] India did improve in the 1990s, but it could provide only 86% of its urban population with safe drinking water, as mentioned earlier.

Availability of Electricity

The distribution of electricity generated in India among both rural and urban households is not very impressive. By the end of the year 1991 only 42% of total households in India had electricity. But the situation is quite grim when we look at the distribution of electricity by some selected states. There are six states in India-Maharashtra, Orissa, Rajasthan, Tamil Nadu, U.P. and West Bengal – where the percentages of households with electricity in their houses are lower than the national average (table 6). The performance of U.P. is very poor, as only 13% of its total households had electricity by 1991. Since it is very difficult to obtain data on electricity distribution and consumption, the available literature on urban services do not provide much in this regard.

Almost similar to the condition of water-supply in Indian cities, we have a crisis prone situation regarding the availability of electricity. The supply of electricity is very erratic in India; In addition, large-scale fluctuations in the supply and very low voltage are characteristics of electricity distribution. Such a lame system of electricity distribution in India encourages households to have alternative arrangements to meet their demand for electric-power. For instance, in 1993, 49% of the sampled households (807) in Bangalore city were using voltage stabilisers to avoid the fluctuations in the electricity supply (Paul, 1993: 2903). This is not only a characteristic of Indian cities, but of some other developing countries too. A study of Nigerian manufacturing industries reveals that of the selected 179 firms, 92% owned electricity generators (Lee and Alex, 1992). In Indonesia, 64% in a total 306 firms had gensets. In contrast, in Thailand where public supply of electricity is efficient, of 300 manufacturing industries only 6% had gensets (World Bank, 1994). In these cases, we mainly find that the demand for electricity overruns the supply.

We also find wastage of electricity, especially in terms of the revenue lost. It is a common sight to witness illegal electric connections acquired by urban 'poor' residents in most Indian cities by using a thick electric wire which is directly hooked on to a passing electric-mainline. Normally, in urban poor residential areas, residents hook-up the electric wire to the mainline by the evening and they would take it out by the dawn. In so doing, they are not caught by the Electricity Board inspectors (linemen), as the latter only visit during the day- time. However, in some cases, such illegal electric connections continue to be hooked on the mainline even during the day-time which is somehow made possible by corrupting the Electricity Board's personnel. It is not only dangerous to human life, it also shows the problems involved in the distribution of the electricity generated in India.

Sanitation Conditions in Urban India

Sanitation, as used in the housing literature is a vaguely defined term – it is difficult to segregate its various elements. Here we concentrate on sewerage, drainage facilities, collection and disposal of solid waste as part of sanitation. (Occasionally, the discussion might appear to be biased towards one element of sanitation than the other, but that would only happen in cases where we have limited data). Though sanitation is one of the important indicators of human health, it does not receive much attention in both rural and urban areas in India, unless plague strikes in a city as in Surat in late 1994. Even an epidemic does not create an atmosphere whereby sanitation becomes one of the priority areas of municipal governments. But, one could argue why make a hue and cry about sanitation in urban areas in India while they are better facilitated in this regard than rural areas. Quantitative data-wise, as seen in table 5, such an argument may be valid for a while. But, we must not forget that the rural environment is already cleaner than the urban environment. In addition, density of population and living conditions in urban areas are entirely different. Nonetheless, the coverage of residents under sanitation in Urban India has not achieved its target proposed for the 1980s. The target was '100% coverage by 1990 in cities with population over 100,000, and at least 50% in other cities. Sewer connections were proposed for every household in cities with population over 100,000 and safe, non-sewerage disposal facilities in other towns' (Agarwal et al., 1980:106). In a rhetoric sense, such targets deserve a mention, while in reality 1980s' efforts for sanitation stand far away from the target. The percentage of total population in India which had access to sanitation has dropped from 18% in 1970 to 14% in 1990 (table 5). It dropped considerably in 1980 when only 7% of the total population had access

5. For more details see, World Development Report, 1994, Table A.2, p. 146.

to sanitation. In the case of urban population, the coverage under sanitation in 1990 has gone up more than one and a half times than what it was in 1980.

Another interesting characteristic of sanitation in India is the limited availability of the underground sewerage system which is least polluting and most hygienic in respect of disposing sewerage and sullage water. As Kundu (1993:213) records in 1981, only 12% of the towns in the sixteen selected states in India had underground swerage system and, only a fraction of the population in such privileged towns is covered by this system. The towns not covered by this system largely depend on open surface drains which causes unhealthy environment. But in Class I cities most areas are better facilitated with underground sewerage system than many areas of other size-class towns. In 1981, the proportion of urban centres covered by an underground sewerage system in Class I towns was 41%, for Class II towns it was 19%, for Class III towns 14% and for other classes of towns only 8%.

The sanitation conditions in urban India in 1981 cannot be tallied with the 1991 figures, as we do not have complete information available for the latter. However, we have data on one element of sanitation for 1991. 64% of the total households in India had toilet facility in 1991 (table 6). This would indirectly mean that 36% of the households in India were defecating in open, public or private places. Regional variations are noted when we look at the state-wise distribution of toiled facility in 1991. Far more numbers of households in West Bengal had toilet facility in 1991 than Punjab and Kerala. Orissa is the only state in the selected states (table 6) where only 49% of total households had toilet facility in 1991.

Sanitation sector seems to be on the lowest priority in most Indian cities just because of the fact that other public utilities such as water, electricity and link roads are the basic requirements for a neighbourhood to begin with.

Sanitation sector seems to be on the lowest priority in most Indian cities just because of the fact and other public utilities such as water, electricity and link roads are the basic requirements for a neighbourhood to begin with. It is common to think, even among the local government system, that people would be able to manage somehow without sewerage system or without a solid waste collection and disposal system. Such a tendency prevails in the minds of both municipal governors and urban residents, whether poor or rich, on mainly three grounds.

(1) Some households build an aqua-privy (soakway-pit) to dispose of the night-soil, if they do not have access to sewerage system. This is a cleaner way of disposing of night-soil than the following ones. (2) Another group of households opt for service-latrine which is served by privately hired sweepers who take away the night- soil on their head and finally dump that in an open place from where it is supposed to be loaded in municipal trucks. We would not be discussing at this point about the efficiency of municipal governments in the collection of night-soil form the place where sweepers/scavengers dump it. In many down-town areas in Indian cities night-soil flows into open drains. There are people who have lived through such unhygienic environment for ages. (3) The last option is to defecate in open places. It is a common sight to see men and woman defecating in open areas such as near-by railway tracks during the early and evening hours of the day. One would believe that these types of people would be the 'urban poor'. The percentage of households without latrines in India is very high among the poor-60% (Kundu, 1993; 283). There is no law to penalise people defecating in open places – public or private.

When these many options are available to both urban poor and rich households, local governments place this element of sanitation at the lowest priority. As in the case of water and electricity, sanitation is another huge responsibility of municipal governments in Indian cities. However, municipal/local governments are mostly under financial distress to meet the demands. In addition, whatever be the basic urban services available in Third World cities, their maintenance is another expensive affair (Kirman, 1989; Grimes, 1982). Possibilities should be explored by developing a simple and efficient urban service system which could minimize the costs of such services and at the same time make the services affordable to many, especially the urban poor.

Basic Urban Infrastructure in Lucknow City

The following analysis of the availability of basic urban infrastructure in Lucknow city is based upon some secondary data of 1981 and 1983, and some primary data collected during the 1990/91 household survey, as mentioned earlier.

The responsibility of providing basic urban infrastructure in Lucknow city is shared by two major

state institutions. Lucknow Municipal Corporation looks after city-roads, drainage system, parks, street lighting and sanitation (cleaning and solid waste collection). Lucknow Jal Sansthan is responsible for the provision and maintenance of water-supply and sewerage system.

The main natural source, other than groundwater, for water supply in Lucknow city is the river Gomti. However, the supply of water from the river is constrained by several factors: the river remains almost dry for nearly six months every year; de-silting of channels which is done by machines costs a huge amount to the Corporation; and river is getting more polluted day-by-day. As the supply of water through the river system is not able to cope with the demand, nearly 64 government operated tubewells and 15 overhead tanks were working in various localities in Lucknow City in 1981 and about 70 million litres of water was supplied daily from these tubewells. In 1983, the water supply system was extended to nearly 60% of the city's total area (70 km sq.) which could only serve about 85% of the total city population. Further, about 230 million litres of water per day was supplied to water consumers in the city for domestic purposes against a demand of 290 mld. This implies that there was a shortage of 60 mld water per day in Lucknow city in 1983.[6]

1920 was the year the sewerage system was introduced in Lucknow City. But, it was only after the Independence that a comprehensive scheme was prepared. The implementation work on this scheme could only start in 1951, however by the year 1961 the work had to be stopped on account of financial constraints. By the year 1981, not more than 60% of the city area was connected to sewerage system. In those areas connected to main or trunk sewer lines, fault in the operation of the system was almost an everyday complaint. This was due to the old age of the sewer lines and very poor maintenance. The U.P. Water Corporation submitted a Sewerage Master Plan in 1981 to the government to extend the city's sewerage system, which was partly sanctioned by the year 1990. As the city has expanded horizontally to a considerable proportion in 1980s, the demand to provide more sewer lines in the southern and northern areas of the city is mounting pressure on the responsible institutions. Which are already under a financial crisis.

The city's drainage system to dispose of waste water and sullage is divided into two main sectors: Old Lucknow drainage system; and New Lucknow Drainage system. The sullage of both sectors is carried by deep-open drains which are about 60 km long. About 105% of the area in the city is covered by Open box drainage system. In contrast, open drainage systems are common sight in the downtown areas where one can clearly see human excreta blocking the flow of the waste water.

For the purposes of solid waste collection, in 1981, there were 3478 scavenging staff who were working for the whole city where they were supposedly collecting the solid wastes thrown along about the 1500 km of streets and paved lanes in the city. It was estimated that about 500 tonnes of solid waste was generated in the city everyday. The Lucknow Municipal Corporation (LMC) is frequently faced with strifes by the scavenging staff. In addition, the vehicles used for solid waste collection in the city are mostly in bad shape.

By the early 1980s, the LMC was maintaining nearly 23,000 street light points and it was proposed in 1983 to develop more than 1000 points for sodium lamps on the main traffic lines. But the street light conditions in the city were in a poor shape in the early 1990s, especially in some newly developing areas in the city.

In Lucknow city, three main agents were observed to be responsible for delivery of land and housing units to the people of varying income groups. During the survey in Lucknow city, households were first asked about the status of their vacant-plot at the time of plot purchase. The purpose of asking this question was to investigate which sector of land delivery in Lucknow city was supplying land for housing purposes with full or partial urban services. It is clear from Table 7 that there is a clear distinction in the vacant-plot status of households in the three land-delivery sectors in Lucknow. Of the total public sector households (164), 35% reported that at the time of purchase their plots had the status of 'urban land with full services'[7]. In contrast, only 6% of households in the private sector, and 1% in the cooperative sector, responded that their plots had 'full urban services' status at the time of plot purchase. Another interesting feature is that the agricultural land without provisions of basic urban infrastructure was sub-divided more by the private and cooperative sectors than the public sector. This clearly implies that the land sub-divided by the public sector has more propensity to be facilitated by basic urban infrastructure than the other two sectors, as we would see in the following analysis.

6. The sources for the hard data mentioned in the context of water, sanitation, electricity and other urban services are unpublished materials of the Lucknow Development Authority

7. In this paper 'full urban services' should be interpreted as the availability of electricity, tap water and roads in the colony, whereas 'Limited urban services' should be considered as the availability of one or two of these services.

The provision of the six most basic urban infrastructure – tap water, electricity, sewerage, link road, street lighting and refuse collection/ sanitation - for peripheral residential areas in Lucknow city in the three land and housing delivery sectors is given in table 8. This table is an outcome of the question: 'Which urban services were available in your colony when you purchased your plot and which services are available in your colony now (that is in 1990/91)?'

Table 7: Percentage of households by sectors according to the status of their plot at the time of plot purchase in Lucknow City 1990/91 (Household Survey Data).

Status of the plot at the time of purchase	Public Sector	Private	Cooperative Sector
Agricultural land	3 (1.8%)	60 (27.3%)	31 (22.6%)
Raw urban land	20 (12.2%)	33 (15.0%)	21 (15.3%)
Urban land without any services	44 (26.8%)	57 (25.9%)	38 (27.7%)
Urban land with limited services	40 (24.45)	57 (25.9%)	45 (32.9%)
Urban land with full services	57 (34.8%)	13 (5.9%)	2 (1.4%)
Total	164 (100%)	220 (100%)	137 (100%)

Source : Amitabh, 1994: 206.

At the time of plot purchase, 60% to 75% of public sector households were served by the six urban infrastructure available in their colonies. Further, by 1990/91, all public sector households had electricity and tap water available in their colony, and 90% to 98% of public sector households had access to the rest of the four urban services in their colony. However, the availability of sewer line as well as refuse collection system was not as pronounced as was the case with the availability of tap-water and electricity to public sector households. On the contrary, at the time of plot purchase, and in 1990/91 too, electricity was the only urban service that was widely distributed in the private and cooperative sector colonies. 72% of private sector households responded that electricity was available in the colony when they purchased the plot, while the percentage of cooperative sector households (66%) was less in this case. But, by the year 1990/91, all the selected households in both private and cooperative sectors had access to electricity. It is necessary to note that though the private and cooperative sector households are fully covered by electric-power supply the number of illegal connections obtained by some of the households in an important characteristic of such hundred percent coverage.

In the case of both private and cooperative sectors, the availability of tap water service is placed next to electricity. 42% of private sector households and 12% of cooperative sector households responded that tap water was available in their colonies when they purchased their plots. By 1990/91, only 56% households from the private sector and 28% households from the cooperative sectors respectively could report that tap water was available in their colony (table 8). This demonstrates that the tap water facility had improved for both private and cooperative sector households by 1990/91; though the coverage had not yet reached one hundred percent.

The availability of link roads and street lights in both private and cooperative sector settlements was improved between the times of plot purchase and 1990/91. But this improvement lagged behind the improvements that had been achieved in public sector developments over the same period. For instance, at the time of plot purchase 70% of public sector households had link roads and that increased to 98% in 1990/91, while for private sector households the coverage increased from 13% to 41% during the same period. Refuse collection/ sanitation and the provision of sewerage remain luxury services which are mainly available to the public sector settlements. In 1990/91, 89% of public sector households were enjoying the facility of refuse collection in their colonies, while only 13% households from both private and cooperative sectors had access to this urban infrastructure in their colonies. This implies that, in terms of refuse collection, public sector households had more than six times refuse collection facility than private and/or cooperative sectors. This story remains almost the same in case of the provision of street lights, where the bias towards public sector households is very much clear (table 8).

'One of the major implications of the differential availability of urban services in the colonies of the three sectors is that when plots are sold by the public sector they are sold with more urban services and a more urbanised status than is provided by the private and cooperative sectors. Further, within the private and cooperative sectors, basic urban services are available more widely in the private sector than in the cooperative sector. However, the gap in basic urban services between these two sectors is not as wide as the gap between the public sector and the other two sectors' (Amitabh, 1994: 206). Such a gap in the distribution of basic urban infastructure in the peripheral residential colonies in Luck-

Table 8: Availability of urban services in the colonies of the selected households by sectors of land delivery in Lucknow City (Household Survey Data, 1990/91)

Urban Services	Status of availability	Number of households whose colony had urban services at the time of plot purchase			Number of households whose colony had urban services in 1990/91		
		Public Sector	Private Sector	Cooperative Sector	Public Sector	Private Sector	Cooperative Sector
Tap Water	Available	121 (73.8%)	93 (42.3%)	17 (12.4%)	164 (100.0%)	122 (55.5%)	38 (27.7%)
	Not available	22 (13.4%)	125 (56.8%)	120 (87.6%)	0 (0.0%)	98 (44.5%)	99 (72.3%)
	Developing	21 (12.8%)	2 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)
Electricity	Available	125 (76.2%)	158 (71.8%)	91 (66.4%)	164 (100%)	220 (100%)	137 (100%)
	Not available	19 (11.6%)	60 (27.3%)	46 (33.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Developing	20 (12.2%)	2 (0.9%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)
Sewerage	Available	111 (67.7%)	18 (8.2%)	2 (1.5%)	153 (93.3%)	20 (9.1%)	2 (1.5%)
	Not avilable	32 (19.5%)	201 (91.4%)	134 (97.8%)	7 (4.3%)	198 (90.0%)	134 (97.8%)
	Developing	21 (12.8%)	1 (0.4%)	1 (0.7%)	4 (2.4%)	2 (0.9%)	1 (0.7%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)
Link Road	Available	114 (69.5%)	29 (13.2%)	11 (8.0%)	161 (98.2%)	89 (40.5%)	56 (40.9%)
	Not available	26 (15.9%)	155 (70.5%)	114 (83.2%)	1 (0.6%)	63 (28.6%)	31 (22.6%)
	Developing	24 (14.6%)	36 (16.3%)	12 (8.8%)	2 (1.2%)	68 (30.9%)	50 (36.5%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)
Street Light	Available	111 (67.7%)	74 (33.6%)	18 (13.1%)	159 (97.0%)	137 (62.3%)	60 (43.8%)
	Not available	25 (15.2%)	141 (64.1%)	117 (85.4%)	1 (0.6%)	72 (32.7%)	65 (47.5%)
	Developing	28 (17.1%)	5 (2.3%)	2 (1.5%)	4 (2.4%)	11 (5.0%)	12 (8.7%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)
Refuse Collection	Available	99 (60.4%)	21 (9.5%)	5 (3.7%)	145 (88.5%)	29 (13.2%)	19 (13.9%)
	Not available	38 (23.2%)	198 (90.0%)	131 (95.6%)	10 (6.1%)	185 (84.1%)	116 (84.7%)
	Developing	27 (16.4%)	1 (0.5%)	1 (0.7%)	9 (5.5%)	6 (2.7%)	2 (1.5%)
	Total Households	164 (100%)	220 (100%)	137 (100%)	164 (100%)	220 (100%)	137 (100%)

Source : Amitabh, 1994: 207

now city clearly indicates that public sector institutions' initiative are required to provide more basic urban infrastructure in private and cooperative sector colonies. However, the irony is that public sector institutions might be willing to provide the infrastructure among colonies developed by the private and cooperative sectors on the condition that these colonies could prove that they did not develop illegally. This is an increasing dispute between public sector institutions (responsible for the delivery of basic urban infrastructure) and the growing demands for urban services in private and cooperative sector colonies.

Public sector institutions' initiative are required to provide more basic urban infrastructure in private and cooperative sector colonies.

Conclusions

Major urban growth in India has taken place in Class I towns, especially in million-cities. Some of million-cities have grown at a much faster rate in the 1990s than their 1970s population growth. Lucknow city was one of such fast growing metropolis in India, as recorded in 1991.

While we focus on developing new townships in metropolitan cities in India which are largely under the control of public sector institutions and in some cases partly developed by public-private joint corporations, we must not forget that the development of such new townships/colonies would always be accompanied by areas which would have adjacent location to these privileged townships/colonies. This happens almost in every city in the Third World and could be termed as 'adjacent urbanisation' of areas that are located around the better served areas. People sub-divide land and build housing units in such areas which are peripheral to developed areas under the expectation that in the near future, government would eventually provide basic urban infrastructure in their areas. However, reaching 'the near future' depends upon who live in those areas. If it is the urban poor area or even middle class area, it is hardly possible that these people would get most of basic urban infrasturcutre in the near future. The aim should be to provide these urban residents with the basic urban infrastructure, at affordable prices.

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Cost Efficiency of Water Supply in Kerala

K. Pushpangadan & G. Murugan

Cost efficiency of water supply has been examined by the author from expenditure data. The fixed and variable costs adjusted for price rise show an increasing trend in the rural as well as the urban sector. The two most important factors that affect cost escalation—delays in commissioning of projects and inefficient use of inputs—are examined in detail. Time overrun is attributed to 'too many projects chasing too few resources'. Increased power consumption during eighties is attributed to inadequate maintenance of plant and machinery. Power has an inefficient usage of 52% more than required while that of chemicals is 237% more, states the author.

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Infrastructure development has been recognised as an important prerequisite for achieving rapid economic growth. Investments should be directed towards water supply and sanitation, roads, power, transport, telecommunication, education and health etc. for accelerating the overall development of the economy. One of the priority areas in this context which influences health and thereby the quality of life and economic activity is water supply and sanitation. Since the benefits from such investments are more social than private, private initiative is usually low in these sectors especially at the early stages of development. As a result, the provision of these services, with a few exceptions, has traditionally been the responsibility of the state. This role of government has become increasingly prominent only during the post-independence era in India, with more emphasis on the urban sector in the seventies and the rural sector in the eighties and ninties[1]. One of the decisions of the conferences held at Argentina in 1977 and India in 1990, was to provide potable water to the entire population by the year 2000. Public funds supplemented by borrowing and assistance from national and international agencies have been invested to achieve the above goal. Despite such huge investment in this infrastructure, questions of sustainability and efficiency of the sector have been relatively unexplored. Hence a study was attempted to assess the efficiency of financial outlays in the provision of water supply with particular reference to Kerala state.

Costs Vs Outputs

The nature and magnitude of investment for the provision of water are not the same for the rural and urban sectors. In the urban systems, usually private connections are envisaged over and above the street taps. These systems are meant for providing per capita water availability between 70 litres and 200 litres depending on the size of the city. On the contrary, in most of the rural

1. The International conferences held in Mar-del-platau, in Argentina (1977) and Global conference in New Delhi, India (1990) on drinking water and sanitation, were mainly responsible for this shift in emphasis.

systems private connections are not envisaged though demand exists. Moreover the per capita availability per day is limited to 40 to 70 litres. Thus the scale of production is usually higher in the urban sector than in the rural. Generally the technology of processing of raw water to potable standards is also different in the two systems. For example, the rural systems which are comparatively smaller in size exploiting ground water wherever feasible, generally do not use the standard processes of sedimentation, coagulation, etc. as is done in urban systems with surface water sources. This technology factor might contribute to a higher fixed cost for urban supplies. However, the scale effect, likely to be realised, would bring down the unit cost of production in the urban sector. Therefore, the efficiency should be analysed separately for the two systems.

For achieving the above objective one needs testable propositions on efficiency in water supply systems. In the case of piped systems this means efficiency in both production and distribution. Efficiency in production is satisfied if all the inputs are optimally utilised, while distribution efficiency is the minimisation of the losses during the transmission of treated water to the final consumers. In the absence of any firm estimate on such losses, we assume that it is negligible. Under this assumption, efficiency in production can be studied within the frame work of either production or its dual cost, in the theory of firm. This study follows the cost function approach.

Efficiency in production is satisfied if all the inputs are optimally utilised, while distribution efficiency is the minimisation of the losses during the transmission of treated water to the final consumers.

The Water Authority for the production of potable water and its distribution to final consumers incurs expenditure on the following inputs: chemicals, power, labour and durable assets such as plant and machinery, building, etc. The expenditure on these items and their breakups are published under two broad heads of accounts, plan and non-plan. The former is mainly on capital expenditure and the latter on operation and maintenance. Cost of production, in the short run, is equal to the sum of fixed cost and variable cost. Since consistent time series disaggregation is not possible from the available data, expenditure in constant prices under plan is taken as the proxy for fixed cost and non-plan expenditure as the variable cost. Two more problems are to be solved before analysing the data. First is the construction of appropriate deflators for expressing the expenditures in constant prices. Methods used for the construction of four deflators are given in the appendix[2]. Basically, it is the weighted average of the wholesale price indices of the major components in the fixed and variable cost. The second problem is the non-availability of published time series data on output for both systems. In the absence of such data, cumulative population coverage has been taken as a proxy for output[3]. Let us examine the temporal behaviour of these items in both sectors.

Capital Stock & Coverage: Rural vs Urban

In analysing the relationship between capital stock and coverage, the measurement of capital, despite all the theoretical difficulties, is very crucial. Capital, mainly of durable assets, has two dimensions; the stock existing at any moment of time and the flow of services from the stock per unit of time. In theory, production is related to services rather than the stock. Such an estimate of services from a stock of machines, plant and equipment, etc. is very arbitrary and requires very unrealistic assumptions. Therefore, the empiricist makes the assumption that this flow is directly proportional to stock and devises methods of estimation of the stock of capital ignoring the theoretical objections. One such empirical approach is the perpetual inventory method which is followed here also[4]. In order to apply this method one has to identify a benchmark year for which gross- net ratios (purchase value to book value) are available for all the capital components. This ratio can be applied to the book value of fixed capital for obtaining the gross value. For the urban sector, the year 1957 just after the formation of Kerala state has been taken as the benchmark year. The gross value of capital stock during 1957 is equal to the gross value of previous investment plus the capital expenditure in that year. But the gross value of previous investment is zero since the two already existing systems[5] have exceeded their life span. Therefore capital expenditure during 1957 is taken as the benchmark capital stock for the urban system. For the rural system, the benchmark year is taken as 1977 since coverage estimates are available systematically only from this year onwards. Plan

2. See A_1 and A_2 in appendix for the details.
3. See A_3 in appendix for the estimation of urban coverage. Since the water authority estimates on rural coverage fluctuates widely during the period, a smoothened series has been used. The details are given in appendix, A_4.
4. See Hashim and Dadi, 1973 for details.
5. The Wellington water works of Trivandrum commissioned during 1933 and the Cochin water supply system commissioned during 1927.

expenditures in constant prices have been cumulated till 1977 to obtain the benchmark capital stock without obtaining the gross value from book value and without adjusting for age structure of the plant and machinery. This is purely due to dearth of data. The capital stock in any year is then calculated for both the systems using the formula;

$$K_t = K_0 + \sum_{t=1}^{n} I_t$$

Where $I_t = C_t / D_t$

C_t is the capital expenditure in current prices in year t and K_0 is the capital stock in the benchmark year[6].

and D_t is the appropriate deflator in year t.

The relationship between the capital stock and population covered in the urban and rural areas is given in figures 1(a) and 1(b). Fig.1 (a) clearly indicates an increasing trend in the cost of coverage during the period, 1957/58 to 1991/92. It is interesting to note that the fixed cost in the urban sector follows more or less the conventional total cost function from 1957/58 to 1975/76 and repeats the same pattern, but less prominent, from 1975/76 to 1991/92. In other words the average cost of the urban system follows a 'U' shape in both periods with higher average cost in the second period. This could be because of the increased attention paid to the development of urban water supply systems in the seventies and the first half of the eighties. In the case of rural water supply, as shown in fig. 1(b), the cost in constant prices grows at an increasing rate during the period, 1977/78 to 1991/92. It neither indicates economies of scale nor cost reducing technical change during the period.

Data permit the comparison of two systems only from 1977/78 onwards. For this purpose the trend in the unit fixed cost of the two systems is given in fig. 2. As expected the unit cost is higher in the urban sector than in the rural. Furthermore, the difference in the unit capital cost between the two sectors is narrowing down over the period mainly due to the cost escalation in the rural sector.

The difference in the unit capital cost between the two sectors is narrowing down due to the cost escalation in the rural sector.

Having studied the nature of fixed cost, let us look at the temporal behaviour of the variable costs in both systems.

Variable Cost Per Unit of Output: Urban vs Rural.

By definition, variable cost is the cost associated with the variable inputs used for production. Here both production and cost are flow concepts. The variable cost is the sum of operation and maintenance expenses. Maintenance cost is treated as variable cost on the assumption that it is a prerequisite for keeping the system operational. However the major components of variable costs are different for urban

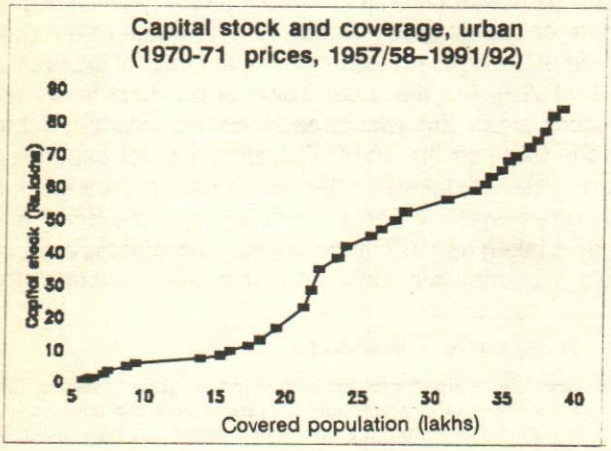

Fig. 1 (a). Urban

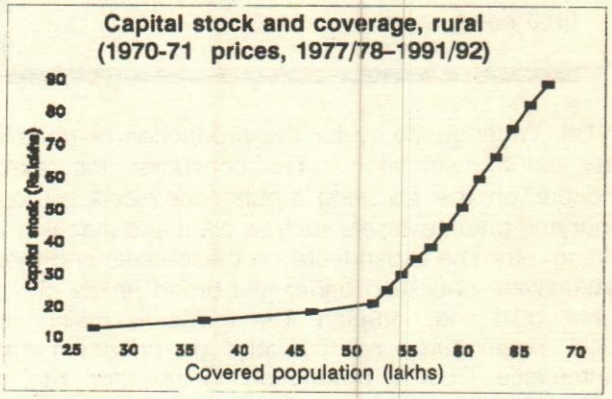

Fig. 1 (b). Rural

6. No depreciation allowance has been permitted, since the discarding date is unknown.

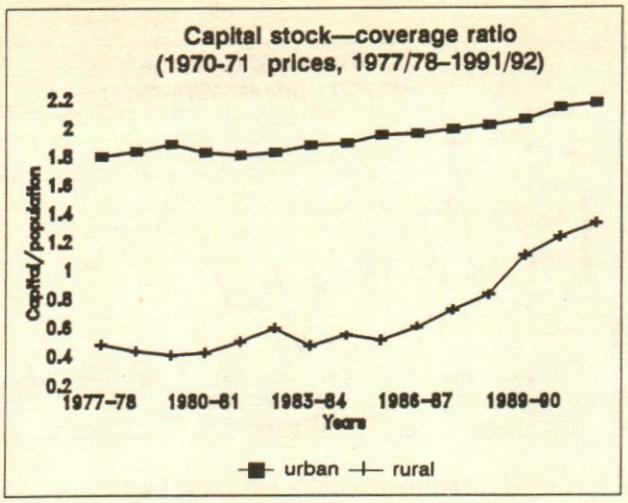

Fig. 2. Rural vs. Urban

and rural sectors. For example, the expenditure on chemicals for disinfection is mainly on bleaching powder in rural supply. In urban systems, it also includes Alumina ferric and lime. Because of these differences in the processing, the per unit input requirements of power, chemicals and labour are also higher in the urban systems. As a result, the maintenance cost is more in urban sector. Therefore the weights of the components are different in the deflators used[7]. The deflated variable cost per population covered for the two sectors is given in figure 3(a) and figure 3(b).

The unit variable cost in both sectors shows an increasing trend since 1977. However, per capita variable cost in urban sector remained stable during the initial years (1960/61 to 1975/76) and showed a steady increase henceforth. The stability during the initial years may be due to the constant input proportions leading to a constant marginal cost. The reasons for increase in cost both fixed and variable are as follows:

The most important factors that affect cost escalation are delays in project commissioning, cost-increasing technology, low growth in productivity, inefficiency due to excessive input use and incorrect input proportions among others[8]. Two factors are taken for detailed analysis, specifically delays in commissioning and inefficient use of input proportions.

The most important factors that affect cost escalation are delays in project commissioning, cost-increasing technology, low growth in productivity, inefficiency due to excessive input use and incorrect input proportions.

Analysis of the first issue, delays in commissioning, is based on our observations from field visits in connection with a recent survey all over the state. The survey team came across several incomplete rural and urban water supply projects which have already crossed the critical path of construction. Mostly due to lack of funds and in few cases because of administrative delays. In other words, too many projects are chasing too few resources. This in turn forms a vicious circle of time and cost overrun. Cost overrun can increase both nominal and real costs. While nominal increase in the cost is

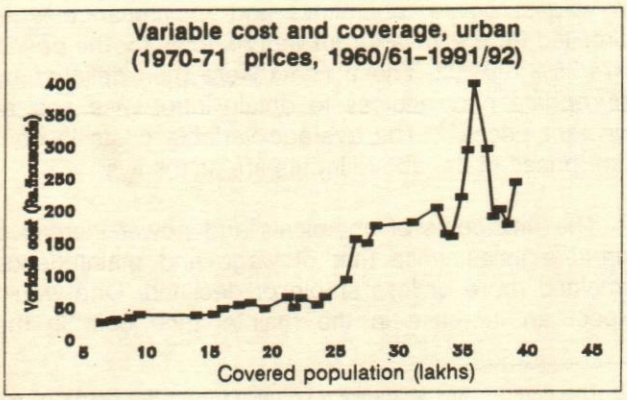

Fig. 3(a). Urban

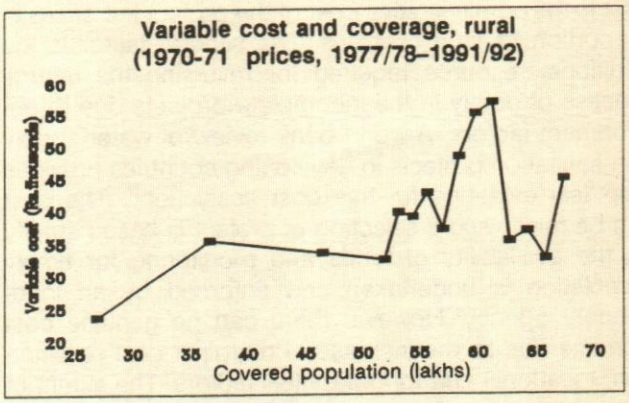

Fig. 3(b). Rural

7. See appendix A_2 for the methodology.

8. See Vitaliano and Toren (1994).

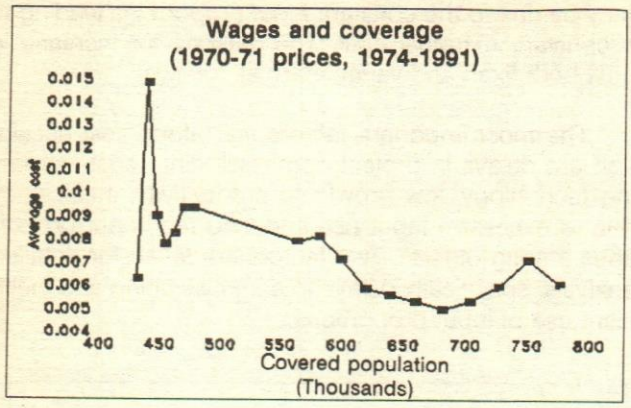

Fig.4(a). Plant-level Unit Wage Cost

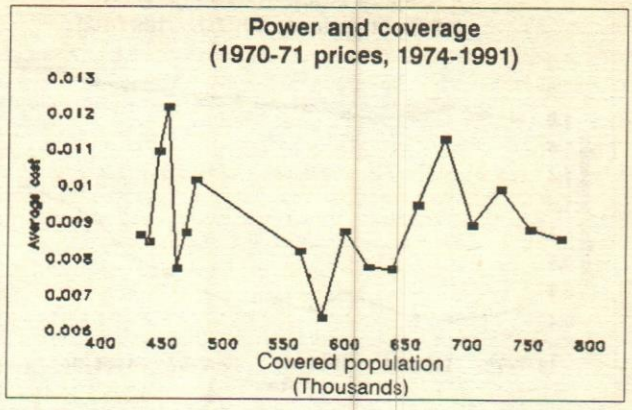

Fig.4(b). Plant-level Unit Power Cost

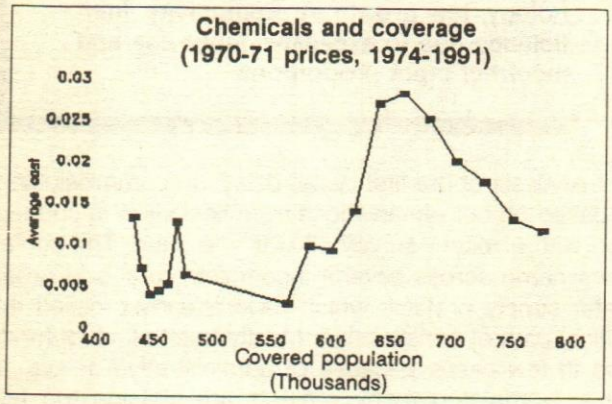

Fig.4(c). Plant-level Unit Chemical Cost

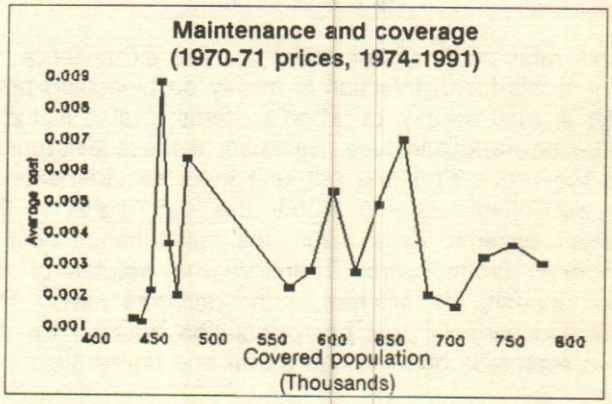

Fig.4(d). Plant-level Unit Maintenance Cost

explained by the double digit inflation during the period, the increase in real cost needs explanation. Two major reasons can be attributed for the real cost increase. First is the administrative cost of the project increases in proportion to time overruns. The second factor is the additional resource required for reversing the natural process of decay in the incomplete projects due to environment factors. A world bank review of water supply and sanitation projects in developing countries provides empirical evidence for this cost escalation[9]. The cost can be minimised if selection of project is based strictly on the availability of funds and monitoring for timely completion is undertaken and enforced by an independent agency. However there can be genuine cost increase due to the increase in marginal cost resulting from locational and topographical factors. The extent of its contribution to cost overrun is largely unknown. Most of the above observations lacks any systematic evidence, hence we attempt the second reason through a plant level study. For this purpose an urban system is examined.

9. World Development Report, 1994, P.91.

Sources of Cost Increase: An Urban Case Study

For the analysis, detailed data[10] on the expenditure on wages, power, chemicals and maintenance were compiled for the Trivandrum water supply for the period 1974/75 – 1991/92. These items were then deflated by appropriate price indices to obtain input wise cost at constant prices[11]. The average variable costs in constant prices of the above inputs are as follows:

The unit costs of chemicals and power increased during eighties while that of wage and maintenance remained more or less stable or declined. One would expect an increase in the maintenance cost in the

10. The data for this study were compiled from the Books of Accounts of the Kerala Water Authority.

11. The price indices used for deflation are:
Wage rates of factory workers,
Wholesale price index of electricity,
Wholesale price index of chemicals and chemical products and
The index constructed for deflating the capital expenditure in the urban system.

second half of eighties because of increased production using older plant and machinery[12]. Instead it shows a decline which may partly explain the increased power consumption due to inadequate maintenance during the period. The increasing trend in the unit cost of chemicals is seen to be more prominent among all the inputs, which is inconsistent with the fixed input output coefficient of chemicals in the production process. This finding is also true to certain extent in the case of power especially in the eighties. Thus a prima facie evidence exists for the inefficient use of at least two inputs. The case of other inputs has not been considered because they are not plant specific due to the externalities in production. Hence inefficiency in input use is measured only for power and chemicals. Since chemicals and power are used in fixed proportions, the excessive input use can be estimated separately. Usage of power per unit was at its minimum during 1986 and that of chemicals minimum during 1981. The average value of the deviations from the respective minimum points is taken as a measure of inefficiency. This average deviation as a percentage of the minimum is 52 for power and 237 for chemicals. This seems to suggest that inefficient use of inputs might explain the increase in unit variable cost in the urban sector. However more case studies are needed for conclusive evidence.

Inefficient use of inputs might explain the increase in unit variable cost in the urban sector.

Summary & Conclusions

Cost of production of water supply in the state has been examined from expenditure data in constant prices, the fixed cost in urban as well as rural show an increasing trend, while the urban sector has a comparatively higher unit fixed cost. The difference in unit cost between the two sectors is narrowing down mainly due to cost escalations in the rural sector. Variable cost in both systems also shows a similar trend. Among the factors affecting cost escalations, delays in commissioning of projects and in efficient use of inputs are examined in detail. Time overrun is attributed to mainly 'too many projects chasing too few resources'. Plant level case study shows that unit costs of chemicals and power increase during eighties while that of wage and maintenance remain more or less stable or decline. Increased power consumption during eighties is attributed to inadequate maintenance of plant and machinery. Inefficiency in the input use is estimated only for the inputs which have plant specific estimates. Applying this criteria, power has an inefficient usage by 52% more than required while that of chemicals is 237% more. The present study has several limitations. Firstly, the lagged effect of investment on production has been completely ignored. Secondly the impact of distribution loss on cost function has not been analysed due to data limitations. Thirdly estimates on fixed cost have an upward bias as a result of not making any allowance for depreciation. Fourthly, the cost estimate includes water consumed by non-domestic users and coverage excludes them. Therefore, the unit costs are overestimates to that extent. The upward bias can be examined only if the output estimates are published regularly and systematically. Finally, coverage is a good proxy only if water supply per unit of population remains constant. This assumption is not valid in rural systems. The impact of this on unit cost needs further study. Future research effort should be directed along these lines to understand the cost structure of water supply.

12. The life of pumps is expected to be 15 years. If this is the case, it has already crossed 80% of its lifespan by late eighties.

Acknowledgements

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Appendix

A_1. Deflator for plan expenditure

For temporal comparison, plan expenditures in current prices need to be adjusted for price increase during the period. The first task in this regard is to construct appropriate deflators. This requires the identification of the major components in the outlays and their price indices. The major components are plant and machinery, building and construction, pipelines for transmission and distribution, land, transport and equipment and other tangible assets. Following the convention, we exclude the price of land from the deflator. In the absence of wholesale price indices of the above items, indices of commodity groups to which the components belong were taken as the proxies for the calculation of deflators. Obviously, the assumption is that the price of materials used for the capital formation moves in the same direction of the aggregate commodity price index. The aggregate price indices are: non-metallic mineral products; basic metals and alloys; machinery and transport equipment; and labour. For labour, we have taken the average daily wage rates of skilled and unskilled construction workers. The weights of the various components in fixed capital, in the absence of their shares in total expenditure, have been estimated from a case study of an urban water supply in Trivandrum (Murugan, 1993).

The weights are:

Nonmetallic minerals:	0.23
Basic metals and alloys and metal products:	0.26
Machinery and machine tools:	0.17
Wage rates of skilled construction workers:	0.34

The deflator for urban sector is the weighted average of the above price indices and in rural sector it is the same except for wage rates, for which daily wage rates of skilled construction workers in the rural sector have been used.

A_2. Deflator for non-plan expenditure

In this case, the deflators are different from urban and rural sectors. This is mainly due to different components and weights in the non-plan expenditure for the two sectors. The non-plan expenditure is mainly on operation and maintenances of commissioned systems. The major components are: chemical products; power; wages for operating the plant and equipment; and maintenance. The deflator is obtained by weighting the wholesale price indices of above components.

For urban sector, the indices used for the deflator were; wholesale price of chemical and chemical products; wholesale price of electricity; wage rates of factory workers; and price index for maintenance. Until 1988-89 the wage rates of factory workers were taken from the Annual survey of industries and for the remaining period the same has been estimated from the growth rate of consumer price indices of industrial workers. The deflator estimated for capital expenditure is taken as the price index for maintenance since the components are the same as in capital expenditure. The weights used for urban systems are the average share of costs of chemicals, electricity, wages and maintenance in the total non-plan expenditure for Trivandrum water supply system during the period 1974-75 to 1991-92. The average weights are:

Chemical products:	0.31
Electricity:	0.31
Wages:	0.25
Maintenance:	0.11

The deflator for operation and maintenance in the urban sector is thus the weighted average of wholesale price indices of chemical and power, the index of wage rates of factory workers and the urban deflator for capital expenditure.

In the case of rural non-plan expenditure, the same method has been used for the construction of the deflator with the following changes: Since the chemical used for rural water supply is bleaching powder, its price index is used instead of the price index of chemicals. Wholesale price index of Bleaching powder has been published only up to 1988/89. For the rest of the period we have taken the price indices of liquid chlorine as proxy to bleaching powder. The index for maintenance is the rural deflator for capital expenditure. The weights are the average share of each component in the total operation and maintenance of two rural water supply stems in Trivandrum district, viz. Mangalapuram and Andoorkonam during the period 1992/93 & 1993/94, of which the first was commissioned almost a decade ago and the other recently. The average weights are:

Bleaching powder:	0.03
Power:	0.28
Wages:	0.40
Maintenance:	0.29

The deflator is the weighted average of the above indices.

A_3. Estimation of urban coverage

The total population covered in the urban sector is based on the projected populations starting from the respective year of commissioning for the 36 municipalities, 3 corporations and its 15 urban agglomerations in Kerala. The method is as follows: Take the case of Quilon urban water supply. The system was commissioned in 1963. The population covered in 1963 is projected from the 1960 census using the compound growth rate of population between the two censuses, 1960 and 1970. Similarly the covered population were obtained for the years during the period, 1970- 1980 and during the period, 1980-1995. The total covered population in a given year is the sum of all such estimates for all urban systems in Kerala. Obviously, if the system is not commissioned in that year its population is omitted from coverage.

A_4. Coverage in rural sector

Published data on rural water supply coverage fluctuate erratically from 1980 onwards. Therefore, we have smoothened the series in the following way. The compound growth rate of coverage between 1980/81 and 1991/92 is estimated. This growth rate is used for the intrapolation of coverage for all the years. This series is taken as the population coverage in the rural sector.

Infrastructural Facilities' Role in Emergence of Kerala Model

Srikumar Chattopadhyay

Infrastructural facilities related to road network, education and health services in Kerala have been discussed in this paper. It has been argued that apart from the people's initiative, the geoecological foundation of the state has played a significant role in shaping the Kerala Model. While emulating Kerala's experience one needs to consider the natural set up of the concerned area, concludes the author.

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Kerala has drawn worldwide attention in recent years for its spectacular achievement in the sectors of health, education, quality of life and social development. However, its per-capita income (US $ 144) is considerably low, even below Indian average (US $ 197).

The Kerala experience refutes the common Keynesian and Marxian thesis that "high levels of social development cannot be achieved in the absence of high rates of economic growth" (Alexander, 1994). Despite Kerala's sluggish economic growth it has been able to make significant headway in important areas such as literacy, life expectancy and mortality rate. This coupled with high quality of life even in rural areas and low rural urban differentiation has placed the state far above the general situation prevailing in the other states of India and most parts of the Third World. In fact in some sectors Kerala's record is comparable to the developed countries. Table 1 provides a comparative statement of some selected human related variables.

The Kerala experience refutes the common Keynesian and Marxian thesis that "high levels of social development cannot be achieved in the absence of high rates of economic growth".

Kerala's experience demonstrates that the people do not have to wait to cross the hump of economic growth to enjoy the basic necessities to live a full human life-school education, primary health care, ownership of residential land, assured supply of food grains through public distribution system and so on (Anonymous, 1994). It is imperative to draw lessons through proper diagnosis of the Kerala condition, so that other states in India and countries in the Third World can adopt it in the right perspective.

Table 1: Comparative Statement of Some Selected Human Development Variables

Variables	India	Kerala	China	Columbia	Canada
Total Fertility rate	2.90	1.75	1.90	2.80	1.80
Infant Mortality rate	74	13	34	34	6.80
Life Expectancy	60.8	72.3	70.5	69.3	77.4
Female Enrolment in High School (Ratio)	55.2	105.7	NA	53	105
Literacy Rate	52	91	69	NA	NA
Percapita Income (in US $ 1995 rate)	197	144	NA	1280	21260

Source : 1. Economic Survey, GOI, 1994
2. Economic Review, GOK, 1994
3. Anita (1994)
4. Alexander (1994)

Kerala's achievement has been attributed in various measures to appropriate public action by involving people; redistributive policies of the government in response to public demand and provisioning of infrastructure, specially social infrastructure by the Government in response to societal demand. While all these measures are important and interrelated at various levels, the infrastructural facilities, specially that of road network, health care system and educational institutions and their role in evolving the Kerala model, are worth a detailed study. For this it is necessary to understand the settlement distribution pattern and the underlying geo-ecological factors in the state.

Geoecological Setup and Settlement System

The spatial organisation of a settlement system largely depends upon water availability, resource base and site character. The geo-ecological setup of Kerala has given rise to a unique settlement pattern, quite different from the rest of India. The dispersed, linear and contiguous stretch of habitation has reduced rural urban differentiation and primary and non-primary sectors coexist.

Kerala occupies a narrow strip of land in the south western corner of India. It receives rainfall throughout the year due to its location in the tropical monsoon belt and orographic effect. Abundance of water and its near uniform distribution provide ample scope for spatial development of settlement without any restriction resulting in dispersed nature of settlement distribution. Due to overall uniformity of climate and soil the primary economic zones are placed longitudinally. The landuse varies in consonance to the distance from the sea (from west to east) juxtaposed by increasing altitudes in the same direction.

The coastal plain is significant for fishing activity and subsistence agriculture of coconut and rice in the adjoining area. Tree crops, rubber and cashew plantation dominate the midland. The eastern plateau and mountain are under plantation of tea, coffee and forests. The valleys all through the state are given to paddy and seasonal crops like banana etc.

The coastal areas characterised by runnel and ridges host linear settlements along the sand ridge on both side of the road. To enjoy equal opportunity of fishing, the settlements are dispersed and linearly placed parallel to the coastline. The laterite ridges and intervening valleys are at perpendicular direction with respect to the coastal ridges. The transport lines have developed along these ridges. The settlements are again linear along the ridges and upper slopes leaving the valley floor and lower slope for agricultural purposes or primary activities.

The landform assemblages and corresponding settlement pattern marked in Kerala are as follows (Chattopadhyay, 1994).

- Coastal plain with runnel and ridge typography along with back waters exhibits linear settlements along the ridges.
- Kuttanad and Kole lands of Alappuzha, Kottayam, Ernakulam and Trissur districts have linear and dispersed settlements along the river terrace and ridges.
- Alternate lateritic ridges with intervening valleys host linear settlements along the ridges.
- Low rolling terrain of Palakkad type accommodates compact, nucleated settlement pattern.
- Steep slopes and ridges with nucleated settlement in the valleys.
- Dispersed and nucleated settlements over the mounds in the Plateau region.

Kerala records the second highest population density in India. Due to the distributed nature of settlement there is little congestion except in few pockets of Kochi. The settlements in Kerala have no distinct core, nor do the villages have any marked modality. This picture was noted even in 14th century A.D. (Logon 1887). This background information is necessary to understand the decentralised development of infrastructural facilities in Kerala.

Infrastructural Facilities

Infrastructural facilities are man-made assets, in the form of capital goods used to produce services for satisfying needs. It is a vital means of production as well. The state of infrastructural facilities can be taken as an index of development. The available infrastructural facilities in Kerala can be broadly classified into two groups, namely, physical and Social or services. A number of items can be listed under each group as given in table 2. The items covered under physical infrastructure (PI) directly affect the landscape and help change the economic scenario in one way or other. Therefore, this set of infrastructure has both positive and negative impacts.

Table 2: Types of Infrastructure

Physical infrastructure
Irrigation
Drainage
Power and Energy and
Transport
Social/Service Infrastructure
Education
Health care system
Public distribution system
Post and telecommunication
Recreation

The social infrastructure provides services to the society and therefore has mainly, positive impacts.

Public investment plays major role in infrastructural development. In fact, except education and health care system all other items have been developed by public funds.

Public investment plays major role in infrastructural development. In fact, except education and health care system all other items have been developed by public funds. Private sectors are increasingly interested in investing in the health care and education system. All India data on investments in hospitals for curative care indicates that private investment has grown from 18.6% in 1974 to 57.4% in 1991 (Duggal et al., 1995). However, these private sector facilities are mainly confined to the urban centers. So far as rural area or mass service is concerned it is the public investment that plays significant role.

Road networks

The transport system in Kerala is constituted by waterways, roadways and railways. However, in terms of service and reach, it is the roadways which from the vital base for socio-economic development. As an element of cultural landscape and as a factor of economic growth, development of road network is a basic need for any development programme.

Table 3. Road Types in Kerala

	Type	Length in Kms.	Total
1.	Highway – National (NH)	1011	
	State (SH)	1889	
			2,900
2.	Other PWD roads		
	Major	6163	
	District	9786	
	Village	2825	
			18,774
3.	Panchayat roads		1,03,880
4.	Others:		
	Municipalities/ Corporations	8672	
	Forest departments	3027	
	Other agencies	1781	
			13,480

The total road length in Kerala in 1994 was 141010 kms, an increase of 1.4% over 1993. This gives an average density of 3.63 km/sq km. which is nearly 7 times of the national average. However, surfaced road (metalled, black topped) constitutes 22% of the total length. Based on the responsibility of laying and maintaining the roads, there are five categories of roads as given in table 3 (Government of Kerala 1995). The panchayat roads constitute the major share (70%) of the total roads. In the past two decades panchayat road construction has got a great momentum under various schemes like IRDP, JRY, etc. The panchayat road length has increased by 47% during the period from 1980 to 1990, which means an annual increase of 4.7%. However, the annual rate of growth has come down from 4.7% in the eighties to less than 2% in the nineties.

Road density in Kerala shows a decreasing trend towards highland. The coastal plain with highest population density (>1500) has the highest road density. Corresponding to low population density, road density is low in the highland. However, the difference between high and low is not very significant.

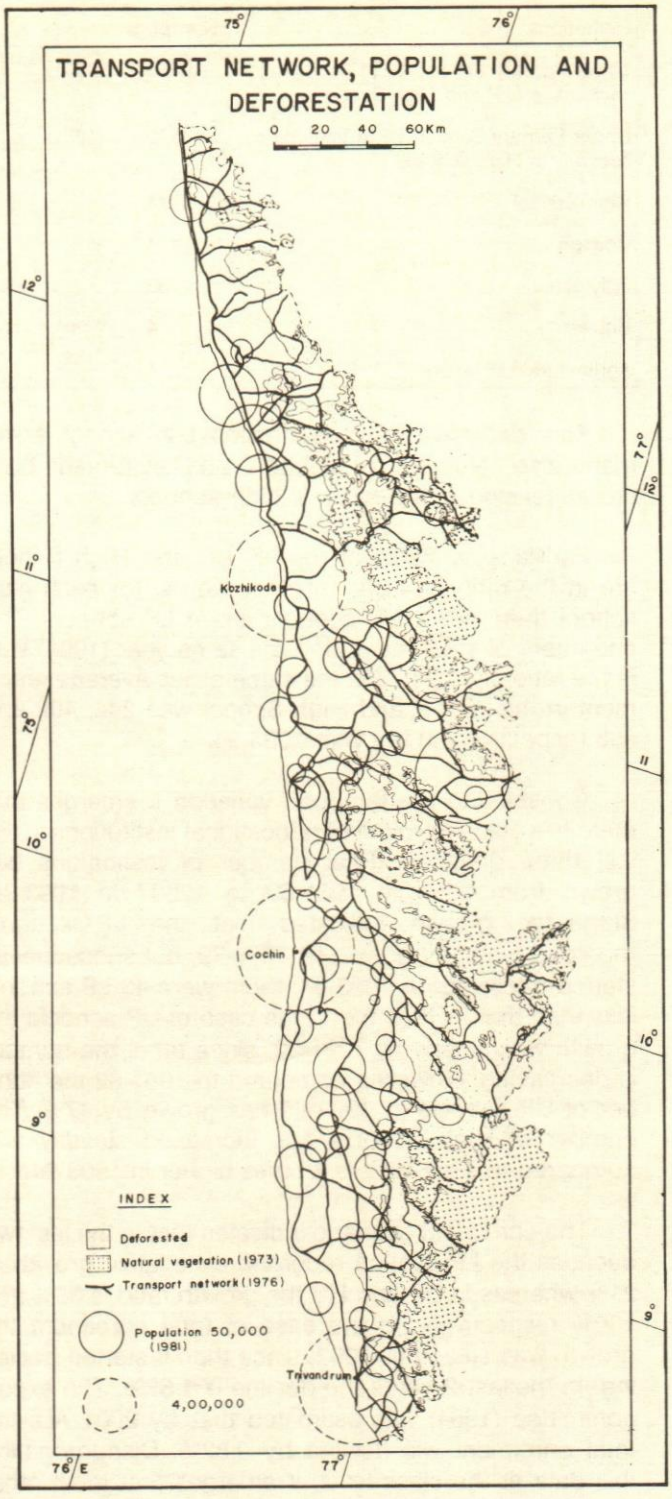

Fig. 1.

This high density of road network indicates high accessibility. It can be observed in the map (Fig. 1) that the longitudinal trank roads running parallel to the coastline concept major centres like Thrivanathapuram, Kollam, Kottayam, Ernakulam, Trissur, Kozhikode, Tellichery and Kannur. A number of small centres (Class III towns in census classification) have developed in between these major centres and also along the foot hill region. Almost all the roads to the east are at perpendicular direction with respect to the main trank roads. The small centres are also interconnected. This type of network is economic both in terms of time and money as it follows the natural landscape setup.

The three major corporation cities, namely, Trivandrum, Cochin and Kozhikode provide almost equal opportunities in the fields of education, health, services etc. They are also equi-distant while placed along the coast line. Each of these centres can be approached within a reasonable time period from its hinterland. A distance zone of 30 km drawn around the class I (>1,00,000) town covers major part of the inhabited area in the state (Chattopadhyay, 1988). This high level of accessibility provides a genuine push for higher physical and cultural interaction.

Environmental Impact or Road Construction

Construction of road brings mixed blessings. On the one hand it enhances accessibility. On the other hand, it opens up the virgin area to the vagaries of human interventions. Figure 1 shows the deforested area. It is noteworthy that deforestation proceeds along the road. Due to road construction, the previously impenetrable forest area became accessible. This in turn aggravates human intervention on a large scale. High positive correlation (0.64) between deforestation and road length at the district level clearly supports this observation.

Direct Impact

Road acts as dyke across the lowlands and restricts free flow of water thereby contributing to the flood problem. Kuttanad is one such area where this problem is frequently marked.

As common lands are not available, natural drainage channels are converted into roads with narrow ineffective drain on one side. The natural drainage path becomes disfunctional. This scenario is widely marked in coastal plain. Wherever roads cut across the slope in the highland, the land loses its stability resulting in landslides/slope failure. During monsoon such occurrences are common in the highland. Roads act as the channel of interaction within the forest area. Deforestation follows roads.

Roads act as the channel of interaction within the forest area. Deforestation follows roads.

Indirect Impact

Due to blockage of normal drainage in the lowlying area, water stangates. This leads to building up of higher moisture regime and dilution of soil nutrients. Further, normal soil drainage/flushing is obstructed. This ultimately reduces productivity and renders water and soil unusable.

Settlement springs up following road construction. Prime-lands are diverted for non-agricultural purposes. This is specially noted around big cities and in the coastal plain.

Blockage of drainage due to road construction in the hilly tracts contributes to high water percolation. This sometimes crosses the water bearing limit of the soil. As a result, landslides/ soil creep takes place. It is a common phenomenon in Kerala during monsoon.

Due to slope failure, landslide and soil creep, excessive sediments are produced. These sediments ultimately contribute to siltation of reservoirs and streams.

Social Infrastructure

Development of social infrastructure has always been given significant importance in the state. The total plan investment on social services from 1st Five Year Plan to 7th Five Year Plan amounted to over Rs. 1402 crores, which constituted about 24% of plan expenditure of the state. During the same period the all India average of plan expenditure has been ranging between 15 to 20% (Government of Kerala, 1995). Expenditure on social services in the last decade is as high as 46% in 1986-87. It is around 40% in the last two fiscal years (1993-94 and 1994-95). However it is to be noted that these data include investments on all the sectors.

Educational Facilities

Educational facilities in the state consist of different level institutions starting from lower primary (LP) to University (table 4). A steady growth of educational institutions has been observed in the last three decades. However, in recent years primary schools are decreasing, so also is the case of Upper Primary (UP) schools.

Table 4: Educational Institutions in Kerala (1994)

Institutions	Numbers	
Lower Primary School (LPS) (including sections in U.P and High School)	9593	(2891)
Upper Primary School (UPS) (including sections in High school)	4890	(1971)
High School	2474	
College	174	
Polytechic	32	
University	4	
Agricultural University	1	

This declining trend is observed in school enrolment also. Number of schools and enrolment both are increasing in the case of high schools.

Facilities available at the LP, UP and High School are in the ratio of 4:2:1. In other words, for each high school there are 2 UP schools and 4 LP schools. The enrolment of students during the same year (1994) was in the ratio of 40:33:27 in the same order. Average enrolment in the LP, UP and High School was 242, 402 and 653 respectively in the year 1993-94.

Considering the temporal variation it emerges that there is a steady growth of educational institutions in the last three decades. Total number of institutions has grown from 9359 in 1961-62 to 12097 in 1993-94. Stagewise growth indicates that the LP schools recorded a steady growth till 1978-79, but subsequently started declining. In 1993-94, there were 43 LP schools less than that in 1961-62. In the case of UP schools the growth was steady till 1991-92, since then, the number is decreasing. However, compared to 1961-62 the number of UP schools in 1994-95 has grown by 47%. The number of High Schools has increased steadily and compared to 1961-62 it is 4 times higher in 1993-94.

The enrolment scenario indicates that in the last two decades the LP section recorded a negative growth of 21% whereas in UP and HS the growth ratio is 36% and 100% respectively. In the case of total enrolment the growth was steady till 1992, since then it started declining. In the last 2 years the decline is 1.67%. The expert committee (1994) has estimated that by 2001 AD, the total enrolment will decline by 9.82%. Disaggregating this data at the class level, it emerges that in all other classes except class X, there is a significant decline in enrolment, highest being in the levels of VII standard (18.87%). Decrease in enrolment at the LP/UP section can be directly attributed to the decline in school-age group population, which can be further related to low birth rate in the state.

District Level Distribution of Educational Facilities

District level distribution of educational institutions has been provided in table 5. Around 20% of the total population is school going in the state. There is not much difference in enrolment among the districts. Thiruvanathapuram, Eranakulam, Trissur and Kozhikode which are supposed to be developed districts record 17 to 20% enrolment. Relatively backward districts like Kasargod record 23%. Malappuram is the only district having a high value of 26%. A hilly district like Indukki or Pathanamthitta has 17 to 18% enrolment. All the districts have colleges. Distribution of population per college is the lowest in Ernakulam (1 college for 1.17 lakh population) and the highest in Malappuram (1 for 2.781 lakh). The ratio between number of school and population varies from 1:1615 in Pathanamthitta to 1:3105 in Trivandrum. On an average, Kerala has one school for every 3.19 sq. km. Idukki and Wayanad, two hilly districts have one school for every 5 sq. km. School density is very high in Pathanamthitta and Kozhikode. About 94% of the rural population is served by lower primary facilities within a distance of 1 km. UP education is availed by 96.2% of rural population within a distance of 3 km. General college education is available to the students within commuting distance.

This has certainly placed the state far above other states, the result of which is reflected in the educational level of the state.

Health Care System

Health status of Kerala is superior to that attained by other states in India. The standard achieved in the state compares very favourable to that of the developed countries. As on 1991-92 per-capita expenditure on health in Kerala is Rs. 80 against Rs. 59 at the national level. In 1994 per capita expenditure in Kerala had gone up by another Rs. 30.

One of the major factors that contributed to the present level of health development is the health care infrastructure and availability of trained manpower which facilitated greater access to institutional care (Government of Kerala, 1995). Apart from the Government health department, private sectors also run health services. Private investment in health sector is increasing significantly. Various studies conducted since 1944 show that the share of the private sector in the health care expenditure has always been around 80% of the total health expenditure in the country (Duggal et. al 1995). As on 1994, availability of bed in the state covering all sectors is 399 per 1,00,000 population. Table 6 provides the details about the health care institutions in the state.

Considering the government institutions including grant-in-aid institution under Allopathy system, it is observed that there are 140 beds per one lakh population. If the grant-in-aid institutions are excluded, the availability of beds per one lakh population comes down to 129.

Table 5: District Level Educational Institutions

District	School Enrolment(%)	No. of Colleges	Population/College in lakh	No. of Schools	Population/ School	Area/ School	No. of Polytechnics
Trivandrum	18	20	1.47	949	3105	1.78	4
Kollam	19	13	1.85	901	2672	1.89	1
Pathanamthitt	18	8	1.49	736	1615	1.54	2
Alappuzha	17	11	1.82	746	2682	1.82	2
Ernakulam	17	24	1.17	987	2854	2.30	3
Kottayam	18	21	0.87	921	1985	2.29	4
Idukki	17	5	2.16	461	2339	5.51	1
Thrissur	19	20	1.37	1001	2735	1.96	4
Malalppuram	26	11	2.81	1330	2328	1.95	2
Palakkad	21	10	2.38	916	2601	3.30	2
Kozhikode	20	14	1.87	1219	2149	1.57	3
Wynad	22	4	1.68	259	2595	5.17	1
Kannur	22	9	2.50	1258	1790	1.97	2
Kasargod	23	4	3.68	506	2118	3.77	3
Kerala state	20	174	1.67	12190	2387	3.19	32

Subsequent analysis will be based on the data obtained from the health department, Government of Kerala.

Table 6: Health Care Institutions in Kerala (1994)

Type of Institutions		Numbers	Beds
A.	Government Sector		
	Hospitals	148	27872
	Primary Health Centre (PHC)	924	5228
	Community Health Centre (CHC)	51	2816
	Dispensaries	53	154
	T B Clinic/ Centre	22	448
	Leprosy Control Unit	14	–
	Leprosy Sanitorium	1	993
	Sub total	1213	37511
B.	Grant-in-institutions	36	4927
C.	Private Sector (all types)	6760	65156
D.	Co-operative Sector (all types)	77	2579
	Grand Total	8050	105246

Number of hospitals per one lakh population in Kerala (0.49) was less than that in India (0.70) in 1961. The trend continued even in 1971. Since 1981 the scenario has changed. Compared to the all India average, the number of hospitals per 1,00,000 population in Kerala was higher by 3 times in 1981 and 5 times in 1991. Similar growth trend is evident in the case of rural areas also. Like other sectors, rural-urban difference in availability of health care facilities is marginal in Kerala. Table 7 provides a comparative picture of India and Kerala during the last 30 years.

Table 7: Temporal Variations in Number of Hospitals per Lakh Population in Kerala and india

Year	India			Kerala		
	Rural	Urban	Total	Rural	Urban	Total
1961	0.28	2.50	0.70	0.30	1.53	0.49
1971	–	–	0.70	–	–	0.55
1981	0.35	3.12	0.99	2.88	3.42	2.98
1991	0.57	3.51	1.32	5.34	7.80	7.02

The rural urban differences in the case of all India average was about 9 times against 5 times in Kerala. While in all India level the difference has come down to 6 times in 1991, at Kerala level, difference is only 1.2 times. Primary health centres (PHC) and community health centres (CHC) which cater to the rural area have increased from 299 in 1995 to 975 in 1994 – an increase of 226% in a span of 9 years. This is significant specially in India, where 76% population lives in the rural area.

District Level Distribution

Table 8 presents the availability of health services at the district level to bringout the spatial perspective of health infrastructure. The ratio between institution and population of the state stands at 1:23989. The hilly and backward districts like Wayanad, Idukki, Pathanamthitta and Kasargod record 20,000 less population per institution. Malappuram and Kollam are two districts which have relatively higher population per institution to centre. The districts of Thiruvananthapuram, Ernakulam and Kozhikode (each one with a corporation city) all record, a higher ratio than the sate average.

Considering the availability of beds per one lakh population it is observed that except Thiruvananthapuram and Alappuzha other districts do not record much variation. Kasargod and Malappuram are two districts lagging behind. Distribution of Primary Health Centre (PHC) catering to the need of the rural population does not show much variation than the overall condition. In districts like Thiruvananthapuram, Alappuzha, Ernakulam, Trissur, Kozhikode, Kannur and Kasargod, the PHCs have to cater to less population on an average. This indicates that rural areas are equally developed. Inter district variation in the rural sector is not very high.

Field investigation indicates that private health services are available in the rural areas also. This contributes to an improvement in the situation though it is gradually converting people's health into a lucrative business.

Infrastructural Facilities at the Microlevel

To present the panchayat level scenario covering three major geographical regions, lowland, midland and highland of the State data has been obtained through the project Panchayat Level Resource Mapping implemented jointly by the Centre for Earth Science Studies, Trivandrum and Integrated Rural Technology Centre, Palghat. Among four selected panchayats two are in the coastal plain lowland, one spreads on the midland and the last one is in the highland. All these panchayats are rural. Tables 9 and 10 provide the road network and educational and health facilities available there.

Road density decreases gradually from the panchayats in coastal plain to the panchayats in the high land following the population density. However, the length of road per thousand population is high in the highland. The settlement distribution in highland is concentrated but dispersed. Inter settlement (a group of house) distance is more and panchayat size is bigger compared to other areas. Hence the Length of road has

Table 8: District Level Distribution of Health Care Facilities

District	Population (P) (in lakh)	Institution (I) PHC	Institution (I) Total	P/I	Beds	Bed/Lakhs Pop.	Rural Pop./PHC
Trivandrum	29.5	84	111	26546	6446	219	23195
Kollam	24.1	65	82	29361	2053	850	30177
Pathanamthitt	11.9	51	60	19806	947	78	20261
Alappuzha	20.0	70	86	23270	3980	199	19880
Ernakulam	28.2	85	113	24931	3743	133	16989
Kottayam	18.3	61	76	24056	3058	167	24711
Idukki	10.8	59	64	16845	863	80	17410
Thrissur	27.4	84	112	24440	4067	149	24013
Malalppuram	31.0	96	113	27401	2149	69	29301
Palakkad	23.8	85	103	23129	2128	89	23620
Kozhikode	26.2	73	90	29111	4308	165	22129
Wynad	6.7	33	43	15631	777	116	19672
Kannur	22.5	77	99	22745	2335	104	14367
Kasargod	10.7	52	61	17566	657	61	17217
Kerala state	291.1	975	1213	23989	37511	129	21967

Table 9: Infrastructural Facilities at the Sample Panchayats : Road Network

Panchayat	Physiographic zone	Area (sq.km)	Population (1991)	Road length Metalled	Road length Unmetalled	Road length Total	Road density (km/sq.km)	Road length (km) per 000 population
Onchiam	Coastal plain-lowland	9	24856	20.11	23.01	43.12	4.79	1.74
Kalliasseri	Coastal plain-lowland	15	24114	21.50	49.50	71.00	4.73	2.94
Akathethara	Midland-Highland	18	20668	17.00	41.00	58.00	3.22	2.81
Poothadi	Highland	83	33328	55.00	56.00	111.00	1.34	3.33

Source: Centre for Earth Science Studies, Trivandrum Integrated Rural Technology Centre, Palghat Panchayat resource mapping 1991-92.

Table 10: Infrastructural Facilities at the Sample Panchayats Educational & Health Facilities

Panchayat	Educational Institutions (E.I) P.S	H.S	Others	Total	E.I.: Population	Health Care Institution (H.I.) PHC/ Hospital	Others	Total	H.I. Population
Onchiam	9	3	3	15	1:1657	2	1	3	1:8285
Kalliasseri	6	5	12	23	1:1048	1	3	4	1:6029
Akathethara	2	6	2	10	1:2067	4	-	4	1:5167
Poothadi	9	2	3	14	1:2381	3	6	9	1:3703

Source : Centre for Earth Science Studies, Trivandrum Integrated Rural Technology Centre, Palghat Panchayat Resource Mapping 1991-92.

to be more to connect the settlement. This distributional pattern indicates that accessibility in terms of population and settlement has a uniform trend throughout the state. The coastal plain with high density of population and road is almost saturated. Around 4 km of road in one square kilometer area means about 4% of total area is occupied by the road (Nair and Chattopadhyay, 1993).

It emerges from this analysis that there is practically only a marginal difference between coastal plain and other apparently remote areas in the matter of road accessibility. The same is true about the rural and urban areas also. The rural area in coastal plain is not really separable from the urban area, which is Kerala's speciality. In the matter of educational

facilities also differences among the sample villages are not that high except for Kalliasseri. Due to people's initiative, Kalliasseri panchayat has an edge over other panchayats in the state. So far as the primary school and high schools are concerned, the facilities available in all the panchayats are more or less similar. Average enrolment per school varies from 414 in Onchiyam to 667 in Poothadi.

Health care system of all these sample panchayats are also well developed. Population per Health Institute is two times lower in the highland panchayat (Poothadi) compared to the coastal panchayat like Onchiyam. Primary Health Centres under Government Health department have been instituted in all the panchayats. Private facilities are also growing. Onchiyam, Kalliasseri and Akathethara also enjoy the services of nearby urban centres. What is important to note is that facilities have been developed even at the panchayat level irrespective of their locations. The highland and midland areas enjoy more or less equal type of facilities like coastal or lowland tract in the state.

Even at the panchayat level the facilities/institutions are not concentrated in one place. Fig. 2 showing the infrastructural facilities of Kalliasseri testifies aspect. This type of decentralized distribution right from panchayat to district and state level has helped evolve an "Equal Opportunity" situation.

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Conclusion

Kerala's unique situation in human development front is attributed to more than one factor. People's movement/ initiative in creating an effective delivery system operating within the existing socio-political system is certainly the prime factor. Role of Voluntary agencies like Kerala Sasthra Sahitya Parishad (KSSP) is noteworthy in this respect.

The people's initiative has got the support of the decentralized resource base to start with, on the one hand, on the other, it has consciously promoted a decentralized pattern. Given the shape and size of the state even economic profitability in the matter of infrastructure development could be maximized by the following the natural ecosystem. In fact, wherever centralized planning is conceived like major irrigation projects or drinking water supply the rate of success is towards the lower side.

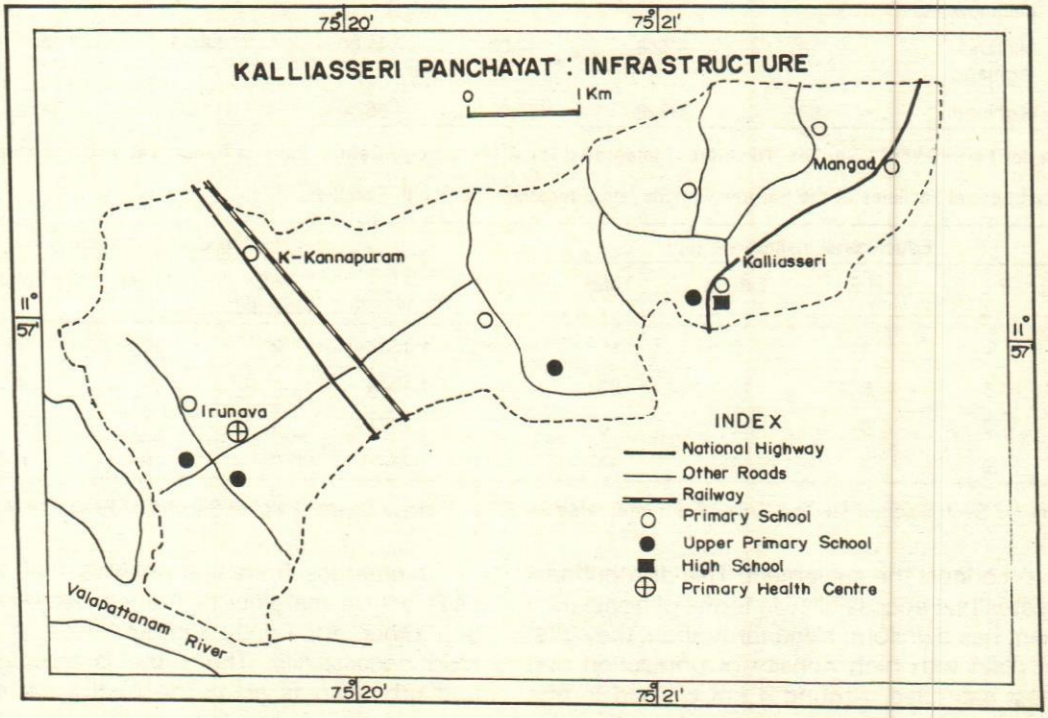

Fig. 2.

The infrastructure at the state, district and sample panchayat level reveals the decentralized mode of development and its role in promoting Kerala type model. Infrastructure exists even in the remote hilly villages. Rural-urban difference in availability of amenities (education, health and recreation) is significantly low. Ratio between value of amenities and population is 1:1810 for urban area against 1:3070 for rural areas. In other words pressure on amenities is less than 2 times in rural areas compared to the urban areas, thereby exodus from rural areas are marginal (Chattopadhyay, 1990).

As Sen (1994) pointed out, "the Indian government should try to emulate the Kerala experience". The society at large is confronted with the problems of paucity of financial resources, increasing environmental problems associated with the present trend of consumer oriented high energy based development and depletion of resource base. Kerala model in these contexts perhaps provides an alternative.

However, there are certain aspects which are to be taken care of while considering replicability of the Kerala model. As pointed out the geoecological set up of the state is a major factor governing the socio-economic scenario. Few states in India barring perhaps Goa have a similar set up.

Comparing Kerala with Tamil Nadu or Karnataka (two adjoining states), it may be observed that there is little compulsion from the geoecological set up to promote decentralised activities in those two states. If the history of settlement development in these states is investigated it will emerge that the process is significantly different from that of Kerala. The concentric nature of the settlements having a high inter settlement distance is the basic matrix of socioeconomic operations. Due to uniformity of topography, agricultural practice is not diversified in terms of unit area; moreover restricted water availability hinders dispersed settlement development.

As the resource base of the urban centres in these states is spatially not so well defined, expansion of the hinterlands takes place in all directions. A larger population can be served by concentrating the activities in the functionally central area (FCA) with less physical and economic effort. Subsequently, with modern trend of development all activities are concentrated more on account of administrative convenience and to cater to the needs of the core population than providing service-function to the people of the hinterland. This coupled with more investment in the FCA to cope up with the population pressure has resulted in further centralisation. As the geoecological set up does not pose any hindrance to this concentration in the initial phase, not much attention was paid to look for an alternative till recently. The above observations might be considered while emulating the Kerala model. As the basic framework is not the same in all the places, necessary adjustment might be necessary. However there are a few alternatives than to provide basic infrastructural facilities at the lowest village level.

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Technology Infrastructure & Industry: The Indian Situation

S.N. Nandi

Indian industry possesses an enviable quota of quality infrastructure in science and technology. The author analyses both macro and micro level conditions to be created in industries for proper utilisation of their services. He also discusses possible approaches to be adopted immediately to ensure better utilisation of the potentials existing in Indian technology infrastructure.

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In the emerging scenario of increasing integration of domestic economy with the global market and rising expectations of Indian citizens, a modern and efficient infrastructure support is vital for achieving a high rate of growth. The Recent World Development Report, (World Bank, 1994) has clearly demonstrated that there is a significantly positive relationship between per capita national income and the per capita stock of infrastructure investment. The above report also says. "infrastructure can deliver major benefits in economic growth, poverty alleviation and environmental sustainability – but only when it provides services that respond to effective demand and does so efficiently."

India exhibits a state of paradox. It suffers from acute inadequacy in some of the economic infrastructure like roads, telecommunications, electricity, etc. But it possesses an enormous amount of quality infrastructure in Science and Technology (S&T), more than what is presently required by its domestic users. At present, there are nearly 180 universities, 6000 colleges and 2100 research and development institutions in the country. It is estimated that today there are about 4.o million S&T personnel in the country. In fact, the country adds around 2.00 lakhs S&T personnel each Year – comprising 80% graduates and 20% post graduates in various streams of science and technology.

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Investments in industries still being much less than socially desirable, domestic demand for S&T infrastructure is very limited. At the other end of the spectrum, many industries in developed countries are in need of infrastructure to undertake research and development activities at an affordable cost. No wonder, there is considerable, 'brain drain' on a regular basis. In view of the poor utilization of technology infrastructure, considerable amount of in-depth studies followed by formulation of a pragmatic policy at the national level is required in order to ensure better utilization of such an infrastructure.

Technology – Some Insights

Technology is defined as the practical knowledge, know-how, skills and artifacts that can be used to develop new products and services and/or new production/delivery systems. In other words, technology can be thought to be an answer to 'what does one know how to make a product?' Many also define technology as a specialised knowledge in a particular field. Regardless of definitions, technology is normally categorised under three groups :

* Product technology
* Process technology
* Management technology

Technology is the practical knowledge, know-how, skills and artifacts that can be used to develop new products and services and/or new production/ delivery systems.

Product technology relates to know-how of products like a micro- processor in computer, coco-cola's syrup formulation, etc. It is easy to identify and the options for their exploitation are also usually understood. Process technology is concerned with production and delivery of products and services. Management technology is often difficult to define and categorize and, because of the inherent difficulties in measurement, is not easy to identify as having marketable value. Management technology incorporates both organisational e.g. manufacturing, marketing, etc. and managerial practices related to planning, controlling, etc.

Thus technology by definition is quite ambiguous. It is difficult to assess the requirements of technology based services. It has now become further complicated with the advent of systemic technology. Till now, technology was thought to be a discrete know how embodied in people, materials, physical process, plant, equipments and tools. Recently the scope of technology has been extended to facilitate integrated working of various kinds of embodied technologies, In many developed countries today like USA, Japan, Germany etc, such disembodied system technologies are more emphasized. Disembodied technologies include such entities as standards, methods, techniques, etc. that are not embodied in a piece of equipment or a product. Instead, they are used to integrate products. both hardware and software into efficient economic systems. In an excellent report by the Manufacturing Studies Board of the National Research Council (1991) in USA, it has been stated that 'firms that use advanced manufacturing technology will thus be distinguished less by their manufacturing process than by the integrated system that drives those processes. Moreover, the changes that attend the development and deployment of advanced manufacturing technology involve the availability of information and the integration of that information with business function to achieve various kinds of intelligence." (Tassey, 1992)

Role of Technology

There have been marked changes in the role of technology in the economic activities of a nation. The predominating thinking till mid seventies was that technology is needed to design new products and new processes which will be implemented in a long standing mass production environment. Competition is based almost entirely on the attributes of products themselves with cost reduction achieved largely through the realisation of scale economies in production. The above view which has been relinquished by western businesses; but still prevails in a developing country like ours. However today, there are many factors based on which the game of competition is played. Six of the factors often quoted are :

* Technology innovation
* Design and process flexibility
* Quality
* Productivity/cost
* Speed to market
* Service mix

This new set of factors dictating global competition has been radically changing the role of technology. Technology is not only regarded as something coming along with new products and process but is

taken as the means and results of the communication process between different functions like R&D, production and market. It is also regarded as an enabler for individuals to make decisions on their own. Further, technology is determining the efficacy of exchanges among external firms, relationships among which were thought to be primarily of market transactions alone. In other words, technology is now going to play a much wider role in societies.

Technology is not only something coming along with new products and process but is the means and results of the communication process between different functions like R&D, production and market.

In a mass production era, product change was slow and relatively simple. A few standards evolving slowly could enable sufficient market based transactions to take place. Today, with the rapid pace of product changes, with complex interfirm partnerships, with transactions taking place not only in finished products but also in technology itself and often being carried out electronically over long distances, the ability to execute them efficiently has become a serious problem. Role of technology has, thus, become an all pervasive one.

Relationships of technology with industrial activities have been recently explored by Tassey (1992) as shown in Fig. 1. Here industrial technology is disaggregated into several components that reflect the major elements of the process by which scientific knowledge is made progressively application-oriented. As shown in the figure, there are four major elements of an industry's technology base. These are:

* Applied research and proprietary technology
* Generic technology
* Infratechnology
* Techno-managerial practices

Applied Research and Proprietary Technology

This refers to a definite body of know-how that has been proven in a form of specific prototype products and processes with fairly well-defined performance parameters, that can be used to make market specific development decisions. This is the output which has been attained in the final stage of technology development process as shown in Fig. 2.

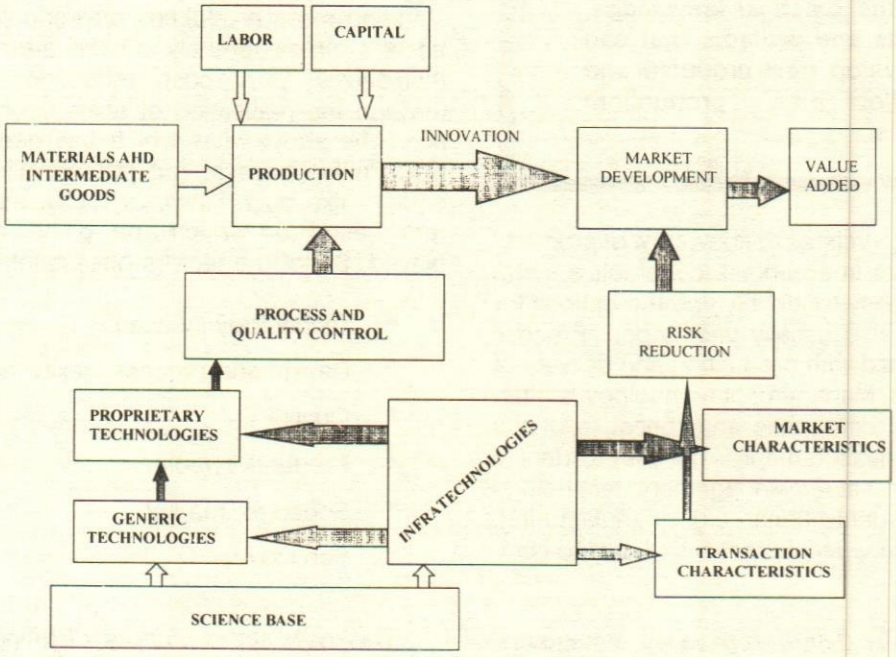

Fig. 1. Disaggregated Technology Model.

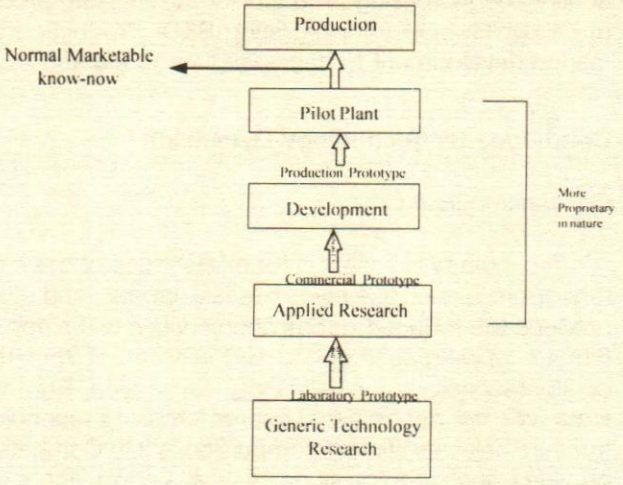

Fig. 2. Technology Development Cycle.

In Japan, a certain amount of technology development work is done also during the production stage. Different groups of working personnel make changes in the process or product technology so as to improve their productivity, quality and delivery performances. This practice is still not popular in other countries. But one can see the potentiality of higher marketability for such improved technology output.

It may be noted that there is a change in risk and utility structure as we go through the stages. At the generic technology research level, the output is of use to many industries as it could spin off many ideas, But the uncertainty in terms of return on investment is very high at this stage. But the last stage— the pilot plant is much more specific to the furtherance of the production stage. Depending upon the risk taking capability and the growth of the business environment, entrepreneurs of various nations develop different degrees of propensity to undertake technology developmental activity. In Indian conditions, so far, none of these technology developmental stages has been undertaken in a big way by private industries. However, in advanced countries like USA, Japan, etc. individual firms have been engaging themselves in all the stages of the above mentioned development process. Hence, the output has been a proprietary item having enormous marketable value.

Generic Technology

Generic Technology development is normally what is done in universities. Government laboratories or by research consortiums in close cooperation with industries. Its objective is to prove that a product or process concept with potential market applications has merit. In fact this is the first phase in the technology development life cycle. Traditionally this may be considered as basic research and a part of applied research. This phase ends with the proof of a concept which may be in the form of a laboratory prototype. Normally these developments will be succeeded by R&D activities at the individual enterprise level with a view to evolving a series of potentially useful competitive products and processes. An early and successful application of such generic technology inputs was semiconductor technology in Japan. In 1976, they launched their now-famous VLSI project. In four years, this cooperative research project between industry and government has caught up with and, to some degree, overtaken U.S. and European firms in semi-conductor processing technology.

In a second, less-appreciated application of this model, Japan pursued the economies of scope inherent in the processing technology by establishing in 1979 a similar cooperative research project in the important area of optoelectronics. Optoelectronics is a critical technology for communications, data and image storage and retrieval, and possibly data processing through optical computing. Through cooperative planning and subsequent cooperative research at the generic technology stage, the Japanese were able to accelerate the optoelectronics technology to the applied research stage. At this point, the Japanese Government basically removed itself from the technology development process (i.e. the pre-competitive line had been crossed). Individual Japanese companies, having the advantage of an early technological lead now greatly increased their individual investments in applied optoelectronics R&D bringing Japanese dominance in this critical techno-logy. Even USA has now invested considerable amount of money on this kind of technology development so as to ensure that their industries are capable of catering to emerging customer requirements.

Infratechnology

Infratechnology consisting of scientific and engineering data, measurement and test methods, practices and techniques has increasing applications with many of the hi-tech manufacturing enterprises in making their products acceptable to customers. For example , at the R&D stage, infratechnology provides measurement data and methods for testing materials with very high precision. Without these new techniques, much state-of-the art R&D would not be possible. For example, research in new high temperature superconductors has been impeded by the lack of a widely accepted

measurement method for determinig the current-carrying capacity of the superconductors. In the absence of such a method, researchers can not compare and verify their findings, At the production stage,measurement of standards and data are crucial for quality assurance and process control. In the past, measurement for process control was mostly static or 'snap shot' activity, occurring mainly at the end of the production. By contrast, many modern processes require continuous measurement and the ability to respond continuously to measurement change during production. Because products are increasingly based on advanced materials, where defects even at the single-atom level can affect performance characteristics, their production requires measurement-intensive control. For example, accurate measurement of the thickness and electrical properties of the thin layers within integrated circuits are essential for controlling the quality of those circuits during manufacture. Similarly, quality assurance was once mostly a matter of inspection at the end of production line. Today the emphasis is on making it right first time. Machines are being programmed to measure their own performance attributes, to measure the attribute of the products being processed and to adjust the production processes automatically to account for deviations from some ideal. Further, during market transaction, measurement data and methods play a role in providing confidence to the customers. For example, power transformers used by electrical utilities must have extraordinarily low electrical losses, since those losses can cost the utility much more over the life time of a transformer than its purchase price. Advanced measurement methods are necessary to detect these losses and severe penalties can be exacted by the buyer for the seller's failure to meet agreed loss specifications.

Besides generic technology and infratechnology, individual enterprises should adapt advance managerial practices to ensure proper utilisation of technologies.

Techno-managerial Practices

Besides generic technology and infratechnology, individual enterprises should adapt advanced managerial practices to ensure proper utilisation of technologies. Without good manufacturing practices, new products can not be developed with the required quality or the timing relative to foreign competition nor will new processes be productive and integrated effectively with the product development. Such practices as "concurrent engineering" and "total quality management" include concepts and standardized methods and techniques for assuring quality and increasing productivity, for enabling product mix flexibility and for integrating R&D, Production and market development to decrease time to market.

Conditions for Technology Dynamism

Competition as a Driver

Technology is essential for efficient use of basic factors of production like raw materials, labour, land etc. to produce the required goods and services in the society. Firms supplying such goods and service will, therefore, deploy-technology for necessary conversion, But these firms will not necessarily keep on crossing technology frontiers unless sufficient compulsion is felt. Competition provides such compulsions. A well known economist Arrow (1971) examines the issue of incentive for innovation by specifying monopoly and competitive market conditions. He argues "the incentive to invent is less under monopolistic than under competitive conditions. But even in the latter case, it will be less than what is socially desirable". However, it was Schumpeter (1950) who first recognized the central role of competitive forces to trigger off an innovation and pointed out that there is no equilibrium in competition. Much later, Michael porter (1985) propounded the theory of 'competitive advantage' being the central element for individual firms to compete in an emerging competitive market situation.

Technologies, especially those related to advanced materials, micro-electronics, information system, etc. become relevant only when the same are used by individual firms to create a sustained competitive advantage. As the situation becomes more competitive, major factor advantages are not enough to succeed in the market. Customers are also becoming discriminating objectively alternative offerings of goods and services. It is therefore, natural that quality, product features, introduction of new products etc., are gradually becoming winning criteria in the emerging market situation. Moreover, cost advantages grow as much out of efficiency in manufacturing properly designed products and with proper process technology as out of factor costs or economics of scale. This is the stage when individual firms realise the importance of technology dynamism through incremental innovation, breakthrough innovation or through diffusion of innovation.

Since the competition in every field fluctuates due to non-uniformity of market information, preferences of individuals, etc., every supplier firm has its own trajectory of technology dynamism. Literature has identified the nature of industry, the size and the firm's strategy to

be the major factors determining nature and degree of technology dynamism.

Since the competition in every field fluctuates due to non-uniformity of market information, preferences of individuals, etc., every supplier firm has its own trajectory of technology dynamism.

Product Life Cycle

Among factors describing the nature of industry, product life cycle has been found to be the most critical aspect as shown by Abernathy and Utterback (1978). Fig. 3 shows a typical pattern of the progress of technology dynamism over the product life cycle. Several product innovations are made in the beginning of the development of a new industry as various suppliers attempt to maximise the performances of their offerings. It is at this stage, users/customers who have a more intimate understanding of performance requirements and sufficient influencing power, play a major role in finalizing a few offerings among the many available innovative product seedlings. For example, three quarters of the computer models which emerged between 1944 and 1950 were developed by users, in one way or other. As the product standardises, demand reaches a higher volume and the production process gets integrated and incremental process innovations become a focus primarily to reduce cost.

However, such process innovations also get reduced in frequency as the integrated system stabilises and unit profit margin becomes too low, discouraging further investment. Such a stage is evident in the case of high volume products such as incandescent light bulbs, paper, steel, standard chemicals, etc. Thus it is the middle stage of industrial development where firms in a competitive economy have been found to have invested heavily on formal research and engineering departments, with emphasis on process innovation and product differentiation through functional improvements.

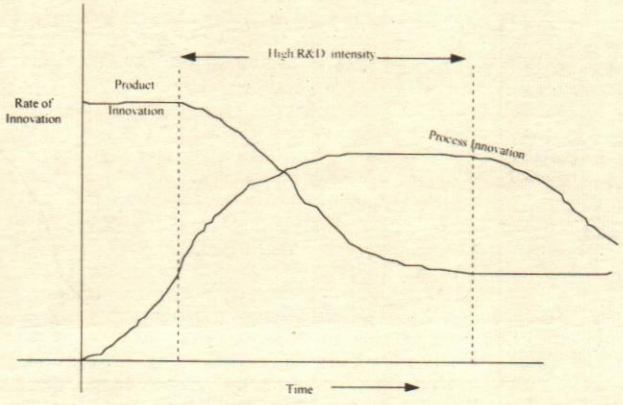

Fig. 3. Technology over Product Life Cycle.

This pattern of technology innovation has several implications, relevant of which are as follows:

* R&D service provider will be able to identify those industrial organizations that will be interested in contracting out some of their R&D activities.
* Many firms in developing countries, intending to borrow know-how from a developed country, may be able to decide the appropriate timing to make further technology innovation to suit local conditions.

Industry Classification

Considering product life cycle and other characteristics, Pavitt (1990) categorised industries/ businesses into 4 basic types, each of which has distinct technology trajectory. There are as follows:

* Science based businesses typically found in electronics and chemical industries.
* Scale intensive businesses found in basic materials, durable consumer goods manufacturing industries.
* Information intensive businesses like financial services, retailing etc.
* Specialised suppliers like machine tools, specialized chemicals, software development houses, etc.

As found in Fig.4 science based industries and specialized suppliers concentrate mostly on product innovations so as to match technology with specific consumer requirements. On the other hand, scale intensive and information intensive industries have major focus on process innovations. Technology infrastructure may provide applied R&D and other developmental assistances to science based industries. Infrastructural technology services could be very useful to specialised suppliers. Scale intensive and information intensive industries will be benefited by sharing of techno-

managerial practices, if available across industry boundaries. A typical case example of such adaptive innovation has been the Xerox corporation of USA who coined the term 'Benchmarking' to denote the same. Benchmarking has become such an effective learning methodology that leading firms in USA have voluntarily established a unique technology infrastructure known as "Benchmarking clearing house".

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	Definition			
	Science-Based	Scale Intensive	Information Intensive	Specialized Suppliers
Sources of Technology	R&D Laboratory	Production Engineering and Specialized Suppliers	Software Systems Dept Specialized Suppliers	Small Firm Design and Large-Scale Users
Trajectory	Synergetic New Products Applications Engineering	Efficient and Complex Production and Related Products	Efficient (and complex) information Processing and Related products	Improved Specialized Producers Goods (Reliability and Performance)
Typical Product Groups	• Electronics • Chemicals	• Basic Materials • Durable Consumer • Goods	• Financial Services • Retailing	• Machinery • Instruments • Speciality • Chemicals

Fig. 4. Basic Technological Trajectories

Firm Size & Strategy

It is often argued, on the basis of either Schumpeter's notion of creative destruction or the so-called product life cycle theory that technology dynamism, especially in relation to major product innovations is associated with the emergence of new small firms that exploit them, given the conservation, inertial and bureaucracy in established large firms. But Galbraith (1992) suggests that present day innovation requires large resources that can be afforded only by large firms. Philips (1965) examines an industry dominated by a few large firms coexisting with a number of small firms. Under such circumstances, he argues, higher market concentration may inhibit the Schumpterian non- price competition as well, through a tacit market sharing agreement among large firms. In such a situation, it is likely that smaller firms in a competitive condition, would become more innovative in order to create their market niche. Baldwin and Childs (1969) argue that with the advantages of size and resources, the big firms might, instead, take the position of "first second" by quickly imitating the innovation of other firms. All the above arguments point a "U" shape (Fig. 5) to describe a relationship between firm size and innovation (Nath - 1993).

The above relationship has been supported by empirical evidences. Data (Rothwell, 1984) from the UK on some 2300 important innovations introduced during 1945 to 1980 across 35 sectors of industry, shows that at an aggregate level, firms, having employees less than 500, account for about 20 percent of innovations constantly each year whereas innovations by the firms with more than 10,000 employees have been increasing steadily from 36 to 52 percent. Moreover, the data also shows that large firms increasingly have innovated via-smaller units and that smaller firms are increasingly being displaced by subsidiaries of large firms as the major source of innovations.

In another empirical evidence (Pavitt, 1990) related to electronic industry of U.K. since 1945, the proportions of significant innovations made by both large firms (with more than 10,000 employees) and by small firms (with fewer than 1000 employees) have both been increasing at the expense of medium-sized firms. It is no wonder that established chemical firms have successfully survived and indeed benefited from successive streams of radical innovations in synthetic products. Similarly, IBM, which is a leading firm in computers, was also a world leader in the earlier

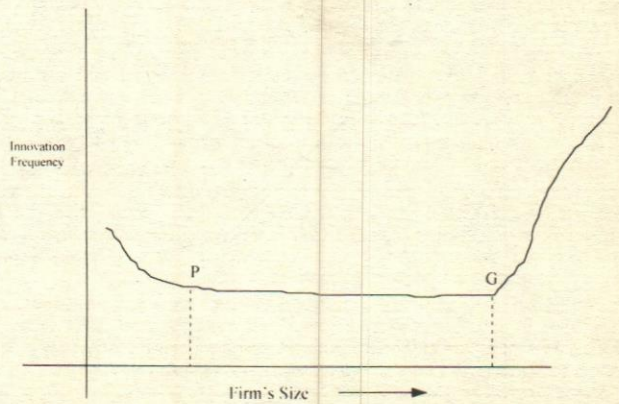

Fig. 5. Technology Development against Sizes

traditional electro-mechanical technologies of office machinery. All these observations indicate that technology infrastructure will be more effectively utilized by dynamic small firms and leading large firms.

Technology infrastructure will be more effectively utilized by dynamic small firms and leading large firms.

Firm's strategy, reflected in its collective disposition towards the preference of means adopted for commercial ends assumes major significance in its investment on technology infrastructure. Many authors have attempted to categorize the firm's strategy in relation to its technological dynamism or innovation. Freeman (1982) makes a six-fold classification of innovation strategies, ranging from 'offensive' strategies designed for technical and market leadership, through, 'defensive', 'imitative', 'dependent', 'opportunistic' strategies to 'traditional' strategies of producing unchanging products for unchanging markets, Each of these strategies displays a characteristic pattern of technological dynamism in terms of in-house scientific and technical activities as shown in Fig. 6.

The firm pursuing an 'offensive' strategy will normally be highly 'research-intensive' since it will usually depend to a considerable extent on in-house R&D. However, it will attach considerable importance to patent protection since it is aiming to be first or nearly first in the world and hoping for substantial monopoly profits to cover the heavy R&D cost it incurs. Examples of such an offensive strategy are RCA's development of television, Du Pont's development of nylon and coirfoam, IG Farben's development of PVC, ICI's development of Terylene, etc. Though debates have been raised whether these firms are engaged in basic research, it is logical to believe that these firms do participate in innovation. Slightly later in the cycle they are joined by those firms following 'defensive' or 'imitative' strategies. Infact, several surveys have shown that in all the leading countries, most industrial R&D is 'defensive' or imitative in character and concerned mainly with the modifications of existing products and processes technical services and other work with short-term horizons.

More or less along the same logic, Richardson et. al (1985) have classified firms again in six categories but their classification has been made in respect of the manufacturing mission and the approach adopted by firms. The categories are:

* Technology frontiersman
* Technology exploiter
* Technological serviceman
* Customizer
* Cost-minimizing customizer
* Cost minimizer

Some of the typical characteristics for each of them are given in Fig. 7. As shown, it is again the top two categories—Technology frontiersman and Technology exploiter that are engaged in heavy R&D work. Infratechnology services could be in greater demand with Technological serviceman and customizer.

Recently Parker (1982) categorized a firm's innovativeness in terms of the nature and caliber of manpower deployed and the kinds of outputs obtained in activities related to product development.

Strategy	In-house scientific and technical functions within the firm							
	Fundamental research	Applied research	Experimental development	Design engineering	Production engineering quality control	Technical services	Patents	Scientific and technical information
Offensive	+	+	+	+	+	+	+	+
Defensive	-	O	+	+	+	O	+	+
Imitative	--	-	O	+	+	-	-	+
Dependent	--	--	-	O	+	--	--	O
Traditional	--	--	--	--	+	--	--	--
Opportunist	--	--	--	--	--	--	--	+ +

Key + + = (very strong) + = (strong)
O = (average)- = (weak) -- = (very weak/non existent).

Fig. 6. Strategies of the firm

Characterization	Description	Corporate Example
Technology Frontiersman	R&D driven : constant new product introduction; price competitive markets abandoned	Hewlett Packard
Technology Exploiter	New products, but follows life cycle through to maturity; product development linked with production design and emphasis on low costs	Texas Instruments
Technological Serviceman	Custom service on complex system for low volume customers and markets; Excellence in product design	Boeing, Rockwell, Missile Division
Customizer	Job shop manufacturing build to custom designs; low volume	Hughes Satellite Division
Cost Minimizing Customer	Low volume mature products manufactured to individual customer designs	Shipyards
Cost Minimizer	High volume standard products	P&G Household Products, Eastman Kodak, etc.

Fig. 7. Manufacturing Strategy Types

He has again proposed six levels of technology as shown in Fig. 8 to denote a companies capacity for innovation. Levels 1 and 2 will seek repetitive solutions from past experiences when encountered with a new product design. At levels of technology 3 and 4, the main differences stem from the emphasis given to evolutionary development.

Innovation is important at technical levels 4, 5, and 6, and aim of the companies operating at these levels must primarily be to generate profits at a level consistent with funding radically improved products, knowing that major ones may result in a negative cash flow for at least five years. The strategic plans of these firms normally seek to increase efficiency throughout the company, stimulate low-cost process innovation, and so provide funds to finance new ideas from which major developments will stem.

Indian Scenario

Pre-liberalisation era saw Indian industry requiring S&T infrastructure to supply technical manpower for very limited purposes, Essentially they are engaged in:

* Plant design and construction
* Quality control during manufacturing

Level of Technology	Nature of problem-solving task required to convert an idea into of a new product	Staff required for new product development	Completion of the problem solving tasks would justify
1.	Repetitive solution from simple choice of things learnt	Craftsman	Only rare mention in publications
2.	Patterned, discriminating choice from past experience and existing knowledge	Craftsman and technical	Mention in trade journals.
3.	New ideas. Moderate level of uncertainty. Improvement main aim	Qualified Engineer/Scientist	Mention in technical journals
4.	New products alien to production and marketing enterprise. Open end problems with infinite number of possible solutions. High uncertainty	Highly experienced engineer/scientists	Publication of papers in scientific or technical journals
5.	Adaptive. Discriminating choice of spin-off from high/medium technology	Engineer/Scientist National reputation	Publication of papers in 'prestige' journals and cause substantial modification to textbook
6.	Precisely formulated, unambiguous high technological goals. New knowledge, power of abstract thinking. Often quantitative problems and singular solution.	Engineer/Scientist International reputation	Sufficient papers in 'prestige' journals to justify a new textbook

Fig. 8. Technology levels in product innovation

There has hardly been any significant R&D activities in Indian industry. At an aggregate level, Indian firms spend about 0.7 percent of their sales turnover on so called R&D activities. Attitude to technological innovation has been so far 'traditional' expecting that the products made on external know-how borrowed one time will sell for ever.

Attitude to technological innovation has been so far 'traditional' expecting that the products made on external know-how borrowed one time will sell for ever.

Absence of competition is the main reason for such limited requirements of S&T infrastructure. Some argue that sizes of individual firms are too small to invest on R&D.

There have been some exceptions which could be found in industries – Electrical & Electronics, Drugs and Pharmaceuticals, Automobiles and chemicals where few firms like TELCO, Ranbaxy, Gharda chemicals. BHEL, etc. have exhibited 'defensive' innovation strategy. The manufacturing mission pursued by these firms can be classified as Technology Exploiters.

The above scenario is expected to undergo changes in coming years. In a survey (Nath, 1993) made with more than 300 private sector organisations, 90% of respondents indicated that they were to be more technologically dynamic in days to come in the forms of increased in-house R&D and faster commercialisation of indigenous technology. They feel confident about their capability of quickly adapting and absorbing foreign technology and also building up indigenous technology.

About 50% of the respondents declared that their R&D activities were to be directed towards manufacturing sciences and technologies including application of micro-electronics so as to achieve higher productivity and upgradation of industrial processes. In other words, process innovation is going to be the central thrust for Indian firms at least during ninties. "Cost Minimizers" will be their preferred manufacturing strategy. 'Dependent' strategy will be their stand towards technological innovation which is already discerned.

Some of the leading firms especially in automobile and pharmaceutical industries have initiated product innovation activities in an organised manner. But their level of technology as Parker has defined may not be higher than four (4) as anecdotal evidences indicate.

Strategies for Utilization

Indian industrial conditions are not yet ripe enough to fully utilize the potentiality of the available technology infrastructure except in some special cases. Managements of such infrastructure should therefore think of globalisation for their proper use.

Indian technology infrastructure possesses the following three distinct competence and factor related advantages:

* Capability of Indian S&T manpower is superior.
* Cost of personnel and other necessary resources for developing technology is much lower in India.
* Indian researchers are quite alert and capable of understanding further customer requirements due to proficiency in English language, and up-to-date knowledge base.

Internationalisation of services has been widely practised in UK and USA which have been exporting services since long in areas of accounting, legal, Engineering, construction, etc. Export of Indian R&D services is therefore quite a possibility. It could be made in many forms (Mashelkar, 1995) :

* Innovation sale : Here an exploitable idea or a concept is sold provided the same is useful at the global standard. National Chemical Laboratory (NCL), Pune has recently successfully negotiated licensing of its US patents on a high performance material with a U.S. firm for an attractive price.
* *Contract Research* : Here a project or a part of it, is sub-contracted by a foreign firm to an Indian service provider. The Indian Institute of Chemical Technology (IICT), Hyderabad, for instance, is undertaking custom synthesis for Abbott Laboratories, USA.
* *Collaborative Research* : It could be a very important vehicle, where synergies of an Indian R&D outfit and foreign firm are used effectively.
* Technology Licensing : Technology could be licensed out on an exclusive or a non-exclusive basis. NCL'S licensing out a catalyst technology

to a leading multinational in Europe is a typical example.

The Council of Scientific and Industrial Research (CSIR), the largest technology infrastructure outfit of India has earned about $ 2 million during the last three years from exports of technology and services to industrialized countries. It could be a trend setter, though a humble one. In order to exploit the opportunity, each infrastructure organisation should organise its internal service delivery process more effectively and allot substantial budget resources for export market development of its services.

Each infrastructure organisation should organise its internal service delivery process more effectively and allot substantial budget resources for export market development of its services.

Market segmentation and identification of potential customers is the first step in market development. Large firms belonging to science based industries and to specialised suppliers categories, according to Pavitt's framework, could be the initial target group. Those firms should be of following strategy types :

* Defensive and offensive to innovation (Freeman)
* Technology frontierman and Technology exploiter (Richardson et al)
* Levels of Technology - 3,4, and 5 (Parker)

These firms may be located in countries like USA Germany, Switzerland, Sweden and other European countries where certain traditions of doing collaborative research with outside agencies are prevalent.

Many Indian firms are expected to start setting up in-house R&D facilities atleast for doing adaptive product innovation work. These firms will have organised groups of scientists and technologists and will thus correspond to levels 3 and 4 according to Parker's model. At this stage, infratechnological inputs, besides manpower, will be important. Kinds of technical information, standards, methods of measurements, etc. will be critical. High volume commodity producers may also look for benchmarking services for evolving better work practices to achieve higher levels of productivity and quality.

Technology infrastructure has another important role in creating scientific outlook and improving the quality of life.

In order to enable Indian industries achieve long-term competitiveness, nobody can deny the need for investments for doing generic or no-competitive research on frontier technological areas such as advanced materials, bio-technology, micro-electronics, superconductivity, etc. Break through in these areas will be greatly benefiting Indian industries in future. It is, therefore, essential that, like US and Japanese firms, some large Indian organisations, especially those having the ambition to follow 'offensive' innovation strategy in future, should collaborate with the national government to undertake research work on a priority basis.

Technology infrastructure has another important role in creating scientific outlook and in improving the quality of life for Indian citizens. Pursuance of this role will also have beneficial effects on Indian industries as it will create a more discriminating and sophisticated customer base.

Conclusions

* Technology infrastructure that has been created over the years in India has several advantages in terms of quality output and cheaper resources. Technologically dynamic organisations of the world may find the Indian infrastructure quite suitable for undertaking collaborative research work. But the most important aspect, in this endeavour, will be the willingness of the managements of the Indian infrastructural institutions to market themselves in a focused and assertive manner. some of the guidelines given in this article towards identification of potential customers may help the management in sharpening the focus. Let's hope that the 'knowledgeware' of India will be as good as Indian software in serving mankind.

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Experience is not what happens to you but what you make of what happens to you.

– ALDOUS HUXLEY

Feature

Partnering & Strategic Alliances: A Benchmarking Perspective

Mohamed Zairi

In today's competitive business world, strategic alliances are the order of the day as business partners share know how and unique resources. The article explains the salient features of such alliances and the essential requirements for success in those ventures.

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As competition intensifies, manufactures and service providers alike find themselves increasingly having to deploy more resources and effort in order to maintain their position in the market place. During the period when market conditions were favourable, competitors were dealt with ferociously and strengths were built on all aspects of competition including technology, methodology, strategy, resource allocation, customer policy and so forth. This is not the case any longer, market conditions have changed dramatically and resource availability has become a key issue. In addition, at a macro level, tighter regulations and attention given to environmental issues mean that competition has become cut throat.

At the core of the changes in the nature of competition is technological advancement which has narrowed the gap between organisations by enabling all organisations exploit available technologies to deliver products and services of similar quality standards. Information availability and the exploitation of computer technology mean that most organisations have similar intelligence and information on market trends, consumer behaviour and so forth. Managers have come to the realisation that having a competitive advantage does not necessarily mean dominating in all aspects of business operations. It is necessary to identify the source of the competitive advantage and to protect it as much as possible by deploying resources in the right way. In the 1980s for instance we have seen a major move from large organisations to sub-contract many aspects of their business, particularly in areas where the competitive advantage was not thought to be so great.

Competition is regarded in a novel way with an intelligent approach of protecting competitive advantage, without straining to do everything and having all operations within. In some industries there have even been braver moves of sharing resources with competitors for the development of specific projects or the exploitation of particular technologies.

Building effective partnerships for carrying out benchmarking exchanges on a regular basis creates the opportunity for going beyond specific process exchanges and sharing benefits from joint strategies.

The concept of partnering or strategic alliances is gaining momentum. It takes many forms such as joint ventures, research consortia, cross-licensing amongst others. Whilst benchmarking when applied for the first time is process specific and does not necessarily commit the organisations concerned to compromise their strategies, strategic alliances however mean that there are long term implications for the partnership, large resource implications and the requirement for a commitment to manage the interface between the organisations concerned. Building effective partnerships for carrying out benchmarking exchanges on a regular basis creates the opportunity for going beyond specific process exchanges and sharing benefits from joint strategies.

There has been a lot of talk about the difficulty in introducing strategic alliances and numerous examples of disastrous outcomes are frequently reported in the literature. In addition, it is sometimes thought that strategic alliances introduce inertia, stifle innovativeness and are not of great benefit to the end customer. Robert (1992) for instance argues: "Alliances generally reduce competition, and reduced competition is not good for the consumer or the companies that are affected. They usually produce higher prices for the consumer and breed complacency in the companies involved."

This however, may not be entirely true if strategic alliances are allowed to evolve as a result of benchmarking. Strategic alliances which are developed from a TQM drive with a need to optimise process performance and deliver better standards of quality to the end customer are certainly meant to delight the customer. In addition, strategic alliances which are born from a culture of exchange through benchmarking create a better climate for innovativeness and creativity. Lastly, the competitive advantage as argued earlier is going to be unique for each individual organisation and may not form part of the strategic alliance agreement and therefore will not affect the nature of competition in any significant way.

What is Meant by a Strategic Alliance?

Strategic alliances have been described in a variety of ways because they tend to include a wide range of agreements including joint ventures, R&D collaborations, equity investments, university research agreements, product licensing agreements amongst others.

Strategic alliances are not proper organisations based on formal structures and reporting systems. The links are common interests for short and long term prosperity, delivered through the commitment and endeavours of key groups operating at various levels. Forrest (1992) suggests the following definition:

"Strategic alliances are those collaborations between firms and other organisations, both short and long term, which can evolve either partial or contractual ownership, and are developed for strategic reasons."

The key points which can be derived from the above definition are that:

Strategic alliances are based on common interests for short and long term prosperity, delivered through the commitment and endeavours of key groups operating at various levels.

* Collaboration may take place not only between firms but also between firms and other organisations such as universities, research institutes
* The nature of alliances could be of short term and long term
* Strategic alliances may involve equity participation or contractual ownership
* Strategic alliances can impact on competitive strategies of the partners concerned and could form an essential element of those.

Learning from Japan: How are Partnerships Developed?

To understand how strategic alliances and partnerships develop in Japan, it is important to first of all focus on the role of the Japanese government. Essentially, the government in Japan assumes a facilitating role in a proactive way to promote high productivity levels and long term competitiveness of Japanese organisations. This role has been referred to as developmental rather than regulatory, as is the case in the West.

The role of the state in Japan can perhaps be examined at three working levels:

- The role of deliberation boards, referred to as *Shingikai* which is basically to establish industrial policy that is workable.
- The composition of these boards includes government ministers and representatives from the industrial sectors concerned and the remit is to review existing policies and to develop strategies for offering help, advice and support.
- Administrative guidance on a continuous basis, referred to as *Gyosei shido* where there is constant dialogue, communication and help lines.
- Trade associations are also very active in Japan, they are a powerful voice representing the views and interest of the industry sectors and bringing together the government and industry.

Strategic alliances work in Japan because of the favourable climate created by sound, long term and clear industrial policies and a state system which is committed to the prosperity of the nation. Strategic alliances work through two main approaches referred to as *Keiretsu* (industrial groupings) and *Zaibatsu* (inter-dependence through holding company).

KEIRETSU

This system evolved after the second World War when capital was difficult to raise and the only alternative was major banks. Indeed affiliation to major banks in Japan is the normal practice and banks such as Mitsui, Sumitomo and Mitsubishi played a key role in the development of strategic alliances, over the years. Through the *Keiretsu* system banks accepted and sometimes encouraged the sharing between companies since there are common benefits.

Japanese Business Alliance is known as *Kinyu Keirutsu* (financial lineage) or as *Kigyo shudan* (enterprise group) (Gerlach, 1987) and is based on cooperation rather than control. There are three critical elements at the core of strategic alliances as described by Gerlach (1987):

- The creation of high-level executive councils representing the group members and also creating a forum for exchange and cooperation.
- The creation of a structure for exchanges and networking to identify the contribution of each specific company and also to identify the constraints and operating boundaries of the alliance.
- Common interest through specific choice of projects that would lead to common benefits thus demonstrating that the principle of *Kigyo shudan* works.

ZAIBATSU

The alliance is controlled by a family-held holding company. This principle essentially works through the replication of relationships between suppliers and customer at various levels. Amongst the key factors which make this type of alliance work are the following (Zairi 1991):

- Cooperation and involvement at various stages of the product development process. Through joint multi-disciplinary teams problems are tackled and benefits shared.
- The encouragement of innovative thinking through team work, inter-organisational new product development and management and the sharing of resources, knowledge and other benefits.

The performance of alliances based on the *Zaibatsu* approach is not viewed at individual company level but at a macro level, from a societal perspective. In times of hardship and duress, the allies display unity reflecting true inter-dependence, and a common stance. For example, employees who belong to a depressed industry sector are often transferred to alliance partners where the prospects are better.

Strategic alliances provide a good equilibrium between external and internal relationships enabling organisations to focus more on optimising product development, raising productivity levels and developing skills since there are no distractions from outside and the climate is, supportive and favourable.

Strategic alliances provide a good equilibrium between external and internal relationships enabling organisations to focus more on optimising product development, raising productivity levels and developing skills and knowledge of employees, since there are no distractions from outside and the climate is, supportive and favourable. This happy equilibrium has helped the

introduction of life time employment (referred to as *shushin koyo seido*).

This is essentially the way business is conducted in Japan with emphasis on cooperation and learning through open exchange rather than conflict and obstructiveness. The prosperity of individual organisations is very much dependent on the prosperity of the country as a whole.

YUGOKA

Whilst the *keiretsu* is mainly between large companies, *Yugoka* is a type of strategic alliance which brings together small companies from different industry sectors. There are currently over 3000 Yugokas meeting on regular basis, the average size of each Yugoka being 30 companies. Yugokas were formed as a deliberate government policy to help Small to Medium size Enterprises (SMEs) collaborate, exchange information on areas specific to their types, conduct joint R&D projects and cooperate in all aspects. In 1988, the Japanese government passed a bill to this effect, called 'Bill for Temporary Measures to Facilitate the Development of New Fields through Tie-ups among Small Businesses in Different Fields'.

The Japan Small Business Corporation (JSBC) of the Ministry of International Trade and Industry manages the working of the various Yugokas. Yugoka is a mixture of industries, having similar sizes and similar capital investment. Only small companies having the capability and know how to design and manufacture their own products are eligible.

Senior management commitment is mandatory and chief executives have to attend and actively participate in meetings which take place once a month.

Government support is given at all stages:

Stage 1: (knowing each other) involves:

* Information Exchange on common interests, company visits
* Preliminary discussion between small businesses to analyse ideas for joint development.

Stage 2: (using each other) entails the formation of

* Specific groups with mutual interests and feasibility studies on agreed areas for cooperation;
* Role definition for each partner.

Stage 3: creating each other

* The commercialisation of joint developments takes place at this stage
* Partners discuss various possibilities of repeating the experience on another project, or joining other groups or leaving the Yugoka altogether
* It takes between 4-5 years for a joint project to be completed from stage 1 to stage 3. Progression from stages 1 and 2 is the most difficult aspect and most drop outs take place during those who stages.

SMEs join Yugokas for various reasons. A survey conducted in 1989, indicated that there are four major reasons why companies wished to join:

* To exchange information on market and technology (65% of respondents)
* To improve business performance (60% of respondents)
* To participate in joint development of new products (55% of respondents)
* To participate in joint development of a new service (35% of respondents).

Relationships and partnerships need to be given time to evolve strategic alliances of this kind to not happen over night. SMEs do not embark on a full scale new product development scheme from day one. The survey indicates that most companies in Yugokas are still at the information exchange and 'getting to know you' stage (60%), 18% of Yugokas have gone further and are at feasibility stage, and 14% only are at the commercialisation stage and maturing. Furthermore, the survey revealed that it is very hard to strike perfect partnerships from the beginning; of all Yugokas at stage 1, only 27% reported that they were progressing smoothly and 15% are no longer active.

What are the critical factors which lead to the success of Yugokas?

* Adoption of best practice technology;
* Regular and continuous level of interactions, sharing of information and knowledge on products, services, operations and practices through visit;
* Representation of participant companies at chief executive level thus demonstrating high

commitment and also enabling the partners move quickly with decisions that need to be made;

* Ultimately, progress that can be made by the various Yugokas is heavily dependent on the role of an appointed coordinator/ facilitator, perhaps an experienced consultant knowledgeable on technological issues to prompt the participants and help them determine the key area in the market to focus on and to gather various information of strategic value. The coordinator/ facilitator should also pinpoint areas for pitfalls, and recent changes in the market place to ensure that the Yugokas work in a dynamic way and their decisions represent current and future trends;
* Good facilitation should also ensure continuous learning resolving conflicts between member organisations straight away, so that the level of synergy, inter-dependence is not threatened.

Successful Strategic Alliances

Successful alliances are often between partners who can positively contribute by having their own competitive advantage or unique strength and also those who are not directly competing with or after the unique advantage of their partner. Robert (1992) reports on the following two strategic alliances which were done for the right reasons:

Successful alliances are often between partners who can positively contribute by having their own competitive advantage or unique strength and also those who are not directly competing with or after the unique advantage of their partner.

3M and Squibb Corp: This is a mutually supportive relationship with each partner bringing in a key strength. 3M contributes its strength in polymer chemistry technology that can be used in the development of drugs which Squibb has its unique distribution system to doctors and drug stores that 3M has no intention of copying.

Apple and IBM: Apple brings its unique graphic and user friendly software whilst IBM uses its powerful RS6000 computer chip. This alliance can bring big leaps in computer technology and establish the superiority of this partnership above other competitors such as Sun Microsystems and Compaq Computer Corp.

Fiat and Peugeot: A strategic alliance took place between the two companies in 1978, referred to as SEVEL (Societa Europa Veicoli Leggeri) for the production of a light van (Lorange & Roos, 1991). Because of limited resources, the two companies combined their R&D capability and manufacturing operations. Marketing and sales strategies remained internal to each company however. Because there was no attempt at controlling the course of the alliance, both companies benefited in a variety of ways.

Kubota and SimthKline: Kubota was Japan's number one producer of agricultural equipment for nearly 100 years. However in 1988, Kubota surprised everyone by shipping its first state of the art and very advanced mini-supercomputer. This success came about through strategic alliances with software and chip manufacturers in the Silicon valley in the USA. Throughout the whole experience Kubota did not attempt to gain control over its partners but kept encouraging them with the provision of cash and other resources for the completion of the project. Kubota used its unique strength of assembly know-how to put the computers together and ship them all over the world (Lewis, 1992). All involved parties benefitted from this partnership, Kubota entered a new market, and the U.S. partners developed further manufacturing know-how through the injection of vital capital from Japan, to advance further and protect their competitive advantage.

Failed Strategic Alliances

There are mainly three pitfalls which cause strategic alliances to fail as illustrated by the following examples of failures (Robert, 1992).

General Motors and Toyota: This was a strategic alliance based on trying to correct a weakness which means that the stronger partner is allowed to dominate and control. General Motors' and Toyota owned a manufacturing plant jointly for the production of small high quality cars. General Motors entered into this partnership wanting to learn from Toyota about the production of small quality cars since this was its major weakness. Ten years after the project started, Toyota has done better than General Motors and is selling cars with its name plate 6 times more than those with GM's name plate.

Interfirst and RepublicBank Corp: This is a partnership of two banks wanting to correct a weakness. The new company called First RepublicBank Corp

collapsed because the two partners brought with them a lot of bad read estate loans.

Soni and Bell Laboratories: This type of alliance basically gives the edge to a partner through the licensing of proprietory technology. Soni managed to acquire its transistor technology from Bell Laboratories for as little as $25,000. This led to the complete removal of all US manufacturers of radios.

Alco and General Electric: The American Locomotive Co (Alco), faced with the challenge to stay ahead in industry and pressurised by advanced technologies joined forces with General Electric. The relationship did not however work out and Alco was driven out of business. Clayton (1992) argued that if one of the partners is bigger in size and has full control over key technologies required for the joint project, then it is very difficult for the smaller partner to exert any influence. If their unique strength is in areas such as marketing, sales, people and customer knowledge, these can be replicated to a large extent. Clayton (1992) concludes by saying: "...The defence of the smaller firm must lie in controlling vital technology that the bigger partner needs to make a saleable product. And regrettably, this Alco never had."

Implementation Strategy for Effective Alliances

Forrest (1992) suggests the following three stages for the development and effective exploitation of strategic alliances.

Stage 1: Pre-Alliance Stage: Matching

Right timing of alliance
Choosing right partner
Good fit between partners
Interdependence of partners
Assessment of strategic costs
Matching of alliance with overall long-term strategy of firm

Stage 2: Pre-Alliance Stage: Negotiating the Alliance

Putting in the time and effort
Strong bargaining position
Development of mutual strategic objectives
Involvement of personnel skilled in negotiating
Top management support
Identification of who will manage alliance
Identification of alliance champions and deal busters
Understanding of partners' strategic intent
Development of trust between partners

Stage 3: Elements of Alliance Agreement

Comprehensive detailed agreement
Scope and objectives of alliance
Resources to be allocated by partners
Definition of duties of parties involved
How alliance is to be managed
Patent, intellectual property, publication policies
How to resolve conflict
Milestone points
Built in flexibility
Exit terms

Stage 4: Implementation of Alliance

Open communication between the two parties
Mechanisms to facilitate communication
Focal point person
Alliance champion
Mechanisms to ensure timely decision-making
Continual mutual commitment of resources needed (e.g. facilities, manpower)
Willingness to change strategic objectives when needed
Good interpersonal relations between partners
Good leadership and motivation of those running the alliance.

Benchmarking & Strategic Alliances

Benchmarking is the key for continuous learning and for the development of the urge to constantly improve, adapt and develop strength. Benchmarking requires a strategy which addresses issues of choosing partners, the choice of the technology, process or practice that needs to be studied, the desired outcomes and the strategic expectation both short term and long term. Although in most cases, benchmarking tends to be short term in its working and the choice of partners is only for specific areas and the exchange stops at information sharing and company visits stages, there is scope for extending the exchanges to go beyond the sharing of information, towards the exploration of joint projects with mutual benefits. Strategic alliances are an extension of benchmarking and as such enhance the learning process considerably more. Strategic alliances enable organisations to continuously learn and exploit state of the art technologies and practices, they can also enhance

Benchmarking is the key for continuous learning and for the development of the urge to constantly improve, adapt and develop strength.

employee development thus providing a pool of knowledge that gives a competitive edge to the organisations concerned. On this point, Lewis (1992) writes:

"Highly innovative, 'high-learning' organisations have a strong propensity of seek and adapt new ideas from all sources. Every outside contact is seen as a chance to find useful practices to be applied at home. On the inside, high learning firms are woven together by countless informal networks that build collective understandings with new information from experience, partners, customers, classrooms and extensive literature scanning". "In high learning firms, part of every manager's job includes encouraging experimentation and helping people find better ways to do things. Failure is not only tolerated; it is expected to lead to new insights and add to the organisation's knowledge. Assumptions are regularly revisited to avoid the trap of yesterday's wisdom."

These quotes demonstrate the spirit of never ending improvement and the continuous search for excellence that successful strategic alliances could establish and as such prove that there is full compatibility between the preachings to Total Quality Management and the role of benchmarking in establishing partnerships and seeking the best practice for continuous learning.

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The fusion of knowledge is the most creative act of the human mind.

– ELWOOD MURRAY

Feature

Analytic Hierarchy Process for ISO-9000 Certification

Rambabu Kodali & Ranjit T.

ISO-9000 is the well known and widely accepted quality system based on the philosophy that an integrated, systematic and planned approach only can ensure quality. In India, the adoption of ISO-9000 is not spontaneous. The implementation of ISO-9000 involves complex decisions. This paper describes a Multi-attribute Decision Model using the Analytic Hierarchy Process for selection of an ISO-9000 certification.

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The trend in recent years is towards 'Globalisation'. The approach in industry till recently was towards appraisal and correction of quality, which can be called quality through inspection. The same is now transforming to planning and prevention which can be termed as the quality assurance approach. ISO-9000 is a series of standards which intends to achieve the same. It is the minimum acceptable level for a supplier, particularly regarding exports to the western markets. The ISO-9000 certification adds to the credibility and image of the company and enhances the marketing advantage. It provides an efficient and economical means of ensuring the satisfaction of customer requirements through all stages, guaranteeing good design, reliable and safe performance, prompt delivery and efficient service.

ISO-9000 certification provides an efficient and economical means of ensuring the satisfaction of customer requirements through all stages, guaranteeing good design, reliable and safe performance, prompt delivery and efficient service.

In consonance with global trends, the Indian industry too is taking up accreditation of its quality system as per the ISO-9000 quality standards. The ISO-9000 is based on the simple philosophy that an integrated, systematic and planned approach can ensure quality. The quality system of most Indian companies is in the evolutionary stage. In India, the focus on quality control remains confined to ensuring the fitness of goods for domestic consumption, reduction of wastage of resources, and the facilitation of the export of certain resources and products. A 1980 survey, published in the Journal of Quality Technology, showed that less than 2 percent of Indian manufacturers used control charts

while less than 10 percent used sample inspection methods that they could explain and defend in an audit. The high effectiveness of even these basic SPC tools on the prevention of quality deviations, scrap, waste and re-work, therefore, is almost unexploited by the Indian industry. It is only the customer pressure for quality that has driven the Indian industry to consider implementation of ISO-9000 (Bagchi, 1994).

ISO-9000 Standards & Guidelines

The ISO-9000 standards are actually guidelines for managing quality rather than being 'standards'. It consists of four models of quality management the ISO-9001, 9002, 9003 or 9004, with the supplier picking the one that best suits his business needs. The selection of the model depends upon the market, nature of the product, production processes and customer's needs (Bagchi, 1994).

ISO-9001 specifies the quality system requirement for use by the supplier where a contract between the customer and the supplier requires the demonstration of his capability to design, produce, install and service a product.

ISO-9002 specifies system requirements for use where a contract requires demonstration of a supplier's capability to control the process that determines the acceptability of the products supplied. This standard aims at preventing and detecting any nonconformity during production and installation. ISO-9003 specifies the features of the quality system where the contract requires demonstration of the capability to detect and control the disposition of any product non-conforming during final inspection and test. ISO-9004 applies to non-contractual situations. It describes a basic set of elements by which a supplier may develop and implement quality management systems. The attributes of ISO-9000 are as specified by ISO-9004, which is the quality system guidelines. All these attributes may require varied level of commitment with respect to the standard 9001, 9002 or 9003.

As Agarwal (1993) expressed an effort has been made to analyse and identify the factors which will be crucial in its success in Indian context. Chandrasekar (1992) attempted to throw more light on the grey areas to unveil ISO-9000 in its true perspective and answered some of the most commonly asked questions on ISO-9000. De et al (1993) used an AHP framework for evaluating the quality system in Indian electrical and electronic industries gearing towards ISO-9000 registration.

Development of the Model

The analytic hierarchy process (Saaty, 1980) has been well received in literature. Applications of this methodology have been reported in numerous fields. The general approach of the AHP is to decompose the problem and to make pairwise comparisons of all elements on a given level with respect to the related elements in the level just above. A highly user friendly computer model was developed which assists the user in evaluating his choices. The schematic presentation of the model is shown in Fig. 1.

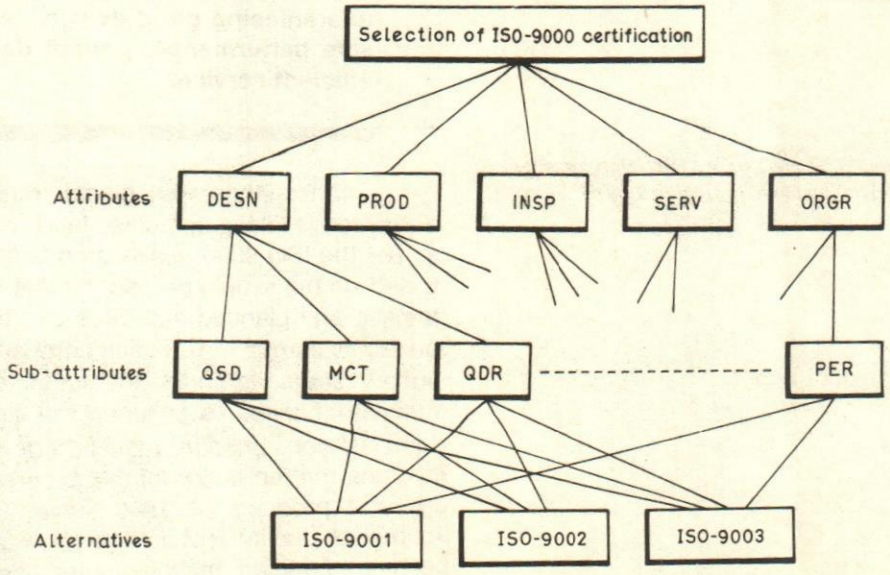

Fig 1. Schematic Presentation of the AHP Model

The general approach of the AHP is to decompose the problem and to make pairwise comparisons of all elements on a given level with respect to the related elements in the level just above.

Description of the Model

A thorough analysis of the problem is required along with the identification of the important system attributes involved. In this problem, there are varied levels of commitment required for the three standards. Based on the ISO-9004 guidelines, the extent of commitment which is necessary for ISO-9001, 9002 and 9003 can be determined. The selection of attributes was through literature survey, discussion and consultation with the industry personnel. The attributes and sub-attributes used in AHP are:

Design (DESN)

* Quality in specification and design [QSD]
* Material control and traceability [MCT]
* Quality documentation and records [QDR]

Production (PROD)

* Quality in procurement [QP]
* Quality in production [QPR]
* Control of production [CP]
* Use of statistical methods [USM]

Inspection (INSP)

* Control of verification status [CVS]
* Product verification [PV]
* Control of measuring & test equipment [CMTE]
* Non conformity [NC]
* Corrective action [CA]

Servicing (SERV)

* Handling and post-production functions [HPF]
* After sales servicing [ASS]

Organisational Responsibilities (ORGR)

* Management responsibility [MR]
* Quality system principles [QSP]
* Auditing the quality system (internal) [AQS]
* Quality in marketing [QM]
* Quality records [QR]
* Personnel [PER]

The alternatives are the ISO certification chosen to be compared and evaluated. From the given set of alternatives, the model evaluates the best ISO-9000 certification for application. The set of alternative ISO-9000 certifications are:

* ISO 9001
* ISO 9002
* ISO 9003

AHP Methodology

The attributes of ISO-9000 can be arranged in levels for relative comparison to determine the certification. The AHP provides a comprehensive structure to combine intuitive, rational and irrational values during the decision making process. The guidelines of the AHP recommend an initial focus on the top level, then moving on to criteria affecting the focus is the second level followed by subcriteria in the third level and so on from the more general to the more particular and definite.

To apply the principle of comparative judgments, a matrix of pairwise comparison of the relative importance of the elements in the second level with respect to the overall focus of the first level, is carried out. A scale is given for entering such judgments.

The following are the steps in the analytic hierarchy process (Wabalickis, 1987).

1. Define the problem and determine the objective.

2. Structure the hierarchy from the top through the intermediate levels to the lowest level.

3. Construct a set of pairwise comparison matrices for each of the lower levels. An element in the higher level is said to be a governing one for those in the lower level, since it contributes to it or affects it. The elements in the lower level are then compared to each other based on their effect on the governing element above. This yields a square matrix of judgments. The pairwise comparisons are done in terms of which an element dominates another. These judgments are then expressed as integ

If element A dominates over element B, then the whole number integer is entered in row A, column B and the reciprocal is entered in row B, column A. If the elements being compared are equal, 1 is assigned to both positions.

4. There are n(n-1)/2 judgments required to develop the set of matrices in step 3 (reciprocals are automatically assigned in each pairwise comparison).

5. Once the data is entered, consistency is determined using the eigenvalue (Aw = (max)w is solved. The consistency index C.I. derived from the departure of the (max) from n is compared with the corresponding average values for random entries yielding the consistency ratio C.R.)

6. Steps 3-5 are performed for all levels and clusters in the hierarchy.

7. Hierarchical composition is now used to weight the eigenvectors by the weights of the criteria and the sum is taken over all weighted eigenvector entries corresponding to those in the next lower level of the hierarchy.

8. The consistency of the entire hierarchy is found by multiplying each consistency index by the priority of the corresponding criterion and adding them together. The result is then divided by the same type of expression using the random consistency index corresponding to the dimensions of each matrix weighted by the priorities as before. The Consistency Ratio (C.R.) should be about 10% or less to be acceptable. Else, the quality of the judgments should be improved, perhaps by revising the manner in which questions are asked in making pairwise comparisons.

9. The desirability index for each alternative is calculated by multiplying each value in 'weight of subcriteria' column by the respective value in 'criteria weight' column, then multiplying the value for each respective alternative and summing the results.

For use in this problem, the focus has to be developed. In this case, it is to determine the best certification Indian industries can attempt for.

The attributes are compared with each other on a pairwise comparison with respect to the case situation described in table 1. The relative weights or priorities are obtained. Highly user-friendly software, the multi-attribute decision model. (AHP process), has been developed in turbo C for aid to the user for pair-wise comparison of the attributes as well as for the alternatives and for analysing the user inputs.

Table 1 : Case situation

Product	:	800 cc Small car
Production Volume	:	100000 cars per year
Company Goals	:	Maintain competitive edge by quality of products
Quality	:	High
Market Segment	:	Family car
Production Location	:	Metropolitan area
Distribution Network	:	All cities

Table 2 : Weightages and Consistency for Different Attributes

Attribute	P.V.	C.R.
Design	0.453	0.001
Production	0.237	0.043
Inspection	0.096	0.039
Servicing	0.058	0.050
Organisational Responsibilities	0.157	0.041

The relative importance and consistency of each of these attributes are given in table 2. From the analysis, it appears that the ISO-9001 option is the best under the circumstances of the developed case situation (tables 3 & 4).

Conclusion

The AHP model possesses many salient features some of which are as follows:

* Has user-friendly, interactive software which is menu driven.
* Options are offered to the user to define his mode of input i.e. from a file, and by direct impact on the screen.
* The screen input and editing are done on a clearly defined matrix. The editing can be carried out on the screen itself, thus on-line changes are possible.
* To see the results of the calculations and editing, there are two options, i.e., on the screen, and on an output file, so as to get a hard copy.
* The validity of the input data is checked through a consistency criteria. The consistency ratio is an approximate mathematical indicator of the consistency of pairwise comparisons.

Table 3 : Weightages of Attributes for Alternative ISO-9000 Certifications

Subcriteria description	Weight of sub-criteria	Criteria weight	ISO 9001	ISO 9002	ISO 9003
QSD	0.682	0.453	0.751	0.185	0.064
MCT	0.236	0.453	0.193	0.724	0.083
QDR	0.082	0.453	0.118	0.201	0.681
OP	0.484	0.237	0.737	0.186	0.077
QPR	0.301	O.237	0.658	0.282	0.060
CP	0.143	0.237	0.581	0.309	0.110
USM	0.072	0.237	0.230	0.648	0.122
CVS	0.056	0.096	0.724	0.193	0.083
PV	0.440	0.096	0.110	0.309	0.581
CMTE	0.278	0.096	0.681	0.216	0.103
NC	0.146	0.096	0.164	0.539	0.297
CA	0.079	0.096	0.571	0.286	0.143
HPF	0.750	0.058	0.164	0.539	0.297
ASS	0.250	0.058	0.764	0.166	0.070
MR	0.275	0.157	0.613	0.118	0.269
QSP	0.440	0.157	0.667	0.222	0.111
AQS	0.073	0.157	0.093	0.292	0.615
QM	0.129	0.157	0.681	0.216	0.103
QR	0.031	0.157	0.174	0.103	0.723
PER	0.052	0.157	0.724	0.193	0.083

Table 4 : Data Summary

Subcriteria Description	ISO 9001	ISO 9002	ISO 9003
QSD	0.232	0.057	0.020
MCT	0.021	0.077	0.009
QDR	0.004	0.007	0.025
QP	0.084	0.021	0.009
QPR	0.047	0.020	0.004
CP	0.020	0.010	0.004
USM	0.004	0.011	0.002
CVS	0.004	0.001	0.000
PV	0.005	0.013	0.025
CMTE	0.018	0.006	0.003
NC	0.002	0.008	0.004
CA	0.004	0.002	0.001
HPF	0.007	0.023	0.013
ASS	0.011	0.002	0.001
MR	0.026	0.005	0.012
QSP	0.046	0.015	0.008
AQS	0.001	0.003	0.007
QM	0.014	0.004	0.002
QR	0.001	0.000	0.003
PER	0.006	0.002	0.001
Total score of alternative	0.557	0.290	0.152

The present model has a few limitations also:

* The pairwise comparisons make the input time large and cumbersome.
* It requires the user to be clear about his goals and objectives.
* The developed software is highly menu driven.
* The model gives a decision based on a single user input. It does not account for multi-user input. However, these responses could be adequately aggregated to get the final ranking.
* Thus a model which is highly effective in the given case situation has been developed. Moreover, the inputs to the model help clarify the goals of the organisation as the process entails deep analysis and constructive discussions.

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Appendix

Scale of Relative Importance

Intensity	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
3	Weak importance of one over another	Experience and judgement slightly favor one over another
5	Essential or strong	Experience and judgement strongly favor one another
7	Very strong importance	An activity is strongly favored and its dominance is demonstrated in practice
9	Absolute importance	The evidence favoring one activity over another is of the highest degree
2,4,6,8	Intermediate values	When compromise is needed

TQM Approach to Software Development Projects

V.S.R. Krishnaiah

Total Quality Management (TQM) methodologies are sweeping the industrialised world. These methodologies, born in the manufacturing environment are being adopted by the Information Technology (IT) industry. When followed, TQM techniques do fulfill the quality objective of the software development project. The paper advances a new understanding of TQM and explains its value to the practitioners in the IT industry.

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Indian Industry, during the last three years, has been subjected to the clarion call that the quality of products and services need to be improved to match the level of their superior counterparts in the foreign countries. Successful companies now advertise their products and services on the basis of quality rather than price. The globalisation of our economy, emphasis on more software exports, adoption of ISO-9000 quality standards by EEC countries and fierce competition in the world software market are factors contributing to the initiation of quality improvement programmes in Indian software organisations.

Time Schedule Vs Quality

Companies world over, are allocating larger amounts of money on software as the completeness and timeliness of information provided by computerised information systems and databases provide a company the competitive edge. Software quality is more important than ever before in the purchasing, and development strategies of customers and producers respectively. Despite notable time and resources devoted to quality improvement activity by a variety of IT organisations ranging from computer education to software exports, there still exist a considerable number of IT firms where the prevalent attitude amongst the top management teams is "let us meet the development schedule first and then, if there is time, attend to quality". Because of this attitude, several software products are on the shelf only failing to become operational.

The managers of software companies must change their attitudes and practices to make quality the real priority.

According to a survey conducted by a large computing firm, 25% large software projects were cancelled, 60% experienced significant cost overruns, 75% had quality problems, and less than 1% of all system development projects were delivered on schedule and met requirements (Ward, 1994a) Historically, software delays have been more serious. A review of 17 major DOD projects in USA by Watts Hymphery (1991) revealed that the average 28 month schedule was delayed by 20 months and no project was on time. Brooks (1975) pointed out that managers with software development responsibilities are often under pressure to keep schedules and they grasp at the myth that men and months are interchangeable. Thus, when management labour is to find ways to meet the time schedule, quality takes backseat in the software project. Timeliness does matter, of course, but it's a matter of priorities. When the choice comes down to packaging and selling what is really a beta test version now or holding on tight through another round of testing and refinement, which path is followed? Though the second option must be the practice for producing higher quality systems, many software developers continue to strive for getting into market before any one else, even it means a bug-ridden product. The history of IT industry is littered with ghosts of companies that were first in the market and are no more. The managers of software companies must change their attitudes and practices to make quality the real priority. If quality becomes priority to the management, it will be important to the software development staff too, and the whole organisation takes a new path.

Translating Quality Awareness to Action Plan

Once organisations decide to try and improve the quality of their products and services, how do they go about it? Translating the enhanced quality awareness into an effective action plan is a challenge. There are several companies offering training courses and seminars on Quality Management Systems, many foreign "gurus" providing lectures on how to develop quality systems to meet the requirements of ISO 9000 standards. But, no one has the ready-made recipe for starting the process of quality improvement in organisations. The overwhelming quantity of quality literature simply adds to the confusion. The top management is uncertain how to start a process of quality improvement. It should be noted that ISO 9000 only defines the essential features and guidelines of the quality management system and does not attempt to prescribe how the quality management system will be implemented. It is for developers to establish procedures appropriate to their own scale, methodology and organisation to achieve the requirements of the standard (Rawat, 1994).

Change the Organisation Culture

The present culture in many organisations is permeated by an atmosphere of distrust. The checks and balances devised to control every action are so many that they not only boggle the mind but cause excessive administrative costs. The managers who emphasize on detecting failures and prescribing punishment can not motivate their staff to contribute to the full extent of their abilities. The modern approach is for managers to provide leadership and support and the staff to be given responsibility and trust to carry out their tasks and duties in a professional manner. Therefore, the organisation which want to take to path of continuous improvement has to effect changes in the work culture and attitudes.

TQM facilitates continuous improvement through a collective vision of quality; a vision that shifts from defect detection and correction to defect prevention.

The change in an organisation's culture can never be spontaneous and easy as the bureaucratic sophistication of organisations works against change to the extent that organisations usually develop an inbuilt resistance to it over the years. The Total Quality Management (TQM) methodologies provide a set of guiding principles to improve quality by examining the way work gets done with a systematic, integrated, consistent and organisation-wide perspective. TQM facilitates continuous improvement through a collective vision of quality; a vision that shifts from defect detection and correction to defect prevention. Continuous improvement means fervently, passionately, and forever challenging and upgrading the status quo. The work culture in many Japanese and American organisations devised through TQM methodologies and teachings of W.E.Deming, Joesph Juran, Philip Crosby, Armand V. Feignbaum, Genichi Taguchi, Shigeo Shingo, Kaoru Isikawa and others, helped the management to drive out fear among the employees till they felt comfortable enough to master their jobs and make suggestions for ongoing improvement.

Train for Self Improvement

The software engineers work in the world of changing technology both hardware and software, changing markets, and growing understanding about information technology and information systems by the customers.

The customers desire information systems which can reap the potential of latest hardware in terms of processing speed, interoperability, portability etc. Building better systems requires more knowledgeable software managers, systems analysts and programmers. The organisation which is committed to continuous improvement of its products and services must institute a vigorous program of education and self- improvement for everyone. Knowledge is a prerequisite for improvement. Therefore both the managers and staff must be educated in new software disciplines, products, techniques and also in software quality. They can be encouraged to attend courses and seminars on TQM and other relevant technical subjects.

Quality is inbuilt into software products through the management and technical procedures defined and implemented by the managers and staff with skills and expertise acquired through the training and self-improvement programmes. The management and staff must realise that education and training is a continuous process that should never stop. The career prospects and rewards for employees must be linked to their constant self-improvement.

Focus on Customer Needs & Expectations

Quality must be defined through the eyes of customers. For each process in the software development project, define who the customer is, internal or external to the organisation. The organisation must place emphasis on personal contact with customers and obtaining regular feedback on the outcome of each stage of software development life cycle and also on the overall products and services. Customer feedback is useful in enhancing the quality of the product or service.

In software development projects, customer needs are normally analysed in the beginning i.e. in the Requirements Analysis stage of software development life cycle.

The systems analyst captures his understanding of the user requirements in the form of specifications. Most development efforts are geared toward satisfying the contents of requirement specifications. Implicit in this approach is the concept that the requirement specification correctly state the needs of the customers. This may not necessarily be true. It depends on how firm the requirements for the system are when they are established. It also depends on the requirements analysis skill of the systems analyst assigned to the project. Also the user organisation's requirement may change according to the changes in the environment in which it operates, and the software scope must also change with its additionalities, or the quality deteriorates. Therefore, the design of the system must take care of the present requirements specified by the customer , and also must be flexible enough to accommodate the future needs of the customer (Krishnaiah, 1993). Flexible software can allow the user to operate with the same system with easy enhancements and modifications to effectively work in the organisation's new environment; otherwise the user has to abandon the existing software and opt for new software to meet new requirements. This type of situation not only results in waste in terms of effort, time and money but also affects the competitive position of the organisation.

TQM has a significant focus on customer emphasis. The Quality Function Deployment (QFD) technique in TQM provides a roadmap on how to improve a company's response to the customer. QFD is the 'voice of customer' (Zutner, 1992) as this technique has been developed by the Japanese for intergrating the customer into the company's systems engineering team. The implementation of QFD method enables an organisation to map customer wants and needs into quantitative and engineering terms.

The implementation of QFD method enables an organisation to map customer wants and needs into quantitative and engineering terms.

Software organisations which have an intense focus on customers consistently exceed both their customer's requirements and expectations. They become proficient at satisfying and delighting their customers.

Continuous Process Improvement

Continuous improvement of process is one of the essential elements of TQM. A minimum set of stable and repeatable processes is required before systems development, maintenance, and operation can be effectively measured, controlled and improved. The processes that must be defined and implemented in an IT organisation are: systems development life cycle (SDLC) methodology, project management methodology, quality assurance and testing methodology, which should include a system of walkthroughs, inspections, and technical reviews (Ward, 1994b).

These processes establish the basis for continuous improvement. In addition, the organisation must estab-

lish standards of performance for every task contained in the system development life cycle and the project management methodology. Without standards, the quality assurance effort becomes subjective and arbitrary, which can quickly undermine any TQM effort. Standards of performance and procedures for determining the status of performance, must be specified for each software project. Standards can be specifically derived for the software project: for example, adopted from standards developed by the parent organisation; or standards developed by the customer or a professional society (IEEE software Engineering Standards, 1993). Continuous process improvement involves documenting, analysing, and measuring all activities performed by the organisation. Errors are analysed for their root causes and aggressive action is taken to eliminate these causes so that errors do not recur. The focus is always on the process, not on the product or on the individual performing the process.

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Do It Right First Time

The standard for software quality in some organisations is six ε which means there could be no more than 3.4 errors in 1000 line code. Of course, the objective must be no failures or zero defect software. This is possible only when every person involved in the software product development understands the need to do it right first time and every time. Therefore, organising for quality is also important. It means looking at the accountabilities of each member of the organisation and specifying the responsibility for quality performance.

The organisation for quality should aim at taking into account of the joint responsibility for quality in software development. The focus should be on team work for quality. Total quality has to be seen by the team member as a permanent and fundamental part of everyday working. The Japanese approach involves seeing quality as a team affair to be discussed by all members at five minute meetings at the start of every day.

TQM is a system of prevention. It focuses on eliminating defects and on doing the job right the first time. TQM emphasises the processes which must be stable, repeatable, visible and measurable. The great advantage of doing right first time, for the software organisations, is the minimisation of waste during the software product development. This will not only result in efficient use of resources and increase in the competitiveness of the organisation but also enables the organisation to very easily adhere to time schedules.

Recognise and Reward High-Quality Performance

Motivating the employees for sustaining high levels of quality performance is part of the total quality management methodology. The work of the software professionals who contribute to process improvement, prevent failures and provide reliable products to customers by their high-quality performance must be recognised and rewarded. The quality achievements of role models must be publicized to keep other staff informed, to promote quality awareness and to maintain the commitment of high quality performers. In addition to financial rewards, these non-financial rewards of recognising achievements and providing additional learning and promotional opportunities are viewed as more valuable benefits for providing positive reinforcement and encouraging others to reach the higher levels of quality.

Conclusion

The introduction of an effective, unambiguous approach to TQM is necessary for creating better work environment and achieving cultural change emphasizing the continuous improvement of quality of products and services. When applied to software development projects, TQM can help organisations maintain the focus necessary to ensure that software products, as developed, meet customer requirement.

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Feature

Imported Technologies, SS Sector & Welfare in North-South Dialogue

Avanindra N. Bhat

The model of wage differentials in a three sector framework pursued here addresses the issues of North-South dialogue from the point of view of the small scale sector. The paper compares the impact on real rational income when equivalent subsidies are given to competing technologies. In particular, the manufacturing sector and the small scale sector are compared and it is found that the sector having the greater impact gets determined on the basis of sectoral equilibrium labour demand elasticities. Similarly, the agricultural sector and the small scale sector are compared, because agricultural plantations can be perceived as small scale units. Results depend on sectoral equilibrium labour demand elasticities again.

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The main issue of the North South dialogue, as seen in the growing literature, is that the South can benefit from importing advanced technologies from the North (Streeten, 1979, pp. 381-400 and Helleiner, 1977). The model of Bhat (1995) examines this issue in the context of the mobile capital version, together with a wage differential model of the labour market and shows that the import of agricultural technology can improve the income distribution of the wage earners in the South. This is in direct contrast with the conventional view that only manufacturing technology is important in the North-South dialogue. Batra and Lahiri (1987) also have examined this issue in the context of the mobile capital version of the Harris-Todaro Model and concluded that the welfare of the South would increase by subsidising the imports of agricultural technology from the North.

Methodology

The present study models three sectors in an economy, namely the agricultural sector, the small scale sector and the manufacturing sector. A mobile capital version together with wage differentials amongst the sectors will be the theoretical framework for analysing the role of imported technologies (and in particular subsidies on them) on the small scale sector and the other two sectors.

The model of rural-urban migration with inter-sectoral wage differentials is assumed as in Bhat (1995). The model is generalised to a three sector small economy framework with two wage differentials. Except for these differences, the model is identical to Bhat (1995). Unemployment in the model is assumed to be pervasive in all the three sectors and is consistent with the search theoretic view of unemployment which implies that unemployed workers are searching for the best job offer and their reservation wage has not been matched. The agricultural sector has a Lewis (1954) type of supply and

a usual demand. Unemployment in the agricultural sector exists as a result of the excess supply of labour at the going market wage rate. Market clearing conditions are assumed to prevail in this sector subject to the Lewis (1954) condition. Both the small scale sector and the manufacturing sector are standard sectors with the wages clearing the market. We are not addressing ourselves to the issue of how appropriate these technologies are in the developmental efforts of the South and refrain ourselves from the question of substitutability of the existing technologies by the imported ones.[1] We ignore substitution effects and focus on the income effects of reduced prices of imported technologies.

The demand for labour in both the sectors is determined by the usual conditions of marginal productivity. It is assumed that the labour supply curves are upward sloping in both the small scale and manufacturing sectors. Under these assumptions, it will be shown that the impact of subsidies for imported technologies on the welfare of the South is not unambiguous. The comparison of the impacts would depend on the sectoral equilibrium labour demand elasticities. In particular, as far as import benefits to the South are concerned, whether the imported agricultural technology is superior (or inferior) to the imported industrial technology or the imported small scale technology would depend on the sectoral labour demand elasticities and is one of the main results of the study.[2]

The Model

Our model is similar to the two sector model (agriculture and manufacturing) as discussed in Batra and Lahiri (1987) and Bhat (1995). The production functions are assumed to be concave and linearly homogeneous and are given separately for the two sectors as follows:

For agriculture,

$$A = A(K_a, L_a, Z_a) = L_a \cdot a(k_a, z_a) \quad (1)$$

For manufacturing,

$$M = M(K_m, L_m, Z_m) = L_m \cdot m(k_m, z_m) \quad (2)$$

and

For small scale manufacturing,

$$S + S(K_s, L_s, Z_s) = L_s \cdot s(k_s, z_s) \quad (3)$$

where K_i is the capital stock in the i^{th} sector, L_i is the labour force in the i^{th} sector and Z_i is the sector specific imported technology in the i^{th} sector; k_i and z_i are the capital/labour ratio and the technology/labour ratio, $i = a, m, s$. $a(.)$, $m(.)$ and $s(.)$ are average labour productivities in agriculture, manufacturing and small scale manufacturing respectively. Without loss of generality, it is assumed that the manufacturing sector is relatively *more* capital intensive, i.e.

$$\frac{K_a r_a}{L_a w_a} < \frac{K_s r}{L_s w_s} < \frac{K_m r}{L_m w_m}$$

This is equivalent to the capital intensity condition due to Neary (1981) in the context of the Harris-Todaro Model needed for stability.

The capital market equilibrium obtains when

$$a_k(k_a, z_a) = r_a, \text{ and } m(k_m, z_m) = s(k_s, z_s) = r \quad (4)$$

where r is the rental for capital services, and r_a is the rental for capital services in the agricultural sector; a_k and a_z are the marginal products in the agricultural sector and m_k, m_z, s_k, s_z are the respective marginal products in the manufacturing and the small scale sectors. Equation (4) follows from the fact that capital is perfectly mobile between the two sectors, namely the small scale sector and the manufacturing sector so that the rental rates are equated across the two sectors. The agricultural sector is modelled differently because agricultural technology may not be eminently suitable in the other two sectors so that capital may not be perfectly mobile between the agricultural sector and the other two sectors and is sluggish because of rigidities. That is why the rental in this sector is r_a that differs from r. Without loss of generality, the constant relative price of

1. These issues are addressed in Helleiner (1977, pp. 305-307), Streeten (1979, pp. 381-400). As excellently stated by Helleiner (1977): "Apart from the prices paid by the developing countries for technology imports, the other principal issue is the 'appropriateness' of imported technologies to local physical, economic and social environments. These two issues of price and quality are interrelated since the lowering of the relative price of unsuitable technology may, through undesirable substitution effects, generate socially perverse effects."

2. In India, with the recent industrial policy liberalisation in 1991, the transfer of foreign technology is permitted in selected priority areas including agro-based products, agricultural machinery etc., but, no preferential tax treatment is accorded to agriculture over manufacturing. In either case, the royalty paid for imported technologies is made tax-exempt, while there are restrictions on the extent of royalty that can be paid to the suppliers. As no estimates of sectoral labour demand elasticities are available, it is not possible to support or negate the policy neutrality of imported technology between the agriculture, manufacturing and small scale sectors followed in India on the basis of our theoretical results.

M and S in terms of A are both assumed to be unity. The marginal productivities of labour in the two sectors is given by

$$w_a = a - a_k k_a - z_a a_z,$$

$$w_s = s - s_k k_s - z_s s_z, \qquad (5)$$

$$w_m = m - m_k k_m - z_m m_z$$

where w_i is the real wage in sector i and is obtained by using the intensive production function assumed in the present model (we use these expressions without proof). Equilibrium demand for labour in the three sectors is determined by these equations, L_a, L_s, L_m.

Wage differentials are assumed to persist between the three sectors such that the manufacturing wage is higher than the small scale wage and the small scale wage is higher than the agricultural wage:

$$w_m = w_s + \alpha, \alpha > 0.$$

$$w_s = w_a + \beta, \beta > 0. \qquad (6)$$

The wage differential between the manufacturing and the small scale sectors assumes that labour is less mobile than capital due to skill differences and other factors. The imported agricultural technology is factor specific and is not mobile between the other two sectors whereas the imported technologies in the other sectors can be mobile and could be substitutes. Each sector imports these technologies upto the point where their marginal productivity equals their real royalty rate faced by the firms in the South, $\lceil_i$. The international real royalty rates of these technologies, $\lceil_i^*$ are assumed to be given constants, since the Southern economy is small and is a price taker and differs from $\lceil_i$ by the amount of the Southern government subsidies. Hence, in equilibrium,

$$a_z (k_a, z_a) = \lceil_a = (1 - s_a) \lceil_a^*,$$

$$s_z (k_s, z_s) = \lceil_s = (1 - s_s) \lceil_s^*,$$

$$m_z (k_m, z_m) = \lceil_m = (1 - s_m) \lceil_m^*, \qquad (7)$$

where S_a, S_s, S_m are the respective subsidies in the three sectors.

We assume that capital is fully employed whereas unemployment exists in all the sectors which is represented by U so that

$$L_a + L_s + L_m + U = \bar{L} \qquad (8)$$

and

$$K_a + K_s + K_m = L_a k_a + L_s k_s + L_m k_m = \bar{K} \qquad (9)$$

where $\bar{L}$ and $\bar{K}$ are the inelastic supplies of labour and capital in the economy respectively.

Real national income of the South is given by

$$Y = A + S \times M - \lceil_a Z_a - \lceil_s Z_s - \lceil_m Z_m$$
$$= w_a L_a + w_s L_s + w_m L_m + r\bar{K}_1 + r_a \bar{K}_2 \qquad (10)$$

where $\bar{K}_1$ is the combined capital stock of the small scale and the manufacturing sectors and $\bar{K}_2$ is the capital stock of the agricultural sector.

Unemployment is assumed to depend on the intersectoral wage differentials, α, β, that is

$$U = g_1(\alpha, \beta). \qquad (11)$$

Further, L_s is assumed to depend on α, β, that is,

$$L_s = g_2 (\alpha, \beta). \qquad (12)$$

The real rental rate r is assumed to be endogenous and is a function of the real royalty rates $\lceil_s$, $\lceil_m$, that is,

$$r = h (\lceil_s, \lceil_m). \qquad (13)$$

This assumes that the cost of the imported technology, $\lceil_s$ or $\lceil_m$ is the dominant cost of capital which gets reflected in the real rental r. Thus, $\frac{dr}{d\lceil_s} = h_s > 0$ because we expect r and $\lceil_s$ to be positively correlated.

There are 16 equations in this model and there are sixteen variables in the model namely: $L_a, L_m, L_s, U, k_a, k_s, k_m, z_a, z_s, z_m, w_a, w_s, w_m, \alpha, \beta, r$. The parameters in the model are $\lceil_a, \lceil_s, \lceil_m, \bar{K}, \bar{L}, r_a$. Since the number of equations equals the number of variables, the model solves itself uniquely. This completes the model of the small open Southern economy.

3. Varying Royalty Rates and National Income of the South

As the focus of the study is the issue of subsidising imported technologies, a natural policy question would be to study the impact of such concessions in the form of reduced royalty rates on the welfare of the South. Welfare considerations are captured by the real national

income of the economy. Real national income Y of the South can be written as

$$Y = w_a(\bar{L} - U) + (\alpha + \beta) L_m + \beta L_s + r\bar{K}_1 + r_a \bar{K}_2 \quad (14)$$

using the fact that $w_m = w_s + \alpha$ and $w_s = w_a + \beta$.

Totally differentiating equation (14),

$$dY = (\bar{L} - U)\, dw_a + w_a\, dU + \beta\, dL_s + L_s\, d\beta + (\alpha + \beta) dL_m + L_m\, d(\alpha + \beta) + \bar{K}_1\, dr. \quad (15)$$

First, we will study the impact of a change in the royalty rate of imported agricultural technology on the national income (in the absence of any subsidies).

Using the results shown in the appendix which are :

$$\frac{dw_a}{d\lceil_a} = -z_a, \quad \frac{dr}{d\lceil_a} = 0, \quad \frac{dw_m}{d\lceil_a} = 0, \quad \frac{dw_s}{d\lceil_a} = 0$$

$dy/d\lceil_a$ can be written as

$$\frac{dY}{d\lceil_a} = -z_a L_a (1 - \in_a) - w_m z_a (dL_m/dw_a) - w_s z_a \frac{dL_s}{dw_a} \quad (16)$$

where $\in_a = -(w_a/L_a)(dL_a/dw_a)$ is the equilibrium elasticity of demand for labour in agriculture.

Similarly, the impact of $\lceil_m$ on Y is given by (see Appendix)

$$\frac{dY}{d\lceil_m} = -z_m L_m (1 - \in_m) + h_m \bar{K}_1 \text{ where } h_m = \frac{dr}{d\lceil_m} \quad (17)$$

and $\in_m = -(w_m/L_m)(dL_m/dw_m)$ is the equilibrium demand elasticity of labour in the manufacturing sector. Similarly, the impact of $\lceil_s$ on Y is

$$\frac{dy}{d\lceil_s} = -z_s L_s (1 - \in_s) - w_m z_s \frac{dL_m}{dw_s} - + h_s \bar{K}_1. \quad (18)$$

Labour Mobility Across Sectors

Now, $\bar{L} = L_m + L_a + L_s + U$ where U is the level of unemployment in the economy.

Thus,

$$\frac{dL_m}{dw_a} + \frac{dL_a}{dw_a} + \frac{dL_s}{dw_a} + \frac{dU}{dw_a} = 0,$$

so that,

$$-\frac{dL_m}{dw_a} = \frac{dL_a}{dw_a} + \frac{dU}{dw_a} + \frac{dL_s}{dw_a}.$$

As w_a increases, L_a decreases and there may be some mobility of labour across sectors resulting in some of this labour being hired in the manufacturing sector (L_m increases) and as a result, the level of unemployment (U) decreases. As in Bhat (1995), we will assume that $\frac{dL_a}{dw_a} < 0, \frac{dL_s}{dw_s} < 0$, and $\frac{dL_m}{dw_m} < 0$.

This is because an increase in w_a will lower the employment in the agricultural sector following a movement along the labour demand curve. Some of the labour thus released will, *ceteris paribus,* migrate to the manufacturing sector. This will shift or tilt the labour supply schedule for manufacturing, depending upon the supply elasticity of labour. This will cause a downward pressure on the wage rate in the manufacturing sector and more labour will be employed, in equilibrium, at a lower wage rate in the manufacturing. Similarly, there will be migration between agricultural and small scale sectors, and the small scale sector and the manufacturing sector.

Thus, we will assume here that

$$\frac{dL_m}{dw_a} > 0, \frac{dL_s}{dw_a} > 0, \frac{dL_m}{dw_s} > 0.$$

Similarly, as w_m increases, we will expect labour released from the manufacturing sector to add to the level of unemployment so that

$$\frac{dL_a}{dw_m} = 0, \frac{dL_a}{dw_s} = 0, \frac{dL_s}{dw_m} = 0.$$

This is because the agricultural sector is not in a position to absorb any labour. It is already operating at near subsistence wages. Also, we rule out reverse migration from the manufacturing sector to the small scale sector. Now,

$$\frac{dY}{d\lceil_a} = -z_a L_a (1 - \in_a) - w_m z_a \frac{dL_m}{dw_a} - w_s z_a \frac{dL_s}{dw_a}.$$

This is negative because

by our assumption, $\frac{dL_m}{dw_a} > 0$,

and as before, $\frac{dL_a}{dw_a} < 0$. The terms $w_m z_a \frac{dL_m}{dw_a}$ and $w_s z_a \frac{dL_s}{dw_a}$ are due to outward migration to the

manufacturing sector and are positive. We shall call these terms, the migration terms.

To compare the two price effects on national income, we consider the following cases:

(A) $\in_m > 1$, $\frac{dY}{d\lceil_m} > 0$ and by the equation above, $\frac{dY}{d\lceil_a} < 0$ if $0 < \in_a < 1$.

(B) $\frac{dY}{d\lceil_s} < 0$ if the migration term dominates $h_s \bar{K}_1$ and $0 < \in_s < 1$.

We shall compare the magnitude of the impacts between the manufacturing sector and the small scale sector as well as the small scale sector and the agricultural sector. The results are summarized in the form of Theorem 1.

Theorem 1

(A) The impacts are compared through equivalent concessions to both the sectors, namely the small scale sector and the manufacturing sector.

Then

$$\left| \frac{1}{Z_s} \frac{dY}{d\lceil_s} \right| > \left| \frac{1}{Z_m} \frac{dY}{d\lceil_m} \right| \text{ iff}$$

$$\frac{\in_{m,s}}{\in_s - \in_m} > \frac{Y_s}{Y_m} \left[1 + \left(\frac{h_s}{z_s} - \frac{h_m}{z_m} \right) \frac{\bar{K}_1}{(\in_s - \in_m)} \right]$$

where

$$Y_s = w_s L_s,\ Y_m = w_m L_m,\ \in_{m,s} = \frac{w_s}{L_m} \frac{dL_m}{dw_s}.$$

Using data, this condition can be estimated which would tell which sectoral impact is greater.

(B) The impacts between the agricultural sector and the small scale sector are compared as follows:

$$\left| \frac{1}{Z_s} \frac{dY}{d\lceil_s} \right| > \left| \frac{1}{Z_a} \frac{dY}{d\lceil_a} \right| \text{ iff}$$

$$k\,(\in_{m,s} - \delta \in_{m,a} - \in_{s,a}) > (\in_s - \in_a) + \frac{h_s \bar{K}_1}{z_s}$$

where $\in_{ij} = \frac{W_j}{L_i} \frac{dL_i}{w_j}$, $\frac{w_m L_m}{w_s L_s} = \frac{w_s L_s}{w_a L_a} = k$ and $\frac{w_m L_m}{w_a L_a} = \delta k, \delta > 1$.

Given the data, using econometric methods, this condition can be estimated and one could find out which impact is greater.

Proof: The proofs of (A) and (B) follow from equations (15), (16), (17) and will not be proved here.

This analysis applies itself to a situation where resource allocation has to be done amongst several sectors. Suppose the government is thinking of investing Rs. 10,000 crores amongst the three sectors. The model here gives policy guidance on how much to invest in each sector depending on the equilibrium labour demand elasticities in the different sectors as seen above in the results proved.

4. Income Distribution of the South

Let us focus on the income distribution of the South and how it changes with respect to the royalty rates of these imported technologies. Let W represent the total wage income. Then,

$$W = w_a L_a + w_s L_s + w_m L_m,$$

$$= w_a (\bar{L} - U) + (\alpha + \beta) L_m + \beta L_s \text{ using the wage differential equations and } L_a + L_m + L_s + U = \bar{L}$$

Let δ be the share of labour in national income. Then, we can express δ as follows:

$$\delta = (W/Y).$$

Furthermore,

$$\frac{d\delta}{d\lceil_a} = Y \frac{\frac{dW}{d\lceil_a} - W \frac{dY}{d\lceil_a}}{Y^2} = \frac{1}{Y} \frac{dW}{d\lceil_a} - \frac{W}{Y^2} \frac{dY}{d\lceil_a}.$$

Now,

$$\frac{dY}{d\lceil_a} = \frac{dW}{d\lceil_a} \text{ because } r\bar{K}_1 + r_a \bar{K}_2 \text{ is fixed.}$$

Therefore

$$\frac{d\delta}{d\lceil_a} = \frac{1}{Y^2} \frac{dY}{d\lceil_a} (Y - W) = \frac{r\bar{K}_1 + r_a \bar{K}_2}{Y^2} \frac{dY}{d\lceil_a}$$

Thus, sign $\left(\frac{d\delta}{d\lceil_a} \right)$ = sign $\left(\frac{dY}{d\lceil_a} \right)$

and as seen before,

$$\frac{d\delta}{d\lceil a} < 0 \quad \text{iff} \quad \frac{dY}{d\lceil a} < 0.$$

On similar lines, $(d\delta/d\lceil m)$ is computed as

$$\frac{d\delta}{d\lceil m} = \frac{r\bar{K}_1 + r_a\bar{K}_2}{Y^2}\frac{dY}{d\lceil m}, \text{ if } \frac{dr}{d\lceil m} = h_m \text{ is negligible.}$$

Thus, sign $\left(\frac{d\delta}{d\lceil m}\right)$ = sign $\left(\frac{dY}{d\lceil m}\right)$

Similarly, $d\delta/d\lceil s = r\bar{K}_1 + r_a\bar{K}_2/Y^2 \frac{dY}{d\lceil s}$ if $\frac{dr}{d\lceil s} = h_s$ is negligible. We summarise these results in the form of theorem 2.

Theorem 2

(a) *Decreases* in the royalty rate on imported agricultural technology would favourably affect the income distribution of wage earners, that is,

$$\frac{d\delta}{d\lceil a} < 0 \text{ if } 0 < \in_a < 1.$$

(b) *Decreases* in the royalty rate on imported manufacturing technology would favourably affect the income distribution of wage earners, only if $0 < \in_m < 1$, that is

$$\frac{d\delta}{d\lceil m} > 0 \text{ if } \in_m > 1 \text{ and } \frac{d\delta}{d\lceil m} < 0 \text{ if } 0 < \in_m < 1.$$

Further, $\frac{d\delta}{d\lceil s} < 0$ if $0 < \in_s < 1$.

Proofs follow by substituting $\frac{dY}{d\lceil a}, \frac{dY}{d\lceil m}, \frac{dY}{d\lceil s}$ in the expressions above.

Conclusion

The model of wage differentials in a three sector framework pursued here addresses the issue of the North-South dialogue from the point of view of the small scale sector. The study specifically compares the impact on real national income when equivalent subsidies are given to competing technologies. In particular, the manufacturing sector and the small scale sector are compared and it is found that the sector having the greater impact gets determined on the basis of sectoral equilibrium labour demand elasticities. Similarly, the agricultural and the small scale sector were compared, presumably because agricultural plantations can be perceived as small scale units. Once more, the sector with greater impact cannot be determined unless the above mentioned elasticities are computed. India has followed a policy of sectoral neutrality in this context, which is questionable since econometric methods exist which could easily compute these elasticities given the existing data base in the Indian economy. On the basis of this model, it is recommended that the policy makers in the less developed countries should adopt and advocate an imported technology for any sector in the economy on the basis of a cost-benefit analysis such as the one pursued here, which would require the computation of equilibrium labour demand elasticities.

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Appendix

In this appendix, we derive the dependence of the real wage rate w_a, w_m, w_s on the royalty rates $\lceil a, \lceil s$ and $\lceil m$. We will assume that the subsidies are being ignored.

We begin by considering the equation,

$$w_a = a - k_a a_k - z_a a_z .$$

This can be rewritten as

$$w_a L_a = A - K_a a_k - z_a a_z.$$

Totally differentiating this equation,

$$w_a dL_a + L_a dw_a = (A_K dK_a + A_L dL_a + A_Z dZ_a) - a_k dK_a - K_a (da_k) - Z_a da_z - a_z dZ_a.$$

From the production function conditions,

$$A_K = a_k, A_z = a_z = \lceil_a, \text{ and } A_L = w_a$$

so that

$$L_a\, dw_a = K_a a_{kk}\, dk_a - K_a a_{kz}\, dz_a - Z_a\, d\lceil_a.$$

This can be written as

$$L_a\, dw_a = -K_a\, da_k - Z_a\, d\lceil_A .$$

Thus,

$$dw_a = -k_a\, dr_a - z_a\, d\lceil_a. \quad . \qquad \text{(A.1)}$$

This shows that

$$w_a = w_a\,(r_a\,,\ \lceil_a).$$

Thus,

$$\frac{dw_a}{d\lceil_a} = -z_a \text{ and } \frac{dw_a}{dr_a} = -k_a. \qquad \text{(A.2)}$$

Also, since r_a does not depend on $\lceil_a$, $\lceil_m$,

$$\frac{dr_a}{d\lceil_a} = 0 = \frac{dr_a}{d\lceil_m} \qquad \text{(A.3)}$$

On similar lines, we can show that $w_m = w_m\,(r\,,\ \lceil_m)$ and $\dfrac{dw_m}{d\lceil_a} = -z_m.$ (A.4)

Also, $w_s = w_s\,(r\,,\ \lceil_s)$ as before and $\dfrac{dw_s}{d\lceil_s} = -z_s$ (A.5)

(A.1) - (A.5) are used in sections 3 and 4 of the paper.

What lies behind us and what lies before us
are tiny matters
compared to what lies within us.

– OLIVER WENDELL HOLMES

Feature

Elasticity of Labour Productivity in Indian Manufacturing Sector

M. Upender

With a view to generating empirical information, an attempt is made in this paper to estimate the elasticity of labour productivity so as to find the substitution possibilities of labour for capital in the Indian manufacturing sector covering the period 1973-74 to 1989-90. The results show that there is need to redirect the Indian manufacturing sector towards greater use of labour intensive technology until the marginal productivity of labour is equal to marginal wage rate.

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The growth of the Indian manufacturing sector depends largely on factor productivities and substitution possibilities between labour and capital. Indian economy which is basically agrarian, has a large endowment of human resources. But the capital-labour ratio is very high in the Indian manufacturing sector. It is not an easy task to switch from capital intensive techniques to labour intensive techniques of production. A study of possibilities of substitution between capital and labour is necessary in the Indian manufacturing sector before any attempt is made to alter the relative factor use. There is a plethora of empirical studies on the possibilities of substitution between capital and labour for both industrially developed and developing countries. The estimation of the elasticities of substitution in manufacturing sector had been based on both the time series and cross-section data. With a view to generating empirical information for policy makers a study was made to estimate the magnitude of elasticity of labour productivity so as to assess the substitution possibilities of labour for capital for the Indian manufacturing (factory) sector using the time series data by ordinary least squares method.

The growth of the Indian manufacturing sector depends largely on factor productivities and substitution possibilities between labour and capital.

Methodology

Data and Variables : The required data on gross-value added, capital, employment and wages were obtained from various issues of the Annual Survey of Industries (ASI) and Basic Statistics relating to the Indian Economy. The study covers the period from 1973-74 to 1989-90 i.e., 17 years. The variables selected for this exercise are gross value added (V),

number of persons employed (L), fixed capital (K) and wage rate (W/L).

Elasticity of Labour Productivity : Elasticity of labour productivity can be estimated both from Cobb-Douglas and constant elasticity of substitution functions. But Cobb-Douglas production function is based on the most restrictive assumption of unitary elasticity of substitution. This assumption can be relaxed by using the indirect method of estimating constant elasticity of substitution (CES) production function based on the conditions of profit maximization under perfectly competitive markets. The CES function is based on the observation that output per labour (V/L) is a changing proportion (increasing, decreasing or constant proportion) of wage rate (W/L).

$$V/L = a(W/L)^{\sigma} e^{ut}$$

The marginal productivity theory of wages has been generally accepted by economists as it gives an adequate explanation of wage determination. It is well known that the price of labour (wage) under the conditions of perfect competition is equal to the average and marginal product of labour in the long run. The firm, being a profit maximiser, will continue to increase the labour force upto a point at which the reward paid to the marginal unit of labour (marginal wage) is equal to the contribution made by the unit (Marginal Productivity of Labour).

The firm, being a profit maximiser, will continue to increase the labour force upto a point at which the reward paid to the marginal unit of labour (marginal wage) is equal to the contribution made by the unit (Marginal Productivity of Labour).

The estimating form of the above equation is

$$\log\left(\frac{V}{L}\right) = \log a + \sigma \log\left(\frac{W}{L}\right)$$

Elasticity of labour productivity with respect to wage rate

$$= \frac{\text{Marginal labour productivity in relation to wage rate}}{\text{Average labour productivity in relation to wage rate}}$$

$$\frac{d\,(V/L)}{d\,(W/L)} \div \frac{(V/L)}{(W/L)} = \frac{d \log V/L}{d \log W/L}$$

$$= \frac{d\,(V/L)}{(V/L)} \times \frac{(W/L)}{d\,(W/L)}$$

The proportionate change in labour productivity due to a proportionate change in wage rate is the measure of elasticity of substitution $\sigma = \frac{1}{1+\rho}$. The numerical value of σ need not necessarily be unity and can take any value. If the estimated value of σ is unity ($\sigma = 1$) then we have the Cobb-Douglas Production function.

When prices are taken, the CES function turns out to be as follows.

$$\log\left(\frac{V}{WPI} \cdot \frac{1}{L}\right) = \log a + \sigma \log\left(\frac{W}{CPI} \cdot \frac{1}{L}\right)$$

where

Real gross value added $= \frac{V}{WPI}$ = gross value added is deflated by whole sale price (WPI) of manufactured products (1981-1982 = 100). Real wage $= \frac{W}{CPI}$ = wage rate is deflated by consumer price indices (CPI) for industrial workers (1981-82 = 100).

Empirical Results

The Cobb-Douglas Production function assumes elasticity of substitution between capital and labour to be equal to unity which may not always be true because of disparity in factor payments. Therefore elasticity of substitution is estimated through CEC Production Function to test the hypothesis of unitary elasticity ($\sigma = 1$). Equation log (V/L) = log a + σ log (W/L) is fitted to the time series data (Nominal Data) and results are as follows:

$$\log (V/L) = -9.31190 + 1.1641 \log (W/L)$$

$$t = 40.2646$$

$$R^2 = 0.9908$$

Durbin Watson (DW) statistic = 1.3853

The value of elasticity of labour productivity with respect to wage rate is found to be 1.1641 which is significantly different from one ($\sigma \neq 1$) at one per cent level. This result suggests that the elasticity of labour productivity with respect to wage rate in Indian manufacturing sector is more than unity and hence the appropriate form of the function for the present exercise is the CES. From this it can be inferred that the marginal

It is profitable for entrepreneurs to substitute the abundant labour force for scarce capital until marginal productivity of labour is equal to wage rate.

labour productivity in relation to wage rate is much higher than that of average labour productivity in relation to wage rate. Therefore, there still exist substitution possibilities until the marginal labour productivity is equal to the average labour productivity. From the value of elasticity it can also be inferred that the wage rate prevailing in the sector is less than the marginal productivity of labour. Profit maximising entrepreneurs facing perfectly competitive markets are supposed to continue to increase the labour force until marginal product of labour is equal to wage rate. In the present exercise the elasticity of labour productivity with respect to wage rate is very high (1.16). Therefore, it is profitable for the entrepreneurs to substitute the abundant labour force for scarce capital until marginal productivity of labour is equal to wage rate. In labour surplus economies like India the possibility of substituting of labour for capital has to be investigated with a view to providing maximum employment opportunities. The value of elasticity of labour productivity is more than unity because historically the compound growth rate of value added per labour (13.24 per cent) is found to be more than the compound growth rate of wage rate (11.22 per cent) during 1973-1990 in the Indian manufacturing sector. Therefore abundant labour can be substituted for scarce capital until marginal productivity of labour is equal to the marginal cost. The value of elasticity (1.1641) suggests that if the wage rate (W/L) is increased by one per cent, the output (gross value added) per labour in the Indian manufacturing sector would be increased by more than one per cent. In other words labour productivity is an increasing function of wage rate ($\sigma > 1$). This suggests a better possibility of labour substitution for capital. It is also observed that even after adjusting the variables for changes in prices (real variables), the elasticity of labour productivity is found to be more than unity confirming that the substitution possibilities of labour for capital are quite high in the manufacturing sector of India. The CES function with real variables (variables deflated by prices) gave slightly a higher value of elasticity (1.40) than that of the value of elasticity (1.16) estimated with nominal data (Variables not deflated by prices). This shows that the compound (over a period of time) growth rate of consumer price indices for industrial workers (deflator for wage rate) is high (7.88%, estimated from log CPI = 3.849 + 0.076t) than the compound growth rate of whole sale price indices of manufactured products (7.315%, estimated from log WPI = 3.905 + 0.071t) (deflator for gross value added). Though both the price indices are moving in the same direction (Correlation Coefficient between CPI and WPI = 0.98) the movements in CPI for industrial workers are higher than the movements in WPI of manufactured products. Thus wage rate has been highly influenced by the rising prices than the gross value added per worker.

The estimated equation with real variables is

$$\log\left(\frac{V}{WPI}\cdot\frac{1}{L}\right) = -9.6170 + 1.4003 \log\left(\frac{W}{CPI}\cdot\frac{1}{L}\right)$$

$t = 7.2740$

$R^2 = 0.779$

$DW = 0.6501$

On the whole, the elasticity of factor substitution estimated through CES production function both with nominal and real variables is found to be more than unity at 99% confidence level evincing more substitution possibilities of labour for capital in the Indian manufacturing sector. The main reason for tying up labour productivity with the wage rate is to findout the possibilities of substitution of labour for capital so as to absorb sufficient number of labour that is in surplus. In a labour surplus economy, it is appropriate to regress labour productivity on wage rate to find the substitution possibilities under conditions of profit maximization.

In a labour surplus economy, it is appropriate to regress labour productivity on wage rate to find the substitution possibilities under conditions of profit maximization.

Conclusion

The results of the exercise indicate that the elasticity of labour productivity with respect to wage rate is significantly more than unity. This indicates that substitution possibilities are quite high in favour of labour because labour productivity is found to be an increasing function of wage rate. In other words, marginal labour productivity in relation to wage rate is much higher than that of average labour productivity. Therefore, there is need to redirect the Indian manufacturing sector towards greater use of labour intensive technology until marginal productivity of labour is equal to wage rate.

Feature

Determinants of Corporate Dividend Policy & the Target Pay-out Ratio

Rudra. P. Mahapatra & Bijaya. K. Panda

The present study seeks to examine the relative significance of some known models in explaining the dividend behaviour in the Indian situation with reference to three selected industries, namely cotton, sugar and paper. The study result discloses that dividend decision is primarily governed by cash flow, a measure of company's capacity to pay and the dividend paid in the previous year. Among other determinants, the impact of flow of net debt is found significant in paper industry. Liquidity factor turned significant in cotton industry. However, the impact of investment demand and share price on dividend decision have hardly been established by the present study.

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Dividend policy is a key decision area in the field of financial management. In spite of its importance various theoritical determinants of dividend decision are not well established. No formal mathematical models have so far been evolved to deal with this decision problem. During the last few decades, research efforts in this area have led to the development of valuation models, seeking to establish the irrelevance of dividend payout on Shareholders' wealth (Miller & Modigliani, 1961). Moreover, a number of behavioural models have also come out in course to time attempting to categorise, explain and measure the different types of observed dividend behaviour. In this context the models associated with the names of Lintner (1956), Darling (1957), Brittain (1966), among others provide useful guidance in handling this complicated decision problem. Inspired by the above works, a handful of studies have been carried out both in India and abroad to analyse the significance of the above known dividend models and to find out the importance of other determinants having a bearing on the dividend decision of the firms (Fama and Babiak, 1968; Rao and Sarma, 1971; Higgins, 1972; Krishnamurty and Sastry, 1975; Swamy and Rao, 1975, Ojha, 1978; Baker et al 1985; Khurana, 1985; Agarwala, 1987; Mahapatra, 1992). Most of these studies explain dividend behaviour in terms of net current earnings, cash flow, lagged dividend, lagged profit, depreciation provision, changes in sales, investment demand, flow of net debt, cost of debt, liquidity, share price etc. as important explanatory variables. The present study seeks to examine and identify the relative significance of some of these known determinants of dividend policy in Indian situation.

Dividend policy is a key decision area crucial in taking investment and financing decisions also in formulating appropriate policies.

Theoretical Framework & Methodology

A judgement sample of 43 companies belonging to three industries, namely, cotton, sugar and paper was chosen. The various dimensions examined in this study relate mainly to identify and determine the relative significance of various determinants having a bearing on the dividend policy decision of the sample companies belonging to these three industries. Further attempts are also been made to specify target pay-out ratios and the speed of adjustment co-efficients of the sample companies belonging to these industries.

The data for the study have been collected from various volumes of Bombay Stock Exchange Official Directory, covering a period of 12 years i.e. from 1977-78 to 1988-89. Initially it was decided to keep in the sample all the companies functioning and belonging to the above categories of industries and listed in any one of the stock exchanges in India. However, on further scrutiny, it was found that only some companies have the data for the entire study period, while the others not. The inclusion of companies which possess data for hetrogeneous period of time undoubtedly will distort the method of study. Hence they have been excluded. The sample finally holds only 43 companies belonging to three selected industries namely cotton (17), Sugar (15) and paper (11).

The present study is based on the theoretical models set up by Lintner for the study of dividend behaviour of American Corporations. His hypothesis states that dividend pay-out is a function of net current earnings after tax (P_t) and the dividend paid in the previous year (D_{t-1}); corporate financial policy is dividend oriented; dividend taking precedence over all other facets of financial policy, while retained earnings is largely a by-product of dividend action taken in terms of well established policies and practices, companies decide to pay-out a fixed proportion of their net profits as dividend to common stock-holders, but in view of their well known preference for stable dividends may try to achieve this target level only by a fraction of the amount indicated by the target pay-out ratio whenever profit changes. The above theoritical formulation of Lintner has been used as an estimating equation for corporate dividend in the present study, which is as follows:

$$D_t - d_{t-1} = a_0 + K(D_t^{\cdot} - D_{t-1})$$

Where D_t is the dividend in the current year (t), D_{t-1} is the dividend in the preceding year ($t-1$) and $D_t^{\cdot}$ is the target dividend. $D_t^{\cdot}$ represents the dividend which the company would have paid in the current year if the dividends were based simply on its fixed target pay-out ratio 'r' applied to current profits. Thus $D_t^{\cdot} = r\,P_t$, where (P_t) is the profit after tax in the current year. The parameter K indicates the fraction of the difference between the target dividend $D_t^{\cdot}$ and the actual dividend payment made in the preceding year D_{t-1} which the company will intend on the average to reflect in its current year's dividend as an increase or decrease from the previous year's payment. Thus K is a positive fraction and represents what is referred to as the "speed of adjustment", whereas 'r' is the desired long run pay-out ratio.

Substituting rP_t for $D_t^{\cdot}$ in the above equation

$$D_t - D_{t-1} = a_0 + K\,(rP_t - D_{t-1})$$

or $$D_t = a_0 + a_1P_t + a_2D_{t-1}$$

Where $a_1 = rK$ and $a_2 = 1-K$

The above formulation can be used as an estimating equation of corporate dividend behaviour. What is needed is to add an error term to the above equation.

$$D_t = a_0 + a_1P_t + a_2D_{t-1} + U_t \qquad (1)$$

Here a_1 indicates the short run marginal propensity to pay dividend out of profits and a_2 indicates the weight attached to previous year's dividends. It is also seen that the "speed of adjustment" $K = 1 - a_2$ and the target pay-out ratio $r = a_1/(1-a_2)$. The constant term a_o is generally expected to be positive and was included by Lintner to reflect the presumably greater reluctance on the part of the companies to cut dividend than to raise them. Equation (1) is used as the basic estimating equation in the present study of corporate dividend behaviour.

Commenting on the use of Lintner's model, Brittain (1966) uses the cash flow version of Lintner's model in his study entitled "Corporate Dividend Policy". He takes as his starting point, the model proposed by Lintner and obtains statistically significant results, but at the same time finds that better results can be obtained by certain modifications and additions. Brittain argues that cash flow (profit after tax + depreciation) is a more appropriate variable as it reflects more faithfully true earnings. This argument of Brittain seems to have a special appeal in the Indian context on the ground that, depreciation account as it stands in the balance sheet contains an element of profit, because of very liberal allowances granted during the recent past. Accordingly the study also attempts to examine whether the co-efficients of a dividend model are likely to be affected much by

replacing profit after tax (P_t) in equation (1) by cash flow (C_t). Brittain's dividend equation is as follows:

$$D_t = a_0 + a_1 C_t + a_2 D_{t-1} + U_t \qquad (2)$$

Here C_t represents the total cash flow defined as the sum of profit after tax (P_t) and depreciation (A_t). In this case

$$K = 1 - a_2 \qquad \text{and} \qquad r = \frac{a_1}{1-a_2}$$

Brittain also uses depreciation (A_t) as a separate explanatory variable along with (P_t) and (D_{t-1}). Thus one of his regression equations is of the form :

$$D_t = a_0 + a_1 P_t + a_2 D_{t-1} + a_3 A_t + U_t \qquad (3)$$

In this case also $K = 1-a_2$, $r = \frac{a_1}{1-a_2}$

In the present study the estimating equations (2) and (3) i.e. the Brittain's Cash Flow Model and Brittain's Explicit Depreciation Model respectively have been tried out to assess their performance *vis-a-vis* the basic Lintner's model given by equation (1). As such the analysis is carried out by fitting regression equations (1), (2) and (3) to the annual time series data on profit after tax, dividend and depreciation for the period 1977-78 to 1988-89. The data on relevant variables have been taken in crores of rupees while estimating the relationships.

The multiple regression equations used in this study are fitted by the method of OLS. The analysis is based on the Nerlove's Auto Regressive Partial Adjustment Model. Here the error term is assumed to be distributed independently with zero mean and constant variance. The explanatory variables are also assumed to be independent of the disturbance term and there is no correlation between the explanatory variables. As a summary measure, we have used the co-efficient of determination adjusted for degrees of freedom ($\bar{R}^2$), to find out the respective explanatory powers of the regression models used in this study. For judging the significance of individual regression co-efficients, 't' test is conducted. Similarly for judging the overall significance of the estimated regression equations, *F* ratios have been calculated. Presence or absence of auto-correlation in the time series have been tested by computing the Durbin Watson Statistics (koutsoyiannis, 1987).

Based on the regression results of all the three models used in respect to the sample data, we propose to select one of them which provides the maximum explanation of dividend behaviour in most of the cases of sample classifications on the basis of the highest $\bar{R}^2$, statistical significance of the explanatory variables measured by conducting 't' test, the appropriate signs of the co-efficients used in the equations and the DW statistics. After selecting the best possible model, a few more explanatory variables are added to it to examine their impact on the dividend pay-out of the sample companies. The additional explanatory variables added to the model of good fit and their basis of measurement for inclusion are discussed in the following :

Investment Demand

Increased investment in plant and machinery, other fixed assets and inventories may result in decreased pay-out ratio. As such investment demand in a company is negatively related to its dividend payment decision. The impact of this determinant on dividend pay-out was examined. In the present study, investment demand in a given year has been measured by the changes in the net fixed assets and inventories over the previous year.

That is $ID_t = \Delta NFA_t + \Delta IN_t$

$$\Delta NFA_t = NFA_t - NFA_{t-1}$$

$$\Delta IN_t = IN_t - IN_{t-1}$$

Where NFA_t and NFA_{t-1} = Net fixed asset in period '*t*' and '*t*-1' respectively. IN_t and IN_{t-1} = Inventories in period '*t*' and '*t*–1' respectively.

Increased investment in plant and machinery, other fixed assets and inventories may result in decreased pay-out ratio.

Flow of Net Debt

Another important determinant of dividend policy, which has been used in the present study as an additional explanatory variable in the model of good fit is the flow of net debt (external finance). Flow of net debt in a company is positively related to its dividend payment. This is but natural. In the study the flow of net debt has been measured as :

$$FND_t = ND_t - ND_{t-1}$$

$$ND_t = TL_t - CA_t$$

where FND_t = Flow of net debt in period 't'. ND_t and ND_{t-1} = Net debt in period 't' and 't–1' respectively. TL_t = Total liabilities (both short and long) in period 't'. CA_t = Current assets in period 't'.

Interest Payment

Financial experts assert that there exists a relationship between the amount of interest payment and dividend and that a rise in interest payment by a company would depress its dividend payment. The impact of this variable has been examined here by using the total interest payment (I_t) by the company as an additional explanatory variable in the model of good fit.

Liquidity

The liquidity position of a company is expected to have a positive relationship with dividend payment. The impact of liquidity on dividend decision has been examined in the present study by using the ratio of current assets to current liabilities as one of the explanatory variables in the model of good fit.

Share Price Behaviour

This variable is expected to have a negative relationship with the dividend policy. This is because the unfavourable market price of a company's share may prompt it to increase the rate of dividend. The present study makes use of the share price in a particular year as a ratio of the average price of the preceding two years as an explanatory variable in the model of good fit.

Symbolically :

$$SP_t^{\cdot} = \frac{ASP_t}{(ASP_{t-1}\ ASP_{t-2})/\ 2}$$

where $SP_t^{\cdot}$ = Share price in period 't' as a ratio of the average price of the preceding two years. ASP_t, ASP_{t-1} and ASP_{t-2} = Average of high and low price of share in period 't', 't–1' and 't–2' respectively.

All the above determinants are used in the present study as additional explanatory variables in the 'model of good fit'. The analysis is expected to throw light on whether the explanatory variables in the regression equations represent the dominant determinants of dividend policy and whether the estimated parameters are reasonably reliable.

Hypotheses of the Study

In course of the analysis the following hypotheses are to be rested with the help of the sample data. They are :

- Dividend payout is a function of net current earnings after tax and dividends paid in the previous year.
- Cash flow, rather than net current earnings after tax is a better measure of a company's capacity to pay dividend.
- Decomposition of cash flow into earnings after tax and depreciation as separate variables help in explaining better, the dividend behaviour of the companies.
- Investment demand of a company is negatively related to its dividend payment.
- Flow of net debt in a company is positively related to its dividend payment.
- A comfortable liquidity position of the company would support dividend payment.
- A rise in interest payment by a company would depress its dividend payment.
- A decrease in the share price of a company may prompt it to increase the rate of dividend with a view to stimulating the price of its shares on the stock market.

Results

A persual of the regression results depicted in table 1 discloses that in the case of sugar industry all the three estimated regression models explain well the dividend behaviour as in all these cases the F ratios are statistically significant. The results further reveal that the substitution of the cash flow variable (Brittain's Cash Flow Model) in place of current profit after tax in the basic Lintner's model has marginally increased the explanatory power of the equation from 0.857 to 0.865 as reflected by the co-efficient of determination adjusted for degree of freedom ($\bar{R}^2$). However the explicit inclusion of depreciation variable (Brittain's Explicit Depreciation Model) in the Lintner's model has marginally reduced the value of $\bar{R}^2$ from 0.857 to 0.850. As such on the ground of better explanatory power, the Brittain's Cash Flow model is favoured for sugar industry, over the other two regression models. In this model, the regression results further disclose that the co-efficients of both the explanatory variables (cash flow and lagged

dividend) are of the expected positive signs and are statistically significant. The *DW* value in this model also shows no auto-correlation problem. In view of the above plus points Brittain's Cash Flow Model is chosen as the "model of good fit" for sugar industry.

It is seen from the results in table 1 and the substitution of the cash flow variable in place of current profit in the basic Lintner's model has substantially improved the explanatory power ($\bar{R}^2$) of Brittain's Cash Flow Model from 0.643 to 0.781 in the case of paper industry. Moreover, the exclusive inclusion of the depreciation variable in Lintner's model has also increased substantially the explanatory power of Brittain's Explicit Depreciation Model from 0.643 to 0.766. Further in the case of Linter's model, the explanatory power of the equation is the lowest and F value in this case is not found statistically significant. In Explicit Depreciation Model also, the F ratio is not statistically significant. However, in Brittain's Cash Flow Model, the F ratio is statistically significant. The co-efficients of all the explanatory variables are found to be of the expected positive signs and are statistically significant. Here the DW value also shows no auto correlation problems in residual terms. In view of this Brittain's Cash Flow Model is considered as the "model of good fit" for paper industry.

All the three estimated regression models seem to explain well the dividend behaviour of cotton industry in the present study, as the F ratios in all these cases are statistically significant. However, a close look at the regression results discloses that in case of Lintner's model, even though the co-efficients of both the profit variable and lagged dividend variable are of appropriate signs, the co-efficient of the lagged dividend variable does not posses the appropriate value. Moreover, the constant term is negative, which violates one of the important specification of this model. Similarly in the Explicit Depreciation Model, even though the profit variable and the depreciation variable are statistically significant, the co-efficient of the lagged dividend variable is not significant even at 10% level. The low DW value in this model indicates the presence of auto correlation in the residual terms. In view of this the above regression models have been excluded for being the 'model of good fit' for cotton industry. However, in Brittain's Cash Flow Model, the explanatory power of the equation ($\bar{R}^2$) is the highest, being 0.988. Here the co-efficients of all the explanatory variables are of appropriate sign and are statistically significant. Further the DW value shows no auto correlation in the residual terms. Brittain's Cash Flow Model is considered suitable to explain the dividend behaviour of cotton industry.

Table 1 : Regression Tests for Selected Industries

Industries	Models	Equation Number	Constant	P_t	C_t	D_{t-1}	A_t	$\bar{R}^2$	DW	F ratio
Sugar	Lintner's Model	(1)	–0.152	0.091*** (1.960)		0.832* (5.513)		0.857	2.453	31.095
	Brittain's Cash Flow Model	(2)	0.217		0.083*** (2.388)	0.601** (2.987)		0.865	2.090	32.253*
	Brittain's Explicit Depreciation Model	(3)	–0.180	0.073 (1.501)		0.536 (1.775)	0.110 (1.123)	0.850	2.017	21.754*
Paper	Lintner's Model	(1)	1.703	0.039 (1.148)		0.751* (3.578)		0.643	2.102	1.929
	Brittain's Cash Flow Model	(2)	3.156		0.066** (2.793)	0.258 (0.988)		0.781	1.922	20.619*
	Brittain's Explicit Depreciation Model	(3)	3.845	0.056*** (1.984)		0.184 (0.629)	0.082** (2.394)	0.766	1.924	3.024
Cotton	Lintner's Model	(1)	–4.810	0.067*** (2.036)		1.249* (11.698)		0.964	1.507	150.057*
	Brittain's Cash Flow Model	(2)	0.950		0.082* (5.494)	0.428** (2.360)		0.988	1.589	456.218*
	Brittain's Explicit Depreciation Model	(3)	2.978	0.068* (3.714)		0.236 (1.028)	0.106* (4.557)	0.988	1.200	326.662*

P = Net profit after tax, C = Cash flow, D = Dividend paid, A = Amount of depreciation, Subscript 't' and 't–1' denote time period. Figures in the brackets denote 't' values of the co- efficients.

* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level.

Cash flow rather than net current earnings after tax is a better measure of a company's capacity to pay dividend.

The above empirical analysis of regression results disclose that, cash flow rather than net current earnings after tax is a better measure of a company's capacity to pay dividend. Further, it is evident that it is the lagged dividend which serves as the 'bench mark' for making changes in the dividend payment in a given year in view of the cash flow position of that year. This has induced us to favour Brittain's cash flow specification for further analysis.

Analysis of other Determinants

The analysis of various regression models reveals that Brittain's Cash Flow Model is the 'model of good fit' in all the three selected industries of the present study. Based on this model, the present study attempts to examine the impact of a few more determinants of dividend policy with the help of the sample data. These determinants are investment demand, flow of net debt, interest payment, liquidity and behaviour of share price. This has been done by including these determinants one by one as additional explanatory variables in the Brittain's Cash Flow Model. The various regression equations estimated for this purpose are :

$$D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3ID_t + U_t \quad 2.1$$

$$D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3FND_t + U_t \quad 2.2$$

$$D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3I_t + U_t \quad 2.3$$

$$D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3L_t + U_t \quad 2.4$$

$$D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3SP_t^i + U_t \quad 2.5$$

where D_t and D_{t-1} = Total equity dividend paid in period 't' and $t-1$ respectively

C_t = Cash flow in period 't'

ID_t = Investment demand in period 't'

FND_t = Flow of the net debt in period 't'

I_t = Total interest payment in period 't'

L_t = Liquidity ratio in period 't'

SP_t^i = Ratio of share price in period 't' to the average price of periods '$t-1$' and '$t-2$' respectively.

U_t = Error term

Investment Demand

The regression results in respect of inclusion of investment demand as an additional explantory variable in Brittain's Cash Flow Model are presented in Table 2.1. The co-efficient of investment demand (ID) has the appropriate negative sign in cotton industry. However, its co-efficient is not found statistically significant. In rest of the cases the co-efficients have the reverse sign. The inclusion of this variable in the 'model of good fit' has not increased, even marginally the explanatory powers of the equation in any one of the cases. It is therefore evident that the investment demand in general appears to have no significant bearing on the dividend decision of the sample companies.

Flow of Net Debt

From the regression results of the inclusion of flow of net debt (FND) as an additional explanatory variable in the Brittain's cash flow model, it is evident that its co-efficient has the appropriate positive sign in the case of sugar and paper industries. However, it is only in case of paper industry that the co-efficient is significant at 10% level and improves the explanatory power ($\bar{R}^2$) of Brittain's Cash Flow Model marginally from 0.781 to 0.786. It can thus be inferred that flow of net debt as a determinant of dividend decision has no significant impact in the case of cotton and sugar industries. However, its impact is felt very mildly in case of paper industry (table 2.2).

Interest Payment

The regression results in respect of inclusion of interest payment (I) as an additional explanatory variable in the 'model of good fit' disclose that its co-efficient has the appropriate negative sign only in case of cotton industry. But this negative co-efficient of interest variable is not found statistically significant. However in the rest of the cases the co-efficient has the positive sign. The positive co-efficient on interest variable in case of sugar and paper industries is found statistically significant and improves the explanatory powers of the model of good fit in both the cases i.e. from 0.781 to 0.817 in the case of paper and from 0.865 to 0.946 in the case of sugar industry (table 2.3). In this context one of the possible reasons for the positive relation of interest payment with dividends could be that, amount of interest paid is a charge on the profits of the company. It is allowed as a deductable expenditure while computing the taxable income of a business. It will be advantageous for the equity shareholders as the ratio of the debt to equity

Table 2.1 : Regression Results of Brittain's Cash Flow Model Along with Investment Demand

Equation : $D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3ID_t + U_t$ (1977-78 to 1988-89)

Industries	a_0	a_1	a_2	a_3	R^{-2}	DW	F ratio
Sugar	–0.103	0.071 (1.683)	0.623** (2.927)	0.005 (0.567)	0.854	2.148	22.454*
Paper	3.097	0.065** (2.561)	0.265 (0.958)	0.001 (0.289)	0.756	1.902	12.374*
Cotton	1.202	0.080* (5.266)	0.458** (2.483)	–0.003 (–0.981)	0.988	2.426	303.162*

Table 2.2 : Regression Results of Brittain's Cash Flow Model Along with Flow of Net Debt

Equation : $D_t = a_0 + a_1C_t + a_3D_{t-1} + a_3FND_t + U_t$ (1977-78 to 1988-89)

Industries	a_0	a_1	a_2	a_3	R^{-2}	DW	F ratio
Sugar	–0.048	0.082** (2.367)	0.551** (2.653)	0.009 (0.984)	0.865	2.358	24.407*
Paper	5.594	0.108* (4.712)	–0.357 (–1.098)	0.020*** (1.985)	0.786	1.996	14.477*
Cotton	0.953	0.078* (4.800)	0.468** (2.422)	–0.003 (–0.757)	0.987	1.906	289.902*

Table 2.3 : Regression Results of Brittain's Cash Flow Model Along with Interest Payment

Equation : $D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3I_t + U_t$ (1977-78 to 1988-89)

Industries	a_0	a_1	a_2	a_3	R^{-2}	DW	F ratio
Sugar	0.309	0.059** (2.586)	–0.061 (–0.285)	0.153* (3.835)	0.946	1.546	65.875*
Paper	4.856	0.053** (2.322)	–0.035 (–0.199)	0.047*** (1.856)	0.817	1.794	17.322*
Cotton	0.504	0.086* (5.054)	0.481*** (2.248)	–0.010 (–0.527)	0.987	1.845	279.831*

increases. This is so because with the increased borrowing, the amount of interest payment would go up. This in turn will reduce the income tax liability of the company, as the company will be able to avail tax concession out of the use of increased debt, as such funds so released may be used to support the payment of dividend to the shareholders. Thus our proposition that a rise in interest payment by a company would depress its dividend payment does not hold good, so far as the present analysis is concerned.

Liquidity

A persual of the regression results of the inclusion of liquidity factor (L), as an additional explanatory variable in Brittain's Cash Flow Model brings out the fact that, its co-efficient has the appropriate positive sign in sugar and cotton industries of the present study. However, its co-efficient is statistically significant and improves the explanatory power ($\bar{R}^2$) only in cotton industry (table 2.4). Thus it is inferred that the liquidity consideration is helpful in explaining the dividend behaviour in the case of cotton industry. In the rest of the cases, it seems to have no impact.

Behaviour of Share Price

From the regression results of the inclusion of share price in a given year a ratio of the average price of the preceding two years(SP'), as an explanatory variable in Brittain's Cash Flow Model it is

evident that, its co-efficient has the appropriate negative sign in case of the sugar industry (table 2.5). In the remaining two cases however, the co-efficients are not of appropriate signs. A close review of the regression results further discloses that even in sugar industry, the negative co-efficient of this explanatory variable is not found statistically significant and it also does not improve the explanatory power of the equation. Thus it may be inferred that, in general companies do not consider share price behaviour while taking dividend decisions. This is true for all the selected industries in our study.

Tagret Pay-out Ratio & Speed of Adjustment Co-efficient

The target pay-out ratio (r) and the speed of adjustment co-efficients (K) of selected Indian industries derived on the basis of Brittain's Cash Flow Model are presented in table 3.

It is seen that the target pay-out ratio (r) and the speed of adjustment co-efficients (K) of the sample industries show wide fluctuations. The target pay-out ratio is found to be the highest in sugar industry, being 0.20, followed by the cotton industry (0.14). The lowest target pay-out ratio is found in paper industry (0.09). This implies that internal financing is emphasised more in paper industry as compared to the sugar and cotton industries in our sample.

Table 3 : Target Pay-out Ratio and Speed of Adjustment Co- efficients in Sample Industries.

Industry	Target Payout Ratio (r)	Speed of Adjustment Co- efficients (K)
Sugar	0.20	0.40
Paper	0.09	0.74
Cotton	0.14	0.43

Note: The values of 'r' and 'k' have been derived from the Brittain's Cash Flow Model.

The speed of adjustment co-efficients are more or less of the same order in sugar and cotton industries, being 0.40 and 0.43 respectively, while in paper industry it is very high, being 0.74. The speed of adjustment co-efficient shows the intensity or desire on the part of the management to maintain stability of dividend rates. Stable earnings induce a management to choose high adjustment co-efficients. If earnings are subject to wide

Table 2.4 : Regression Results of Brittain's Cash Flow Model Along with Liquidity

Equation : $D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3L_t + U_t$ (1977-78 to 1988-89)

Industries	a_0	a_1	a_2	a_3	R_{-2}	DW	F ratio
Sugar	–3.638	0.069 (1.710)	0.622** (2.783)	2.861 (0.735)	0.858	2.176	23.114*
Paper	6.444	0.081** (2.878)	0.072 (0.223)	–2.122 (–0.978)	0.780	1.560	13.998*
Cotton	–5.283	0.083* (6.137)	0.362*** (2.152)	5.329*** (1.948)	0.990	2.362	374.636*

Table 2.5 : Regression Results of Brittain's Cash Flow Along with Share Price Changes

Equation : $D_t = a_0 + a_1C_t + a_2D_{t-1} + a_3 SP_t^{\bullet} + U_t$ (1977-78 to 1988-89)

Industries	a_0	a_1	a_2	a_3	R^{-2}	DW	F ratio
Sugar	–0.051	0.083*** (2.253)	0.598** (2.789)	–0.143 (–0.138)	0.848	2.067	21.541*
Paper	1.450	0.044 (1.438)	0.503 (1.480)	0.708 (1.107)	0.786	2.584	14.500*
Cotton	–0.843	0.075* (4.586)	0.513** (2.635)	–1.382 (1.112)	0.988	2.309	312.526*

C = Cash Flow, D = Dividend paid, ID = Investment demand, FND = Flow of net debt, I = Interest paid, L = Liquidity ratio, $SP^{\bullet}$ = Share price change. Subscripts t and t-1 denote time periods. Figures in the brackets are 't' values of the co-efficients.
* Significant at 1% level, ** Significant at 5% level, *** Significant at 10% level.

Stable earning induce a management to choose high adjustment co-efficients. If earnings are subject to wide fluctuations, a desire to have stable dividends lead to choosing lower adjustment co-efficients.

fluctuations, a desire to have stable dividends lead to choosing lower adjustment co-efficients. Generally companies do not like to have unstable dividend rates. The high speed of adjustment co-efficient in paper industry suggests the stability in the earning power of the sample companies belonging to this industry. On the other-hand, the low speed of adjustment co-efficients in case of sugar and cotton industries reflects instability in their earnings due perhaps to fluctuations in the demand for their products.

Summary

The above analysis brings out that Brittain's Cash Flow Model of dividend behaviour is better than all the other models analysed by the present study. It explains satisfactorily the dividend behaviour in all the three selected industries taken up by this study. It implies that dividend decision is primarily governed by cash flow, a measure of company's capacity to pay and dividend paid in the previous year. Among other determinants, the impact of flow of net debt on dividend decision is found significant in paper industry alone; its impact is not felt in rest of the cases. Liquidity factor has turned out to be a significant determinant in cotton industry only. Another interesting finding of this study is that interest payment turned out to be a significant determinant having a positive relationship with the dividend payment in the case of sugar and paper industries of the present study. However, determinants like investment demand and behaviour of share price have no significant bearing on the dividend policy decision of the sample companies. Further the analysis reveals that the target pay-out ratio and the speed of adjustment co-efficient of the sample industries in the present study show wide fluctuations. The low target pay-out ratios evident in case of paper and cotton industries indicate that, in the above group of sample companies the emphasis seems to be more on internal financing. The high speed of adjustment co-efficient in the case of paper industry indicates the policy of the companies belonging to this industry to maintain stable dividend.

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Feature

Are Technological Improvements Sequential? – A Preliminary Analysis

T.R. Madan Mohan

Attainment of indigenous technical capability at firm level has gained center stage with both policy-makers and managers concerned with management of technology in developing countries. Technological improvements that accrue at firm level are believed to be incremental and linear in nature. This paper based on an empirical study of sixteen manufacturing firms attempts to trace whether the technological improvements are sequential, and if so, what is it. Preliminary results indicate that product focus firms pursue a strategy of materials, operations and product changes in that order. Process focused firms pursue materials, operations, product changes and scale changes in that order.

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The industrial revolution led to the recognition of technology's paramount role in promoting rapid economic growth and social development. Development of indigenous technological capability (ITC) at the firm level has hence become top priority with policy makers of most developing countries. Studies have assumed that organisations acquire ITC by progressive learning from minor modifications to major technical changes (Dahlman & Westphal, 1981; Fransman, 1985; Kim, 1980; Lee et al., 1988) . Further, it is argued that firms do not like to risk changes during adoption for lack of enough generic and product specific knowledge (Enos & Park, 1988). Studies indicate that a substantial portion of indigenous technical capability that is harnessed in most developing countries is adaptive and incremental in nature (Deolalikar & Sundaram, 1985; Sethuraman, 1989; Swierczek and Nourie, 1992; TDRI, 1990). According to Desai (1985), a development economist, most of ITC in India has been built up, for and in the course of production, only the beginnings have been made towards ITC for transfer, and nothing beyond a glimmer is in evidence of ITC in innovation. Studies of Metcalfe and Gibbons (1988) and Cohen and Levinthal (1989) have pointed to the role played by incremental technological changes in a firm's learning. However, little is known about the particular sequences by which these are mastered and implemented. The importance of this issue stems from the fact that theories in business policy emphasize the need for fit or consistency between environmental demands and organisational states for attaining the desired performance (Tushman & Romanelli, 1985). To reduce this gap, an empirical study of sixteen manufacturing firms was attempted to examine the dynamics of incremental technological improvements in Indian manufacturing firms.

Literature Review

The incremental technological improvements that could be accomplished at the firm level can be broadly

classified into : material changes, process changes, and product changes (Abernathy & Townsend, 1974; Dewar & Dutton, 1986; Ettlie et al., 1984). Material changes include knowledge and implementation of locally available alternate materials (factor-substitution) or recycled materials and/or improvement of the material yield. It also includes the ability to suit the existing technology to the use of substituted or recycled raw materials (Deolalikar & Sundaram, 1985). Process changes encompass the ability to change operations and the capability to incorporate system changes. Operational changes refer to the ability to introduce changes in routing and scheduling operations, changes in the number of operations, rate of production, changes in process reliability, and quality. Operational changes may sprout when firms recognize that some of the operations are redundant, can be grouped or modified without trading off the production yield (Deolalikar & Sundaram, 1985) and also as response to increased demands on throughput time and delivery performance (Fransman, 1985; Ettlie, 1988). Firms in developing countries also witness a need for change in production systems (scale efficiencies either to meet new demand or to exploit local factor endowments) or change in technical parameters affecting the rate of production. The system changes include those in scale variations, throughput variations, and system integration.

Product changes refer to the ability to modify the characteristics of the product such as efficiency, dimension and application area. Successful product modifications require appreciation of the market need and the ability to translate these needs into products that perform. Researchers purport an incremental attainment of technical capability within firms (Lee et al., 1988). However, there are no empirical studies looking at the exact sequence of incremental technological improvements.

Successful product modifications require appreciation of the market need and the ability to translate these needs into products that perform.

Methodology

Recognizing the difficulty of obtaining longitudinal data, a multi-case method was adopted. Capital goods sector was chosen for its criticality in the processes of technology generation and diffusion. Additionally, in the capital goods sector both formal (market) and informal (non-market) information induces modifications, adaptations and innovations and hence allows a complete tracing of the technological transformation process. To reduce the influence of the variations in product-life stages and to account for at least one technology life-cycle, firms registered in the period 1970-1980 were chosen due to following reasons. Between 1961 and 1980, Indian firms signed some 6,000 technical collaborations, a majority of which were in the manufacturing sector and nearly all of which involved license agreements. Of the thirty firms contacted only sixteen agreed to participate in the study. Ten out of these are product focused firms and others firms in processing (both batch and continuous). The average employee strength and paid-up capital were 69 and Rs. 4.8 million, respectively. Table 1 presents the industry and ownership details of the sample.

Table 1 : Industry and Ownership Details of the Firms Studied

Industry Type	Type of the firm			Total firms in industry
	Public sector	Private sector	Joint sector	
Product industries				
Machines and mechanical	5	3	2	10
Process industries				
Chemicals and allied	3	2	1	6
Total	8	5	3	16

Analysis

The purpose of the study is to verify whether incremental technological improvements follow a particular sequence and to use this process model to discuss and analyse the technology development process. The intention was to base this, as far as possible on empirical evidence, i.e. the theory should display 'descriptive adequacy' (Chomsky, 1966). Descriptive adequacy refers to a theory based on a system of rules relating signals to semantic interpretations of the signals. The system of rules operates on list structures which are mapped into sentences by grammatical transformations. The study of incremental technological changes being still in its prospective stage, the situation calls for something different from methods geared to hypothesis-testing and verification. Thus, we avoided cross-sectional surveys recording instances of a number of preselected variables. The aim was not a quantitative generalization based on estimates of variables, but structural generalization about the process underlying the phenomenon in question.

The executives in the sample were asked to narrate their experiences of incremental technological

improvements in their firms. Measures of incremental technological changes were based on constable and New (1986), Enos and Park (1988), Hawaleshka and Mohamed (1987) and Malerba (1992). An interview sheet describing each of these were given to the respondents for clarification purposes only. Table 2 lists the measures and scales considered in this study. The critical incidence technique (Flanagan 1954), was used to define the process of technological improvements. This technique does not elicit opinions from the respondents, but rather asks them to recount what happened in specific instances. It has been found to be useful for identification of critical events of a phenomenon and researchers have effectively employed this technique to issues related to technology development (Utterback 1971). Wherever possible company records were used to verify and improve upon the details. To ensure consistency in the critical incidence for a firm, the researchers conducted a review meeting with all the members of the organisation contacted. This not only helped in reducing personal bias, but also in getting a comprehensive view.

Table 2 : Incremental Technical Capability Measures and Indicators

Incremental capabilities	Indicators	Reference
Material changes	Alternate materials incorporated Changes in material specifications	Constable and New (1976)
Operational Changes	Routing and scheduling changes, Operations changed Material balance improvements Changes in process reliability Changes in quality and performance	Constable and New (1976) Craig and Harris (1973)
System changes	Scale variations throughout rate improvements, Equipment changes incorporated subsystem integration	Hawaleshka and Mohamed (1987)
Product change	Feature additions Dimensional changes Product performance improvements Robustness of usage	Enos and Park (1988)

Four independent raters, each of whom was well acquainted with qualitative techniques and possessed doctoral-level training in management, were than asked to evaluate the improvement process from these critical incidences. This strategy has been successfully adopted by researchers to elicit the sequence of events that occur over a project/ technology history (Van de Ven 1992, Newman & Robey 1992). The raters, who were never in communication with each other, were given no special instructions except details regarding the abstractions ensuring completeness and clarity. Raters initially evaluated using critical incidence for sixteen firms and the Spearman correlation were computed. The correlations ranged from 0.77 to 0.92 revealing high concordance amongst the raters. An example of the above process is given in table 3.

Table 3 : Examples of the Classification by Raters

Examples	Inter-rater correlations
Product variations were possible as already material variations were standardised	0.78
Improvements in blending operations paved chances for increasing the production rate	0.89
The permissible material losses were reduced by trying alternate materials and switching over to open calcination process which required changes in two succeeding operations.	0.87

Result

Table 4 : Incremental Technological Changes in Product Firms (base-period 1980)

Firm	Product manufacturing	The process of improvement
A	Heavy Electrical machinery	Material changes to reduce the cost of reworking during 1982. Introduction of product variants to exploit demand in 1985. Operational changes to consolidate manufacturing efficiency.
B	Machine tools	Market demands reliability. Specifications to counter trace elements. Robust product planning and feature changes in 1986. Routing and scheduling change in 1988.
C	Light machines (punching and retrofitting)	Product modified to accommodate different mounting in 1983 operations combined in 1984.
D	Heavy Industrial valves	Shift from Sg Iron to Vg. O.3 Mg Iron in 1984. Seat configuration changed to quadrant method.
E	Titanium-based m/c tools	Customer complaints of complex stress for flange loads in 1982. Standardisation of physical property by grain modifications in 1983. Wider range of tools manufactured. Higher product applications in 1985.
F	Alternators	Higher ranges of alternators added in 1983. Routing changes in 1984.

Tables 4 and 5 show the details of technological changes in product and process firms. It is interesting

to note that product firms witness an incremental technological change trajectory of material changes first, product changes next and finally operational changes. Asian Productivity Organisation (1994) reported similar routes of technical change from Japan, Pakistan, and Taiwan. However, process firms seem to address system changes only after exploring material changes, product changes, and operational changes. Such trends have been noted by Enos (1962) in petrochemicals, Hollander (1965) in rayons and Lieberman (1987) in Chemical process industries. It has been observed that when faced with indivisibilities and difficulty in modifying the scale of production through additional investments, firms resorted to scale changes.

Table 5 : Incremental Technological Changes in Process Firms (Base-period 1980)

Firm	Product manufacturing	The process of improvement
W	Bulk chemicals	Material changes to reduce the manufacturing cost. Changes to exploit material conversion in 1984. Setting time changes in 1985 to consolidate steam efficiency.
X	Carbon based products	Material changes to reliability. Product feature changes in 1986. Scale changes in 1987.
Y	Bulk chemicals	Product modified to accommodate, Combination of operations to reduce throughput time.
Z	Dye chemicals	Slag improvements in 1982. Changes in bond strength in 1984. Scale changes in 1986.
ZZ	Thermo-plastics	Mechanical properties altered in 1984. Continuous forming process in 1986.

The results imply a sequence of incremental technological learning from one of minor modifications to major technical changes. It appears that material changes are easier than changing the product characteristics or operations, and firm's hence pursue this particular trajectory first (Malkawi, 1986; Sethuraman, 1989). While attempting technological changes, the firms may require not only technology (product/ process) specific knowledge, but also generic technical knowledge in allied areas. Firms attempt to elicit this knowledge from universities, federal labs and R & D institutions; material suppliers and allied industries may also contribute towards this knowledge. For a firm to effectively use technology as a part of its strategy, it appears that an emergence of specialised product markets and incremental experimentation is necessary.

Additionally, the results indicate that priorities of technical capabilities differ with the 'manufacturing focus' of the firm. In product firms with deterministic demand and possibilities for production scale exploitations, changes in operations and product would have substantial influence on the throughput time. While in process focused firms the capabilities system changes to exploit any changes in product become crucial. Improvements driven from manufacturing scale considerations have a significant role to play as far as new product marketing is concerned. Firms may go in for product changes which are within the capability of the manufacturing system, and these could be of the nature of a variant of the existing model, including dimensional changes and cosmetic improvements needed by marketing. The gestation periods required for incremental scale innovations are small and less risky in process firms in comparison to product firms (Wild, 1984).

Material changes are easier than changing the product characteristics or operations, and firm's hence pursue this particular trajectory first.

Conclusions

The present study attempted to understand the trajectories of incremental technical capability in Indian manufacturing sector. The first conclusion concerns the sequence of incremental technological changes. The study found that material changes, operational changes and product changes are the incremental changes attempted by the product firms in that order. Knowledge about materials is mastered first and corresponding changes in operations (redundancy/ grouping of operations/ cycle time exploitations) are mastered next.

Governments that seek to expedite the process of technology diffusion and development must selectively offer support specific to the technical capability pursued by the firms.

Further, the study offers some interesting lessons for public policy in the areas of innovation and technology development. The results imply that governments that seek to expedite the process of technology diffusion and development must selectively offer support specific to the technical capability pursued by the firms. The ability

to correctly identify the bottlenecks in acquiring the technical capability requires a high degree of expertise and investment specific to the incremental capability itself. Development of testing and design centers, quality improvement programs, exposure to new non-destructive techniques and dissemination of product generic information (including standards) at appropriate timings strengthen the technical base.

Some shortcomings need to be mentioned that may limit the impact of our findings while suggesting avenues for further research. The first limitation of the study arises from its sole reliance on analysis of independent variables based on critical incident technique alone. Ideally, the study should have attempted multi-variate analysis of time related variables. Further research can be addressed on the lines of Noble (1991). Secondly, the study did not include analysis of incremental technological changes on the organisational performance measures such as Return on Investment, IRR, etc. Future studies can attempt identifying variations with high and low performers on these criteria and map the locus of incremental technological changes. Analyzing the organisational performance along with environmental variables may be challenging as it offers avenues for identifying the relationships with the sequence of incremental technical capability and performance.

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Feature

Deregulation of Telecommunications : A Case Study of Punwire

B.S. Ghuman

In this paper the impact of deregulation on Indian telecommunications industry in general, and on the firm, PUNWIRE has been analysed. Deregulation has led to growth, improvement in productivity, product diversification, penetration into new market segments patterned on a competitive basis, better profitability and dividends, reduction in costs and prices, raising of funds from domestic and international markets, creating awareness in the minds of employees about share culture, and increasing the number of foreign collaborations. At the same time the adverse effects of deregulation are alarming as there have been no qualitative changes.

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Deregulation has now become a world wide phenomenon. Its nature, extent and effects however are unlikely to be the same in developing and developed countries. India – one of the largest democratic developing countries – provides a big laboratory for deregulation studies. The Nehruvian model of growth adopted during the 1950s and patterned somewhat on the Soviet model involved strict regulation in most areas of the economy. However, since the beginning of the 1980s, winds of change have been blowing leading to the New Industrial policy, (NIP), 1991 involving sweeping measures of deregulation aiming at growth, efficiency and equity through competitiveness. A number of studies of deregulation have been made (Ahluwalia, 1991; Sandesara, 1991; Subrahmanian, 1991; Mani, 1992; Sandesara, 1992; Sen and Das, 1992; Gokarn and Vaidya, 1993, Jain, 1993, Sengupta, 1993; and Swamy, 1994). However, since these are based mostly upon aggregate data, they do not throw sufficient light on the various factors involved and the various effects, given the heterogeneity of industries. Keeping this in view the present study is confined to the telecommunications industry in general and to a firm belonging to this industry in particular. The telecommunications industry is among the fast growing industries in India. The increasing interest of international as well as domestic capital in this sector indicates that it has a very high growth potential. Wide ranging deregulation reforms are in progress in this industry which was highly regulated till recently. These aspects of telecommunications industry were the major guiding factors for selecting this industry for study. The Punjab Wireless Systems Limited (PUNWIRE) has been selected on the basis of its dynamism and reputation in the capital market.

Modalities of Deregulation

Broad deregulation measures relating to the telecommunications industry may be summarised as follows. In the Industrial Policy Resolution of 1956, the

manufacture of the complete gamut of telecommunication equipment was the monopoly of the state sector. In 1984-85, cent per cent private ownership of equipment such as telephones, EPABXs, teleprinters, fascimile cum data communication equipment and terminals at the subscriber's premises was allowed. For other items, participation of the private sector was to be encouraged upto 49 percent of equity shares. Measures during 1985-86 included broad-based licensing, liberal import of technology and foreign collaborations, greater freedom in regard to location of new units, exemption for Monopoly and Restrictive Trade Practices (MRTP) companies from clearance under Sections 21 and 22 of the MRTP Act, reduction of import duty on raw materials and capital equipment, and authorization of regional licensing authority for processing import applications for capital goods and raw materials. In 1986- 87, the Union Government delegated powers to the Ministries to issue foreign collaboration approvals involving payment for technology not exceeding Rs. 10 million. In 1987-88, the upper limit for capacity was removed. During 1988-89, cent per cent Indian private companies were allowed to manufacture switching equipment upto a capacity to 2000 lines and transmission equipment upto a capacity of 120 voice/ data channels. The domestic private sector was also permitted to manufacture wireless apparatus such as multi-channel radio relay systems upto 120 voice data channels; paging systems; lower power wireless control gadgets namely, cordless telephones, cordless microphones, remote control units for T.V., remote control alarm systems, remote control electronic toys and games. In 1989-90, manufacturing of telephone amplifiers was exempted from licensing and liberal export measures were announced. The year 1991-92 and subsequent years have been witnessing drastic reforms in the telecommunications industry. Four major changes were : abolition of state monopoly in the manufacturing of all telecommunication equipment, taking the industry outside the purview of the licensing system; industry manufacturing electronic equipment components including subscribers' and telecommunication equipment, being included in the list of industries for automatic approval of foreign technology agreements and for 51 percent foreign equity approvals; and introduction of Electronic Hardware Technology Park (EHTP) designed for liberalized import-export procedures. In addition, the telecommunications industry has been reaping the advantages of other measures announced in the NIP, 1991 and subsequent central budgets.

The telecommunications industry in India has been responding to these measures. As deregulation experience accumulates, the studies indicate that some of its results are at variance with its rhetoric.[1] The studies in general conclude that deregulation has stimulated growth, encouraged competition and reduced prices. These positive effects are accompanied by adverse effects on the industry's capability to generate employment, value added and foreign exchange (Joseph, 1989; Rao Committee Report, 1990; Bowonder and Miyake, 1990; Electronics Information and Planning 1990; Rastogi, 1991; Joseph, 1991; Narayana and Joseph, 1993; Joseph and Subrahmanian, 1994). This uneven trend suggests that the exact effects of deregulation, are hard to gauge. Hence it is of importance to find out by means of micro studies, with a multi-disciplinary approach, the exact changes that are taking place in various aspects, namely, growth, financial performance, product diversification, marketing, ownership, employment, dependency and overall organizational structure.

Sample Profile

PUNWIRE was set up in 1975 under the Companies Act of 1956, as a wholly owned subsidiary of the Punjab State Industrial Development Corporation (PSIDC) – a public sector undertaking of the Punjab Government – with the objective of manufacturing communication equipment for police and defence services. The Company started commercial production in 1979. PUNWIRE has two manufacturing plants equipped with sophisticated machinery and other infrastructure. It has 970 employees on its pay roll. Its policy matters are managed by its Board of Directors comprising experienced professionals in the field of electronic equipment. Its day-do-day functioning is managed by a Managing Director who is an electronics engineer having over twenty one years' experience. He is assisted by qualified and experienced personnel in the field of R & D and production, commercial, financial, marketing and general management. Its authorised and paid up capital was Rs. 100 millions and Rs. 64 millions respectively in the year 1993-94. It is one of the few profit-earning and dividend paying companies operating in the public sector. PUNWIRE has been serving the communication needs of different segments of the market such as the Defence Ministry, the Department of Telecommunication (DOT); Police and Paramilitary Forces, the Oil and Natural Gas Corporation (ONGC); Indian Railways, the Indian Navy, private consumers and the international market.

PUNWIRE has initiated a series of measures to reap the benefits of deregulation. The measures have affected aspects such as growth, productivity, financial

1. In most macro studies the behavior of the telecommunications industry, due to data constraints, has been analysed as a part of the electronics industry.

performance, product diversification, marketing, ownership, employment, and import dependence. A methodological question arises in regard to gauging the effects of deregulation. Since there are always a number of factors in the situation, isolating the effects of deregulation alone poses a problem. This question has been raised with regard to macro studies (e.g. Joseph, 1989; Ahluwalia, 1991; Joseph, 1991; Subramanian, 1991; Pradhan, 1992; Gokarn and Vaidya, 1993; Narayana and Joseph, 1993, and Joseph and Subramanian, 1994) which have attributed most effects to deregulation on the assumption that other factors pale into insignificance before it. We have tried to meet this objective in our case study. First we have studied projected/actual figures relating to products launched during deregulation. Secondly, we have tried to get qualitative data through interviews with the management. Our findings indicate that the assumption about the dominant role of deregulation is valid.

The sources of data include a wide range of reports of the Company, interviews with the management and proceedings of the first extraordinary general meeting of shareholders.

Growth & Productivity

The growth profile of PUNWIRE in relation to deregulation reveals a mixed picture. During the pre-deregulation period – from 1981-82 to 1984-85 – the turnover of the company grew at rate of 20.30 percent per annum. In the post-deregulation period – from 1985-86 to 1993-94 – the rate of growth of turnover was 18.56 percent. The bifurcation of deregulation period in terms of slow (1985-86 to 1990-91) and fast (1991-92 onwards) shows that PUNWIRE recorded only 14.76 percent per year growth in its turnover during the slow phase whereas the growth rate during the fast phase was 51.52 percent. The major sources of growth are turnover of push button telephones and export sales of modems – the direct outcomes of deregulation policies.

Both labor and capital productivities have improved during post deregulation period. For example, labor productivity grew at the rate of 10.91 per cent per annum during post-deregulation period, whereas during the pre-deregulation phase its rate of growth was 6.13 percent. The rate of growth during the fast deregulation period was much higher (56.92 percent) as compared to the slow deregulation period (6.74 percent). Capital productivity registered negative rate of growth during both the periods. However, the rate of growth in the post-deregulation period (–5.66 percent per annum) was higher than that of pre-deregulation period (–19.83 percent). Recently, the rate of capital productivity has improved further.

Financial Performance

There is little doubt that profitability of the company has improved after deregulation. Table 1 reveals that the ratio of profit before tax to capital employed, barring the year 1981-82 has been higher during post – deregulation period as compared to pre-deregulation period. The comparison of this ratio across slow and fast deregulation phases indicates that though it was low in the years 1991-92 and 1992-93 as compared to most of the years belonging to the slow deregulation period, the trend during fast deregulation is on the rise. During the last few years of slow deregulation this ratio has continuously declined. The net rate of return (ratio of profit after tax to net capital employed) has more or less followed the same pattern. Cost trends indicate that percentage of cost of sales to sales has declined, though marginally, during deregulation. In fast deregulation phase, the declining trend in cost becomes more visible. The dividend paid, undoubtedly, has increased during post-deregulation period. Within post-deregulation period, higher dividend has been paid during the fast phase of deregulation.

Product Diversification

As a result of deregulation measures, PUNWIRE has also been diversifying its products. Before deregulation, it was producing only VHF transreceivers, HF transreceivers/transmitters and semi-conductor devices. During the post-deregulation period, the company launched programmes of broadening the product mix. The new products introduced are push button telephones, feature phones and cordless phones, multi-access rural radio (MARR) and modems. The production of push button electronic telephones, and MARR respectively was introduced in 1987-88 and 1989-90. Modems and feature phones including cordless phones were launched in 1992-93 and 1993-94 respectively. The new products have established their edge over traditional ones. The share of push button electronic telephone instruments, for example, was only 15.62 per cent in total turnover during 1989-90 and increased to 24.77 per cent in 1992-93. The turnover of modems during the very first year (i.e. 1992-93) constituted 24 percent of the total turnover. On the other hand, the share of traditional products like VHF transreceivers and HF transreceivers and transmitters has declined from 81.31 percent in 1989-90 to 46 percent in 1992-93.

Table 1: Punwire's Financial Performance

Year	Profit Before Tax (PBT) (Rs. Millions)	Profit After Tax (PAT) (Rs. Millions)	% age of PBT to Capital Employed	% age of PAT to Capital Employed	% age of Cost of Sales to Sales	Dividend (Percentage)
1981-82	4.53	3.03	36.45	24.35	88.92	10
1982-83	1.95	1.95	3.69	3.69	95.87	10
1983-84	(–)3.40	(–)3.40	(–)4.44	(–)4.44	111.69	Nil
1984-85	1.77	1.77	4.06	4.06	97.92	5
1985-86	10.32	10.32	18.16	18.16	91.98	10
1986-87	8.69	7.12	11.31	9.26	95.65	10
1987-88	21.78	18.28	19.86	16.67	89.47	15
1988-89	14.39	10.44	10.30	7.47	92.71	15
1989-90	14.05	11.59	9.39	7.45	94.10	20
1990-91	10.80	10.80	7.10	7.10	95.13	20
1991-92	15.30	13.10	7.40	6.34	94.91	25
1992-93	37.20	33.30	14.72	13.18	92.15	30
1993-94	–	71.20	–	–	–	50

Note: Cost of sales is worked out as the difference between sales and profit before tax.

Source: Annual Reports of PUNWIRE and the Tribune

New products, namely digital time division multiple access (TDMA) equipment, digital microwave radio relay, walkie-talkie- UHF tactical radios, and 2/15, 4/30 multiple access rural radio, have just been launched. In the first extraordinary general meeting (EGM) held on May 9, 1994, after the Company went public, the shareholders approved an ambitious expansion, diversification and modernization plan of Rs. 1600 million. It is now getting into the manufacture of pagers, GSM cellular phones, fibre optic terminal equipment and digital microwave systems (table 2).

PUNWIRE has also decided to provide telecom services. The Company's Memorandum and Articles of Association have been amended to authorize it to carry on business in the telecom services sector. The Company announced its plan to operate value added services such as cellular mobile services, radio paging services, e-mail and voice mail satellite. In order to get orders from DOT, the Company has collaborated with operating companies having international experience (table 2).

Marketing

In the beginning the Company was marketing its products to the Defence Ministry, police and paramilitary forces. These market segments are highly regulated. The Company has shaken off the defence-police bias and has penetrated into other market segments. The new products cater mainly to the needs of the Department of Telecommunications (DOT), Mahanagar Telephone Nigam Ltd. (MTNL), industrial organisations, individual consumers and the international market. During 1992-93, the Company marketed about 37 percent of its products to traditional buyers. The products supplied to DOT and MTNL constituted 41 percent of the total. About 14 percent of the total products was sold to industrial organisations and individual consumers and 8 percent to international buyers.

For traditional products, namely, 2-way Radios, the Company has been competing mainly with WEBEL, Phillips, and Motorola; and controlling 35 percent of the total market (table 3). In case of push button telephones, the Company has been facing severe competition from BPL, TATA, ITI, and BEETAL, and claiming 15 percent share of the market. Increasing competition and changes in the procedure of placing bulk order by DOT in favour of the lowest bid have resulted in reduction of prices of push button telephone ranging between 5 and 15 percent. The Company has been meeting 15 percent requirement of the rural telecom equipment market. Its two major competitors are SHYAM and ARM. With regard to Radio Trunk Systems/Radio Local Systems (RTS/RLS), the Company enjoys monopoly position. In case of microwave equipment, the Company's competitors are HTL and SHYAM and the Company is likely to claim 10 percent of the market share. The Company initially had monopoly status in case of TDMA. However, with the entry of TATA and GCEL, its share is

Table 2: Punwire's Corporate Expansion & Diversification Plan

PHASE	DESCRIPTION	INVESTMENT	IMPLEMENTATION PERIOD	COLLABORATIONS	EXPECTED TURNOVER 1995-96	1996-97
PHASE-I	*FUNDING THROUGH PLACEMENT OF EQUITY WITH FIIS-Rs. 700 Million*					
	Expansion into existing product lines. Working capital requirements.	Rs. 500 million	December '94	Relm Communication USA for VHF products, Tadiran Israel for Wireless Local Loop & Tank Radio,	Rs. 1500 million	Rs. 2500 million
				Hagenuk Germany for Satellite Phones & Tamagawa for Cordless Phones.	Rs. 2500 million	Rs. 500 million
	Setting up facilities for manufacture of Pagers.	Rs. 200 million	December '94	Own development	Rs. 300 million	Rs. 500 million
PHASE-II	*FUNDING THROUGH US$ 30 MILLION GDR ISSUE - Rs. 900 Million*					
	Manufacture of GSM Cellular Phones	Rs. 27 million	June '95	Hagenuk, Germany	Rs. 400 million	Rs. 600 million
	Manufacture of Fibre Optic Terminal Equipments	Rs. 28 million	June '95	Being Finalised	Rs. 350 million	Rs. 700 million
	Manufacture of Digital Microwave Transreceivers	Rs. 34 million	June '95	Being Finalised	Rs. 450 million	Rs. 700 million
				TOTAL	Rs. 3000 million	Rs. 5000 million
PHASE-III	*PUNWIRE TO DIVERSIFY INTO TELECOM SERVICES-(Funding plan to be finalised)*					
	To Operate Radio Paging Services	PUNWIRE proposes to setup separate	December '94	Telecom Denmark, Denmark	Expected return on investment is 25% to 30% in telecom services.	
	To Operate Cellular Mobile Services	joint venture operating	June '95	Digital Telecom, U.S.A.		
	To Operate E-Mail, Voice-Mail, Satellite Services	companies, Funding to be decided later for these services.	December '94 June '95	Being Finalised Orbitel, U.K.		
	To Operate CT-2 Services					

Source : PUNWIRE

likely to come down to 40 percent. Regarding cordless and feature phones, the Company is claiming 10 percent of the market share and is competing mainly with imported brands.

PUNWIRE has been marketing its products mainly on the basis of tenders floated institutional buyers. Its marketing strategy, thus, is focussed upon a few select institutions. However, a recent decision of DOT is likely to weaken the tender culture and pave the way for open marketing. At present, the telephone instruments or customer premises equipment are supplied by DOT alongwith connections. DOT has decided that from October 1, 1994, in cities having more than 10,000 lines, it will supply connections upto the customer's window and from that point, supply of wiring and instruments would be the responsibility of customers. The decision has been extended to the whole country on April 1, 1995. These deregulatory measures will require the customers to buy telephone instruments from the open market and will pose a new marketing challenge to PUNWIRE. In addition, the Company has been marketing products such as cordless and feature phones to consumers. The new products likely to originate from the new plan of the Company, will also mainly be sold in the open market. In view of these developments open marketing will gain momentum. The Company has acknowledged the change and has initiated a series of measures. It has set up a separate consumer marketing department to deal with product planning, pricing, sales promotion devices, after sales service and channels of distribution. It has opened sales-cum-service centres in four big cities – Delhi, Bangalore, Bhopal and Lucknow. The Company is in the process of opening centres at

TABLE 3: Punwire's Bussiness Scenario in Existing Product Lines

	INTRODUCTION	CUSTOMER	MARKET		COMPETITORS		PUNWIRE'S MARKET SHARE		COMPETITIVE STRATEGY REQUIRED
			Present Rs. in million	Future Rs. in million	Main	Others	Present Percent	Future Percent	
1.	2-Way Radios	Police & Security Agencies Business Industry	520 130	700 320	WEBEL MOTOROLA PHILIPS	UPTRON BEL, MACE MELTRON	35	30	Introduction of new technology
2.	Push Button Telephones	DoT Other	850 50	– 2000	BPL, TATA ITI, BEETAL	PRIYARAJA CROMPTON GECL	15	10	Introduction of new series of EPBTs
3.	Rural Telecom Equipment	DoT	800	1500	SHYAM, ARM	NATALCO, UPTRON VINFO. ITI BEL, ECIL	15	17.5	Development of 4/32, analog & Digital MARR System
PRODUCTION JUST COMMENCED									
4.	RTS/RLS	Defence	500	500	–	–	100	100	Installation of balancing equipment
5.	Tactical Radio	Defence	200	200	–	–	100	100	Investment in plant & equipment to support bulk production
6.	Microwave Equipment	Dot	2000	2000	HTL, SHYAM	ARM, PCL, ITI, TATA, BEL, L & T, TATA	–	10	Investment in plant & equipment to support bulk production
7.	TDMA	DoT Business Industry	Nil 50	600 150	TATA	GCEL	100	40	Investment in plant & equipment to support bulk production
8.	Cordless & Feature Phones	Consumers	200	900	IMPORTED BRANDS	WESTON, BEETAL, TATA	10	15	Investment in plant & equipment to support bulk production.

Source : PUNWIRE

Calcutta, Bombay or Ahmedabad. Thus, it will have marketing network spread over the whole country.

Deregulatory measures will require the customers to buy telephone instruments from the open market and will pose a new marketing challenge.

Ownership

The pace of expansion and diversification depends upon the availability of finance. However, due to resource crunch, it is difficult for the parent company – PSIDC – to finance expansion and diversification plans of its subsidiaries including PUNWIRE. The NIP 1991, contains the way to ease financial constraints of PUNWIRE being a subsidiary of PSIDC. As stated earlier, NIP, 1991, opened the manufacture of telecommunications equipment to private sector. PUNWIRE by taking advantage of this reform decided to move towards privatization through equity participation of mutual funds, employees and the public.

The Company approached the market in October 1993, to raise resources to the tune of Rs. 150.2 million to finance its ambitious diversification-cum-expansion plan. It floated a public issue of 3,755,000 equity shares of Rs. 10 each for cash at a premium of Rs. 30 payable in two instalments – Rs. 10 on application and remaining Rs. 30 on allotment. Out of the total, 194,000 equity shares were reserved for preferential allotment to the employees of the Company with the aim of improving their identification with it. The total number of employees was 970. All employees barring one got 200 equity shares each. Equity shares numbering 751,000 were reserved for preferential

allotment to mutual funds. The company received 10 valid applications for 3,334,500 equity shares from mutual funds, resulting in an oversubscription of 4.4 times. The net public offer consisted of 2,810,000 equity shares. In response to this, the Company received 726,891 valid applications for 105,394,700 shares resulting in an oversubscription of 37.50 times. The two hundred unsubscribed shares reserved for employees were added to the net public offer and hence net public offer comprised 2,810,200 shares. Following the spirit of NIP, 1991, the Company encouraged wider share ownership at the time of allotment of shares. The Company did not allot more than 100 shares to each allottee irrespective of the number of shares applied for.

The distribution pattern reveals that 60 percent of the allottees belonged to the category of those who applied for 100 shares, 17 percent were from the category of 200 shares and only 0.05 percent from the category of those who applied for shares numbering 2200 to 5000.

After the completion of this process the nature of ownership of PUNWIRE has changed. The equity capital of PSIDC has come down to 41.77 percent. The rest is with the public, employees and mutual funds. PUNWIRE thus became a public limited company.

The recently completed process of public issue has brought interesting facts to light. The first and most important fact is underpricing of shares and consequently huge losses to the company. This is proved by the high price of share i.e. Rs. 285 and Rs. 350 respectively in Delhi and Bombay stock exchanges at the end of the first day of trading of shares. The high volatility continued for two months. The share price has now settled between Rs. 270 and Rs. 280. The enormous windfall gain per share to the extent of Rs. 243[2] in Delhi stock exchange and Rs. 314[3] in Bombay on the first trading day and to the tune of Rs. 235[4] at present, is really astonishing. It has been found that four factors resulted in underpricing. First, it was the first issue of the Company and hence the premium was kept deliberately low with an aim to experience maximum oversubscription. Secondly, the capital market trend in general and that of public issue of public enterprises in particular was low profile at the time of finalization of premium. Thirdly, the Company came to know about its market reputation when the scheduling of the public issue was almost finalized. This indicates that the spade work done by the Company and the lead managers to determine the premium was inadequate. Above all, a firm like PUNWIRE working as a wholly owned subsidiary of a public sector undertaking has no channel of information to gauge its market reputation. This lack of information has also contributed to underpricing of shares. In situations like this a small public issue is a suitable approach to understand the interplay of market forces. The result may be used as a guide for larger public issues.

The preferential allotment of shares to workers ensured smooth completion of the process. However, a majority of the employees of PUNWIRE disposed of shares allotted to them. Many of them sold the allotment letter at a premium. A few sold the shares at a later stage at an attractive premium. Only a small number of employees have retained the shares. Of the latter, the majority belongs to the managerial cadre followed by engineers and supervisors. Other categories of employees, particularly skilled, semi-skilled and unskilled workers have almost disposed of their shares and the Company's intention of increasing employee identification with it, did not succeed. The Company did not explain to the workers, a majority of whom were exposed to equity culture for the first time, the long term benefits of retaining the shares. The company also did not offer incentives in the form of vouchers and share bonuses for loyalty to employees for retaining shares. Left to themselves, the employees could not contain the temptation of selling shares at soaring prices to garner immediate monetary gains. Thus the company lost a golden opportunity to win over its employees on a long term basis. However, it has created awareness in the minds of employees about share culture and a sizeable number has been investing in primary and secondary markets and hence in the long run it may be helpful to promote workers' interest in buying shares.

Information about selling of the shares by the public is also pouring in. The buyers are mutual funds and brokers. According to one estimate, a few mutual funds have acquired 7 hundred thousand shares from the market over and above the firm allotment to them. Similarly, one of the brokers has obtained 11 percent stake in equity of the Company. It can be inferred that market forces have set a trend towards concentration of shares in the hands of mutual funds and brokers and in the process small investors and employees have been marginalised.

Deregulation has made access to the foreign capital market easier. in view of this, the company has recently decided to tap the global market in a big way by raising resources to the tune of Rs. 1600 million. The shareholders have approved the proposal to raise Rs. 700 million through placement of equity with foreign financial investors (FIIs) within prescribed placement limits fixed by the Securities and Exchange Board of India (SEBI). The placement price per share with FIIs is

2. The gain per share was 613 percent.
3. The gain per share was 775 percent.
4. The gain per share was around 588 percent.

likely to be between Rs. 350 and Rs. 400. However, the final outcome depends upon the relative strength of PUNWIRE, its merchant bankers and FIIs. Undoubtedly, the market trend is in favour of PUNWIRE. In addition, the shareholders have also approved the proposal to raise Rs. 900 million through an Euro-issue. The foreign equity participation, is expected to be helpful for importing the sophisticated technology required for its future expansion and diversification plans (table 2).

Deregulation has made access to the foreign capital market easier.

The rapid marketing of shares resulting in skewed distribution of shareholdings, and proposed funding through placement of equity with FIIs and Euro issues, are likely to lead to takeover bids. To thwart this move, the shareholders have approved to maintain the present shareholding (i.e. 41.78 percent) of PSIDC by issuing warrants entitling it to apply for and be allotted one equity share per warrant.

Employment

The existing level of employment has not been adversely affected by deregulation in PUNWIRE. The Company being a subsidiary of a Punjab State Undertaking, has not resorted to retrenchment of staff in view of its social and political obligations. PUNWIRE, however, decided to utilize its manpower intensively by introducing new product lines. In the expansion-cum- diversification project of the Company, there is no provision for additional labor in the non-management category. The project, however, envisages to double the number of engineers and senior commercial executives. Deregulation in this way is likely to change the structure of employment in favour of high quality jobs. To conclude, the new policy is resulting in stagnation in employment of supervisors, semiskilled and unskilled labor but growth in the categories of engineers and senior commercial executives. In a country like India which has largest chunk of unskilled and semiskilled workers, this outcome has far reaching implications.

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Import Dependence

Import dependence of a Company is studied in the form of material and technology dependence. Material import dependence is defined in terms of consumption of imported material as a percentage of total consumption of material during a particular year. Technology import dependence refers to import of capital goods as a percentage of addition of capital goods during a year (Rao, 1993).

The Company is using both indigenous and imported raw materials. It endeavors to use more domestic raw materials. In many of the projects including the latest one, the target of imported raw material is envisaged to be around 40 percent of the cost of total raw material however it has never been achieved. The Comptroller and Auditor General (C & AG) of India in one of his reports has called for reasons from the Company regarding this. The reply, the report points out, was awaited. In post- deregulation period, the trend is slowly favouring indigenisation of raw material from domestic industries which are coming up as a consequence of deregulatory policies. The degree of material import dependence is still very high. For example, in 1992-93, it was as high as 66 percent.

The Company has been operating in a hi-tech area and hence depends on foreign technology. Before deregulation, import of technology was restricted and the related procedure was cumbersome. The Company had to seek the permission of the Central Government and as a result, on an average, one to two foreign technical collaborations per year were signed. Since inception of NIP, 1991 and subsequent changes, the import of technology has become easier and hence the number of foreign collaborations per year has increased twofold. This has been resulting in technology import dependence. In the latest project of the company, the total plant and machinery is valued at Rs. 511.3 million, out of which 78 percent was imported. The technology import dependence has been accompanied by an increase in expenditure in foreign currency on items such as technical knowhow fees, royalty, travelling and conveyance of the Indian technicians. For example, expenditure on these items was 0.52 percent of the sales in the pre-deregulation period (i.e. 1983-84). In post-deregulation period barring 1991-92 this figure each year was much higher. In 1992-93, it was 3.14 percent. The technology fees already paid for the latest project constitutes 4.51 percent of the projected sales for the year 1993-94 likely to flow from the new project.

With easy access to foreign technology, the in-house R & D facilities have been marginalised. For example, out of five new products recently launched by the Company,

With easy access to foreign technology, the in-house R & D facilities have been marginalised.

only one is to be manufactured with in-house technology, and the remaining four in collaboration with firms from USA, Germany and Japan. In the latest corporate expansion and diversification plan approved by the shareholders, the Company would manufacture products and provide services in collaboration with seven foreign firms. Only one product would be manufactured with in-house technology (table 2). Another indication in this direction has been the reduction in R & D expenditure as proportion of sales. For example, in new products, R & D expenditure has been assumed to be only 0.5 percent of net sales in all the projections. Earlier, expenditure on R & D as proportion of sales was around 3 percent. The low profile of R & D efforts in the company is a departure from the earlier path of 'dependence-independence' continuum of technological change (Subramanian, 1991). In the past, during both the pre-deregulation and gradual deregulation periods, the imported technology through R & D efforts was suitably adopted and finally absorbed. However, during the fast phase of deregulation, the Company has been preferring to go to the international market more frequently for importing required technology, and hence caring less about its adaptation and absorption.

The PUNWIRE model of growth may be beneficial to a firm to garner short term gains but is likely to affect adversely its own interests in the long run. In the liberalized policy regime foreign telecommunication firms are entering the Indian market. The possibility of entrance of the firms supplying technology to PUNWIRE and hence competing with it is not ruled out.

In the light of increasing import dependence, what are the options for a firm like PUNWIRE to survive and succeed? First, the firm may sign technical collaboration agreement with foreign firms which as per agreement can also buy its products. The Company has already achieved reasonable success in this direction. It has imported equipment required for modems from NUVO Corporation, USA with an agreement to supply modems to the technology supplier. It has exported modems worth Rs. 112.7 million in 1992-93, constituting 23.79 percent of the turnover. The Company has in hand an order for Rs. 310 million. The company should strengthen this path of import-led exports. Secondly, in case of R & D facilities, it is difficult for a small company like PUNWIRE to compete with foreign firms and their domestic partners. In that situation internal R & D facilities need to be encouraged by the Government through fiscal incentives. Alternatively for the promotion of R & D facilities, the Company may sign Memorandum of Understanding (MOU) with institutions of technology and engineering.

Organizational Issues

During the course of this study it has been found that the impact of deregulation has hardly gone beyond quantitative variables. Qualitative variables such as composition of board of management, internal organizational structure, management styles, work culture and industrial relations have not experienced noticeable changes in response to deregulation. The Company is intending to bring certain changes in tune with liberalization, adopting a flatter organization structure. The Company would be organized into smaller and dynamic teams. Each team would be given operational autonomy and made accountable for results. The business environment scanning group would be strengthened. The thrust of the Company would be market driven rather than technology driven. However, delay in bringing about these changes is likely to make more space for foreign firms already attuned to liberalization and globalization.

The impact of deregulation has hardly gone beyond quantitative variables. Qualitative variables such as composition of board of management, internal organizational structure, management styles, work culture and industrial relations have not experienced noticeable changes.

Conclusions

Deregulation has led to growth, improvement in productivity, product diversification, penetration into new market segments patterned on competitive basis, better profitability and dividends, reduction in costs and prices, raising of funds from domestic and international markets, creating awareness in the minds of employees about share culture, and increasing the number of foreign collaborations. The adverse effects of deregulation are equally alarming. The ambitious privatization program, in the absence of information about market reputation, has resulted in huge losses to the Company. The Company has failed to increase the identification of employees, particularly workers, as most of them have sold the shares allotted to them. The interplay of market forces is resulting in concentration of shares in the

hands of financial institutions and brokers. This trend is also creating conditions for takeover bids. Deregulation has led to stagnation in employment particularly for supervisors, skilled, semi-skilled and unskilled workers. Job opportunities for engineers and managers have improved. Thus deregulation is changing the structure of employment in favour of high quality jobs. This has far reaching implications for a labor surplus economy like India. Deregulation has resulted in import dependence both relating to material and technology, involving a large amount of foreign exchange outflow. With easy access to foreign technology, the in-house R & D efforts have suffered considerably. Qualitative aspects of the organization have not recorded noticeable change in tune with fast changing external environment. The stagnation or slow response of qualitative variables in relation to policy changes indicates that the domestic market is likely to be dominated by foreign firms already patterned on a liberalized environment.

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Feature

Break-even Analysis of Dairy Farm Business

P.S. Khattra & Maninder Kaur

In dairy farm ventures, like all other commercial enterprises, profit forms the predominant determinant for assessing the financial health and viability of the business. The article attempts a break-even analysis to generate information for farm entrepreneurs and offers a few insights and recommendations for better profitability

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Profitability of dairy farm business is the major determinant of its relative strength in the agricultural economy. This is so because dairy farming is mainly based on private investment by individual entrepreneurs who are primarily motivated by the considerations of relative profitability for allocating funds to the business. Researchers, therefore, have made extensive efforts to study the profitability of dairy farming under different situations across different size categories throughout the country. Some studies proved that dairying was more profitable than crop production; (Gill and Gill, 1972). On the contrary, Bal et. al, (1980) showed that crop production was more profitable than milk production. In some other studies by, Banerjee (1986) and Bhogal et. al, (1988), it was established that dairy enterprise competed favourably with crop enterprises for scarce resources of the farmers. Besides, Gupta and Patel (1985) revealed that capital investment in a herd of crossbred cattle on a commercial scale was a highly lucrative proposition. Despite the fact that most studies lend support to the evidence of higher profitability of dairying than crops, still interdependence between crop production and milk production continued to exist in rural areas. The term interdependence implied dependence of crop food production on animal draft power and of milk production on crop byproducts. This means that most of the farmers in the rural areas are not induced to expand the size of dairy enterprise from the present low level to make it independent of crop production.

Dairy farming is mainly based on private investment by individual entrepreneurs who are primarily motivate by the considerations of relative profitability for allocating funds to the business.

This situation may be attributed to the failure of farmers to use the results of studies involving sophisticated programming techniques in establishing the superiority of dairy enterprise over crop enterprises. Under such circumstances, it may be desirable to use a naive technique of cost-volume-profit analysis for gaining insight into the effects of interactions of various determinants of profit from the dairy farming business. The break-even analysis which is a widely known form of CVP Analysis, can generate information for the farm enterpreneur, Break-even-point indicates the level of production at which gross returns just cover the total costs. It is a point of no profit and no loss. However, the break-even point being just incidental in CVP studies, the more significant is evaluation of the effects of changes in costs, volume and prices on profits from dairy farm business. The likely variability in the milk prices, input prices and scale economies across different situations viz. urban, semi- urban and rural areas and their impact on break-even point and profitability further enhances the usefulness of break-even analysis in dairy farm business. Thus, in view of its appropriateness and practical utility, break-even analysis was used in this study.

Methodology

Ludhiana city and its surrounding villages formed the universe of this study. The selection of this area was made because no such study was conducted earlier in this area and the location of agricultural university could have affected this area favourably. Adopting a purposive-cum-random selection procedure, four villages namely Gill, Bains, Barewal and Lalton, falling within the distance of ten kilometers from the periphery of the city and forming a semi urban area were randomly selected. Four other villages namely Jugiana, Gobindgarh, Pahwa and Kanganwal situated beyond ten Kilometers from the city were selected to represent the rural area. In the urban area, out of the two major dairy complexes, i.e. Harbowal and Tajpur, the former being larger and nearer to the University Campus of the two was selected.

The complete lists of dairy farmers along with the number of milch animals were prepared for the three selected clusters. These farmers were classified into three homogeneous groups viz., small, medium and large in each of the three clusters using cumulative cube-rood frequency method. Owing to highly skewed distribution of farmers in each category, equal number of farms, viz., seven were selected from each category in each situation. Therefore, weighted average was used for the analysis. Thus, the total sample covered 63 dairy farmers with twenty-one each from rural, semi-urban and urban area.

The data were collected from the sample farmers through personal interview method with the help of specially constructed and pre- tested questionnaire for the year 1989-90. The data collected pertained to the composition of the dairy herd at various farms. Information on fixed and variable expenses was also recorded. The main items of fixed costs were depreciation cost of animals, buildings, machinery and equipment. The variable expenses included expenditure on feeds and fodders, veterinary and medicinal charges, fuel, water, electricity, labour, repairs, etc. In order to compute returns from dairying, data on milk yield and milk prices were also collected.

Break-even analysis is based on the following set of assumptions:

- The costs can be differentiated into two broad groups namely; fixed costs and variable costs. Fixed costs are assumed to remain constant for a certain range of output. The variable costs vary with the level of output.
- Fixed costs vary considerably between size categories and between situations.
- Total variable cost varies linearly with the level of milk production within each herd-size category in each of the situations viz. urban, semi-urban and rural. It implies that unit variable cost remains constant within each size-category of any situation.
- Unit variable costs of milk production (variable cost per farm, variable cost per animal and variable cost per litre) vary significantly between size categories and between situations.
- Price of milk is assumed to remain constant for different levels of milk produced by individual dairy farmers of a particular herd-size category in a particular situation.
- Inventory changes are assumed to be nil. It implies that whatever be the quantity of milk produced by the individual farmer it was assumed to be sold in the planning period.

The linear relationship between total variable costs and levels of milk could not be statistically verified because of paucity of observations in each size category of each dairy farming situation. However, such relationship does not seem to be invalid in view of the classification of dairy farms into distinct situations and herd-size categories. The usefulness of this analysis provides justification for the estimation of break- even levels for different herd-size categories of different dairy farming situations. An indepth study of variations in

break-even level across herd-size categories of different situations adds more practical utility to this analysis.

The break-even output levels, the profit for a given level of output and the quantity of output to be produced to attain a given level of profit can be computed using equation (i).

$$NR = O \times P - F - O \times V \quad (1)$$

Where

NR = Net returns

O = Quantity of output

V = Unit variable cost

P = Unit selling price

F = Fixed costs

The break-even output level is the value of O for which NR = zero. From Eq. (i), we get :

$$O = \frac{F}{P - V}$$

The profit for a given level of output can be obtained simply by putting the given value of O on the right-hand side of Eq. (i). Similarly, the output level required for a certain level of profit can be obtained simply by defining the value of NR in Eq. (i) and solving it for O.

Results and Discussion

Knowledge of the important characteristics of the dairy farms in the study area seems prerequisite for enhancing the practical utility of this empirical study. Information on these characteristics is, therefore, given in table 1.

Table 1 : Important characteristics of dairy farms in Urban, semi-urban and rural areas.

Farm category	Range of adult animal units	No. of adult animals per farm	Proportion of Wet animals	Proportion of buffaloes	No. of young stock per farm	Proportion of young stock	Proportion of heifers
Urban farms							
Small	Upto 25	15.57	71.80	81.63	4.14	21.00	13.77
Medium	26 to 62	43.43	89.64	60.53	10.71	19.78	6.82
Large	63 to 165	98.71	91.27	62.09	10.43	9.56	10.93
Oveall weighted average (6:2.9:1.1)		32.80	85.09	67.04	6.74	17.05	13.65
Semi-urban farms							
Small	Upto 12	8.43	72.72	77.94	2.86	25.33	15.03
Medium	13 to 28	21.72	81.08	61.83	4.57	17.38	12.47
large	29 to 65	43.43	84.57	69.40	6.86	13.64	18.80
Overall weighted average (3:5:2)		22.08	81.48	66.62	4.52	16.99	14.82
Rural farms							
Small	Upto 4	3.57	62.46	56.02	2.57	41.86	16.73
Medium	5 to 8	6.28	72.77	63.69	3.29	34.38	30.39
Large	9 to 46	20.57	74.62	67.38	9.14	30.76	40.59
Overall weighted average (7:2:1)		5.81	69.02	61.79	3.37	36.71	25.82

The perusal of table 1 reveals that herd size, proportion of animals in milk and proportion of buffaloes in the herd witnessed inverse relationship with the distance from the city. The average herd size in urban farms was about one and half times larger than that of semi-urban and six times larger than that of rural dairy farms. Similarly, number of young stock per farm was found to vary inversely with the distance from the city. However, the proportion of young stock in the herd appeared to be much higher on rural farms than that of its counterparts in urban and semi-urban areas. The proportion of heifers in young stock showed direct association with the distance from the urban area. It implied that proportion of calves (less than one year) varied inversely with the distance from the city area. These observations lent support to the credence that in urban areas dairy entrepreneurs make more frequent replacement of dry animals with newly calved animals as compared to their counterparts in semi-urban and rural areas.

Proportions of buffaloes, young stock and heifers did not show any systematic relationship with the herd-size. However, there was direct relationship between the proportion of animals in milk and herd size in all the three situations. It may be inferred that the increase in herd size is accompanied by increased productivity of milch animals.

Important characteristics which are crucial for the efficiency of dairy business such as herd size, wet ratio and proportion of heifers were more favourably distributed towards urban dairy farms and thus provided an edge for higher current business efficiency compared to other dairy farming situations. Similarly, larger dairy farms in all the situations, besides having advantage of economies of size were also characterised by higher wet ratio, thus witnessing higher business efficiency over their counterparts.

Important characteristics which are crucial for the efficiency of dairy business such as herd size, wet ratio and proportion of heifers were more favourably distributed towards urban dairy farms.

The variability in the determinants of break-even analysis across different herd-size categories and across different dairy farming situations is the cause for different break-even points of different size categories and situations. Fixed costs, variable costs and unit selling price being the determinants of break-even analysis, their variability across herd size categories and across dairy farming situations was examined to study the causes of variability in break-even levels.

Fixed costs

Annual fixed costs of dairy farm business include depreciation of animals, buildings, and machinery and interest on fixed capital. The annual fixed costs were computed on a per farm as well as on a per animal basis and are given in table 2.

Table 2 : Total annual fixed costs per farm and per animal

(Rupees)

Particulars	Small	Medium	Large	Overall
Urban farms				
Per farm	54999	143290	330393	112977
Per animal	3532	3299	3347	3444
Semi-urban farms				
Per farm	22176	66502	112301	62648
Per animal	2631	3062	2586	2837
Rural farms				
Per farm	8494	15621	53523	14078
Per animal	2379	2488	2602	2423

It may be seen from table 2 that there were considerable variations in annual fixed costs across herd size categories and across situations, not only on per farm basis but on per animal basis too. There was a direct relationship between annual total fixed costs per farm and the size of the dairy herd in all the dairy farming situations.

However, it was further observed that annual total fixed costs per animal could show positive relationship with herd size only in case of rural farm situation. Herd size witnessed direct relationship with quality of animals, buildings and machinery in the case of rural dairy farms.

Variable costs

The variable costs of dairy farming include cost of feeds, fuel, electricity, water, fodder, labour, veterinary services and medicines, minor repairs on buildings, machinery etc. Annual variable costs per farm, per animal and per litre of milk were worked out and are given in table 3.

Annual total variable costs per farm showed direct association with the farm size in all the dairy farming situations.

On an average, annual total variable costs per farm were the highest (Rs 356781) on urban farms followed by semi-urban (Rs 194787) and rural dairy farms (Rs 55037). Annual total variable costs per farm showed direct association with the farm size in all the dairy farming situations. However, in the case of total variable costs per animal there was inverse relationship between intensity of variable input use and the herd size in all the dairy farming situations. The figures of table 3 provide ample evidence of substantial differences in variable costs per farm as well as per animal across different herd-size categories and across different dairy farming situations which necessitated the computation of B.E.Ps across different herd-size categories and situations.

Table 3 : Total variable costs per year per farm, per animal and per litre of milk

(Rupees)

Particulars	Small	Medium	Large	Overall
Urban farms				
Per farm	171143	473694	1004173	356781
Per animal	10992	10907	10173	10877
Per litre	3.96	3.84	3.50	3.87
Semi-urban				
Per farm	81765	185549	356277	194787
Per animal	9699	8543	8203	8822
Per litre	3.33	3.04	3.12	3.14
Rural farms				
Per farm	34788	57435	169196	55037
Per animal	9745	9146	8225	9473
Per litre	3.54	3.54	3.36	3.52

The small magnitude of variations in variable costs per litre of milk across herd-size categories/ situations was due to the smaller size of the accounting unit of output. The variable costs per litre of milk evinced inverse relationship with the herd size on urban farms. In case of other farm situations, there was no systematic relationship between unit variable costs and herd size. On an average, the highest unit variable cost was recorded in case of urban farms (Rs 3.87) and it was the lowest in the case of semi-urban farms (Rs 3.14).

Unit selling price

Table 4 reveals that milk price showed inverse relationship with distance from the urban areas on medium, large and overall herd size categories. However, in the case of small herd-size category, the minimum milk price was recorded by semi-urban dairy farms and the maximum milk price was found in the case of urban dairy farms. Price of milk witnessed positive relationship with herd size in the case of rural and semi-urban dairy farms. In the case of urban dairy farms, medium dairy farms could fetch the highest price for milk among herd-size categories.

Table 4 : Milk price per litre

(Rupees)

Situations/ Size categories	Small	Medium	Large	Overall
Urban	5.84	5.91	5.71	5.85
Semi-urban	4.68	5.13	5.64	5.08
Rural	4.79	5.02	5.26	4.88

Table 5 : Break-even levels of milk per animal per day and per annum

(Litres)

Situations/ Size groups	Small	Medium	Large
Urban			
Per day	5.15	4.37	4.15
Per annum	1879	1594	1515
Semi-urban			
Per day	5.34	4.01	2.81
Per annum	1949	1465	1026
Rural			
Per day	5.21	4.60	3.77
Per annum	1903	1681	1377

Break-even levels of milk production per animal per day for various herd-size categories in different dairy farming situations were computed and are given in table 5. The Break-even levels of milk per animal evinced inverse relationship with herd-size in all the the situations under study which implied improvement in profitability with increase of dairy herd-size. Semi-urban dairy farms showed the lowest break-even levels among all the situations in the case of medium and large herd-size groups which witnessed the highest profit earning potentials of dairy farming in semi-urban situation among all the dairy farming situations. However, in the case of small dairy farms, the lowest break-even point was recorded by urban

dairy farms among all the situations which might be attributed to the larger economies of size due to the relatively larger herd-size in this situation along with better management of dairy animals.

Milk production per animal per annum below 1515 litres, 1026 litres and 1377 litres is uneconomical on urban, semi-urban and rural dairy farms respectively in the case of even large dairy farms and the corresponding figures for small dairy farms were as high as 1879, 1949 and 1903 litres respectively.

In order to gain better insight into the profit generating characteristics of dairy farming, assuming the productivity of milch animals constant at the level observed on sample dairy farms, the number of animals per farm required in different situations and herd-size categories to generate income equal to total costs, were computed and are presented in Table 6.

Table 6 : Break-even number of milch animals per dairy farm

Situations/ Size groups	Small	Medium	Large
Urban	39*	84	155
Semi-urban	30	45	75
Rural	11	18	51

* These figures rounded to the nearest whole number.

The perusal of table 6 reveals that break-even number of animals per dairy farm portrayed direct relationship with herd-size and was inversely related to the distance from the urban area. It may be further observed from this table that no profits from dairying under small, medium and large categories of dairy farms were available upto the number of 11, 18 and 51 per dairy farm respectively.

Break-even number of animals per dairy farm portrayed direct relationship with herd-size and was inversely related to the distance from the urban area.

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Any approach to strategy quickly encounters a conflict between corporate objectives and corporate capabilities. Attempting the impossible is not good strategy; it is just a waste of resources.

– BRUCE HENDERSON

Feature

Organisational Human Resource – Appreciating or Depreciating?

M.K. Kolay

Based on analysis of cost, value and behavioural related approaches towards human resource valuation, the paper suggests a financial measure of their value representing the total performance of an organisation in relation to plant base deployed and man-related cost incurred. It recommends a pragmatic approach to monitor the condition of the human resource, the building blocks of the functional value so assessed. The human resource of an integrated iron and steel plant has been found to have depreciated to 54% of its base year value by the end of the ten year period under study.

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In the era of liberalisation when the corporate houses need to compete even for the domestic market with no more subsidies and protection, the contribution of organisational human resource (HR) that directs all other physical and financial resources in search of excellence for sustained success assumes tremendous significance. When more and more small scale industrial units, the centres of technological innovations and entrepreneurship development, are becoming sick day by day, as also many a big industrial house, the dreams of the policy planners for economic growth and development are in the red, instead being the centres of employment generation. The performance of HR can no longer be left untraced in the cloud of subjectivity of the man-machine interactive system geared towards the objective of corporate profitability. Wages are increasing faster than productivity in the corporate sector, the Labour Minister (1993) regrets, but on the other hand due to acute unemployment problem, exploitation of labour still continues in many a unit even in the presence of legal provisions. The benefits should exceed the cost for any viable decision, likewise, the performance of HR needs to be judged in relation to the cost incurred on them to assess their functional value. The condition of HR needs to be monitored on line to maintain the value of the most important asset of the organisation on the appreciating track.

The benefits should exceed the cost for any viable decision, likewise, the performance of HR needs to be judged in relation to the cost incurred on them to assess their functional value.

Critical review of available HR value models

To put a value tag to organisational HR, the pioneers in the field of human resource accounting

(HRA) have proposed different models and approaches, some of them are cost-based following historical, replacement or opportunity cost principles, some are based on economic principles of value while others are based on psycho-social measures of the organisational HR (Kolay, 1991). The different models and their relevance towards HR value measure are presented in table 1.

Table 1 : Analysis of HRA models towards reflection of HR value measure

HRA models and their proponents	Model in brief	Relevance towards HR value measure
A. Cost based approaches		
1. Historical cost based approach. Brummet, Flamholtz & Pyle (1968)	Cost of (a) the acquisition, training and development of individuals (b) organisational development capitalized with subsequent amortisation over the years to reflect the value of (a) individuals and (b) the organisation.	Cost of manpower acquisition, training and development (more reliably for HR as a whole) may be relevant, in addition, the likely contribution from HR should be assessed.
2. Replacement cost based approach Flamholtz (1973)	Assessment of a) replacement cost of individuals b) rebuilding cost of human organisation to reflect HR asset value of a) individuals b) human organisation.	Replacement cost may not be relevant to reflect either the actual costs or the contribution associated with HR.
B. Model based on opportunity cost principle		
Competitive Bidding Model Hekimian & Jones (1967)	Envisages competitive bidding amongst the investment centre managers to win services of individual employees based on the highest bid price to be included as human asset value along with investments in physical assets while assessing return on investments achieved by the investment centres.	The concept of opportunity cost may not be feasible, so long as the task is measure the contribution of individuals on the job.
C. Economic models		
1. Goodwill method Hermanson (1964)	Extra profits earned as compared to industry average rate i.e. goodwill, credited to organisational HR for its valuation either partly or fully as 1) HR value = goodwill × Investments in HR/total investments 2) HR value = goodwill/estimated contribution rate of HR	Contribution rate of HR need not be the same as in other investments (particularly the technology) as assumed in 1) and the same being unkown as required in 2), besides profits alone may not be the contribution.
2. Adjusted discounted future wages method Hermanson (1964)	Persent value of wages payable for the next five years equated to organisational HR, the discounting rate being average rate of return on owned assets of all firms in the economy multiplied by the efficiency ratio defined as weighted average rate of return on owned assets based on the past five years for the organisation in relation to that of all firms in the economy with comparatively lower weightings for the previous years.	HR contribution may be more or less than the average rate of return, particularly due to technology difference; so also efficiency ratio is appropriately defined in relation to all firms in the economy instead of only those in the relevant sector, besides profit alone may not be HR contribution. More importantly, wages may not be appropriate HR value surrogate as it may not be based on employee contribution.

HRA models and their proponents	Model in brief	Relevance towards HR value measure
3. Model proposed by Lev & Schwartz (1971)	Specific or general HR value suggested as the present value of future wages payable based on organisation specific wage rate or market average wage rate assuming : (i) Estimation of wages and consequently HR value on a group basis. (ii) Wages as function of age alone (iii) remaining tenure includes provision for likely death before retirement.	Estimate of future wages may only be relevant towards measure of HR as an asset, if we can estimate the likely future contribution from them.
4. Model proposed by Flamholtz (1971)	HR value considered individualwise as present value of likely services available from service states (i.e. rank and performance rating) to be occupied by the individual. Likely movement of each employee onto different service states (including exit due to retirement and likely death/ resignation before retirement) over the years estimated probabilistically. Four possible surrogate measures of contribution relevant to each service state proposed: (i) acquisition cost (ii) replacement cost (iii) wages (iv) Performance measure	Acquisition cost, so also the wages payable for each service state on an individual basis may only be relevant when we could measure the contribution of an individual as he/she occupies a specific service state.
5. Model proposed by Jaggi & Lau (1974)	Present value of likely services available from different service states (i.e rank and performance rating) to be occupied by employees considered as HR value on a group basis. Likely movement of employees (on a group basis) onto different service states including exit due to retirement and likely death/ resignation before retirement, estimated over the years, assuming the past trend of employee movement to continue in future.	Employee movement analysis onto different service states may not be relevant towards measure of HR as an asset, as the task is to dimension the likely contribution from employees relevant to the different service states.
6. Model proposed by Sadan and Auerbach (1974)	The present value of future wages payable considered as HR value. Estimates of future wages based on stochastic model of employee movement onto different states (the last state being the absorbing state with zero salary level at the point of employees leaving the organisation), each state characterised by number of state variables like age, salary level etc.	Estimation of likely future wages payable may not be relevant towards measure of HR as asset unless we could assess the likely future contribution from them.
7. Model proposed by Friedman and Lev (1974)	Based on the premise that wage differentials between the firm and industry average as the return on investments in welfare provisions and training and development of HR, the present value of wage differentials considered as HR value.	Estimation of likely furture wages may not be relevant towards measure of HR as asset unless the likely contribution from employees (both for organisation specific and market average) could be assessed.

HRA models and their proponents	Model in brief	Relevance towards HR value measure
8. Model proposed by Myers and Flowers (1974)	Employee attitude being the most important factor to govern the productive behaviour of employees on the job, as hypothesised, employee attitude index multiplied by wages payable considered to reflect the likely benefits as against wages payable as the cost and the gap between benefits and cost to reflect an individuals' value.	Attitude multiplied by wages may not reflect contribution of employees unless it is validated.
9. Model proposed by Morse (1975)	Present value of likely future wages payable, based on possible employee movement onto different service states, age category and wage classifications, considered as the value of human capital (rather than of human asset) of the organisation.	Estimation of likely future wages may not be relevant towards measure of HR as asset in absence of a measure of future likely contribution from them.
D. Behavioural Model		
Model proposed by Likert (1967)	Aims to establish through psycho-social test results how a set of causal variables reflecting the management system adopted by an organisation determine the appreciating or depreciating condition of its human organisation, as reflected by a set of intervening variables, which in turn result in the achievement of end-result variables over time. Investements in HR as the basis of HR value proposed, to be amortized over the years in tune with the condition of human organisation.	Psycho-social measure of condition of the human organisation may not be reliable towards measure of HR as asset in absence of its established valid relationships with organisational performance.
E. Current Indian Practices		
	Services available from employees considered to be dependent on role played by them i.e. service state specific, however, service state reflected by wage scale, only i.e. (excluding performance rating). Likely future movement of employees on different wage scales as service states considered on a group basis within the existing promotion norms and in tune with the retirement schedule. Estimates of likely future wages payable made based on : (i) Average wage rate relevant to each service state. (ii) Provision for wage revision. (iii) Provision for usual increment in wages. (iv) Provision for likely exit due to death or otherwise before retirement.	More reliable estimates of future wages payable to employees may not be relevant so long as the task remains to assess their likely future contribution.

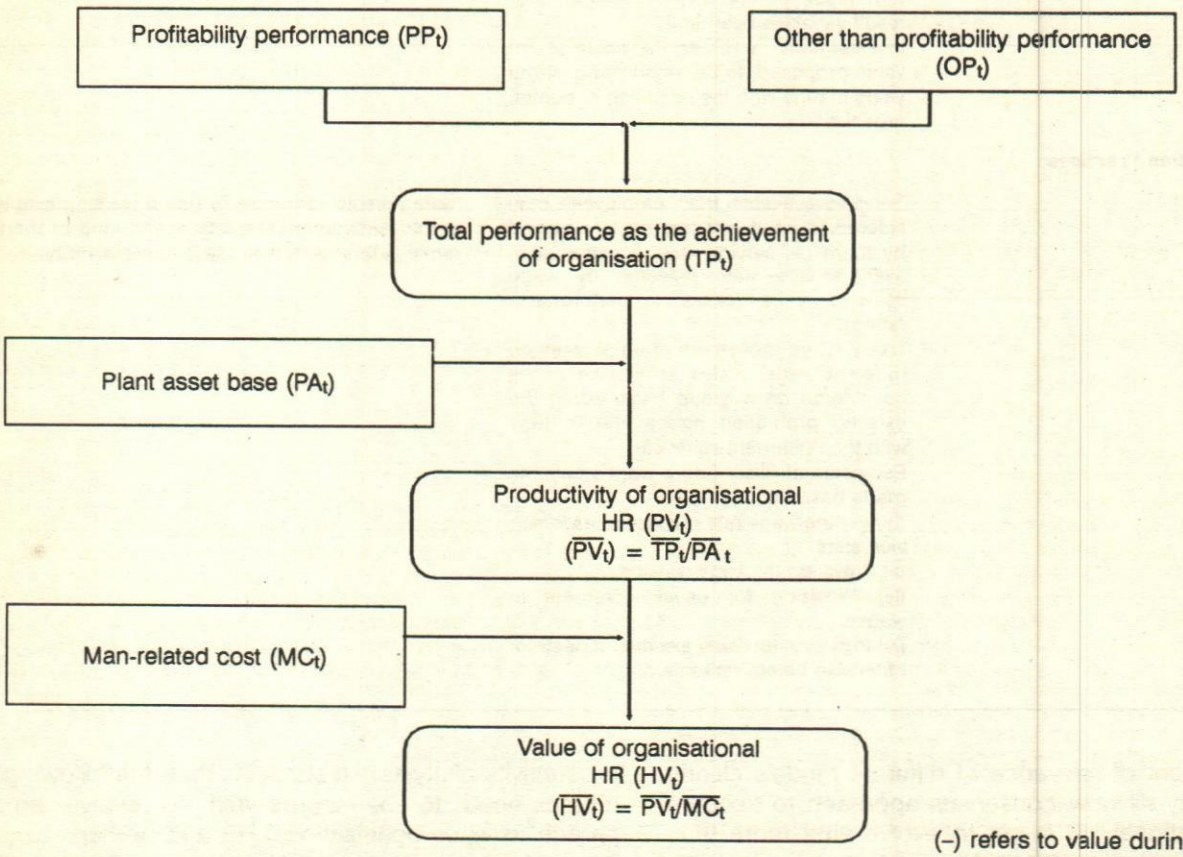
The extent of relevance of different models clearly explains why till now consensus approach to account for organisational HR is yet to evolve after more than two decades of research and trials by the pioneers like the accountants, economists, behavioral scientists and productivity analysts. It suggests that the following attributes need to be incorporated to evolve an approach to value oganisational HR and perhaps to gain foothold amongst the traditional accountants in the realm of HRA.

* Value of organisational HR as a whole (to start with, later may be extended for its constituents like the divisions, departments etc.) rather than that of individual employees
* Appreciating or depreciating nature of HR over time instead of its absolute value
* Functional value of HR i.e., HR performance in relation to relevant cost rather than cost alone
* Periodic assessment of HR value directly based on relevant perfomance rather than resorting to subjective amortisation of HR investments.

Value of organisational HR assessed

With due recognition to the evolved attributes a new approach has been proposed for HR value measure based on the following premises:

* An organization may be conceptualized as a system comprising man-machine resource base with its human mass, the primemover of the organisation at its nucleus. The performance of the man-machine system reflects the achievement of the man i.e. HR asset base (Kolay, 1991).
* The HR asset base dovelops and utilizes the other asset base i.e., the plant and other infracturature, herein termed as the plant base, to convert the inputs to outputs to add value and achieve the corporate profitability objective from the shareholders' point of view i.e, profitability performance along with favourable or adverse impact on the areas of concern of other interest groups viz. the consumers, the national economy and the society i.e. 'other than profitability performance.' The 'profitability performance' and 'other than profitability performance' together may be considered to reflect the total performance of an organisation (Kolay, 1993).
* The total performance of an organisation in relation to the dimension and quality of the plant base reflects the productivity of the organisational HR.



(–) refers to value during period (t) relative to that of the base period (o).

Fig. 1 Value of Organisational HR

* An organisation adopts different man-management strategies to have the necessary HR asset base with appropriate levels of remuneration, welfare provisions, training and development opportunities to sustain, improve and maintain the quality of HR to enable them to improve the productivity of the organisational HR.
* The productivity of HR when viewed in relation to the man-related cost incurred on them through adoption of different man- management strategies reflects the surrogate value of the organisational HR (as reflected in Figure 1).

The productivity of HR when viewed in relation to the man-related cost incurred on them through adoption of different man-management strategies reflects the surrogate value of the organisational HR

Monitoring the assessed value of HR

The functional value of orgnisational HR based on their relative contribution may be the reflection of the end result variables but to facilitate the organisation to adopt suitable strategies to manage HR as an asset and improve their value, the condition of the organisational HR, the building blocks of their value, needs to be analysed.

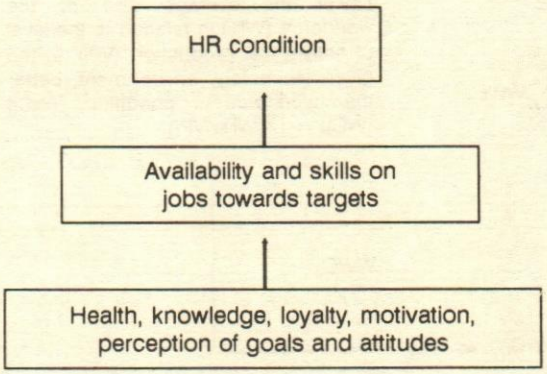


Fig. 2 Relationship between the determinants of HR condition

To reflect the condition of the organisational HR, five dimensions i.e., knowledge, skills, health, availability and attitudes may be important as suggested by Myers and Flowers (1974). Quantitative surveillance on the interevening variables of organisational health like loyalty, attitude, motivation, performance goals and communication has been advocated by Likert (1967). Use of such psycho-social test results may be difficult to implement in practice to reflect the condition of the HR. But what is more important is the interrelationship amongst the envisaged variables. The value of organisational HR as the reflection of their condition would depend basically on two variables i.e., availability (Physical as well as mental) and skill, not availability and skills per se but their applicability on the job towards achievement of the targets. The other variables, in fact, belong to the next lower level which in turn influence the availability and skills on the job as reflected in Figure 2.

Based on the above discussion the first step would be to evolve a simple framework using the basic variables like availability and skills applied on the job to analyse the HR condition rather than taking into account a number of variables from two different levels at a time without having valid empirical relationships amongst themselves. Accordingly, a framework is builtup as follows to reflect the condition of the organisational HR and hence their functional value.

HR of an organisation includes the workforce and the management staff and the condition of HR may be the interplay of the condition of the management with that of the workforce. The condition of the workforce may be reflected by their availability and skills on tthe job towards achievement of the production targets as conceptualised earlier i.e.,

HR of an organisation includes the workforce and the management staff and the condition of HR may be the interplay of the condition of the management with that of the workforce.

* Availability level
* Skill level
* Level of production relative to workforce size.

Using the traditional control ratios as practised by the personnel managers, the availability of workforce may be reflected objectively by the extent of :

* Labour turnover
* Absenteeism percent
* Grievance rate
* Mandays lost percent due to strikes, go slow, non-cooperation etc.

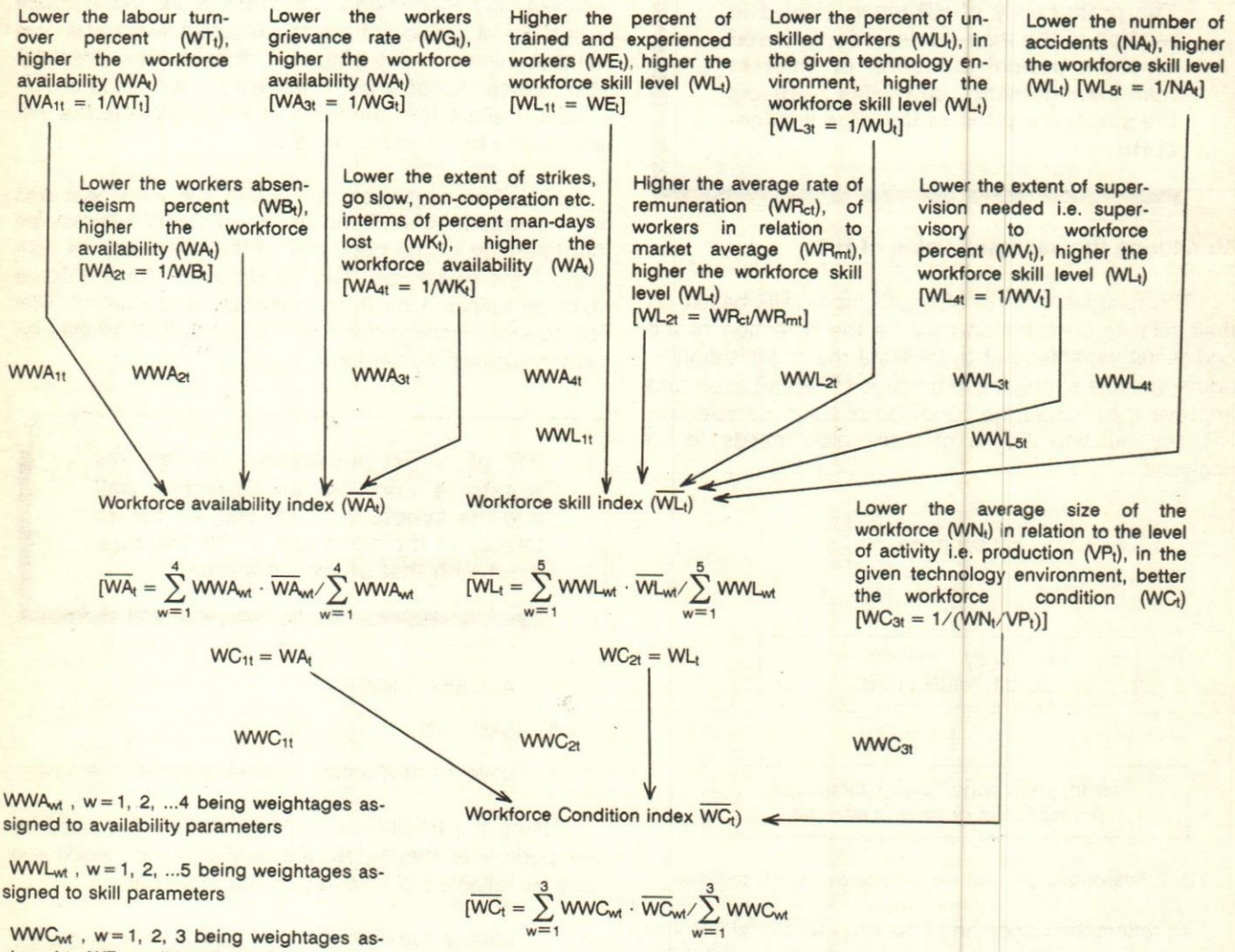
The skill level of the workforce may be reflected in an objective manner by the extent of :

* Porportion of trained and experienced workers
* Average rate of remuneration of workers in relation to market average rate
* Proportion of unskilled workers
* Supervisory to workforce percent
* Frequency of accidents (including severity thereof)

Thus, based on the availability and skills, applied on jobs to achieve the level of production, the condition of the workforce may be assessed as shown in Figure 3A.

Unlike the workforce condition on jobs, the intrinsic condition of management staff may be reflected objectively using the following three conventional measures (as shown in Figure 3B) :

* Proportion of qualified and experienced professionals
* Average rate of remuneration of management staff in relation to market average rate
* Rate of turnover amongst the management staff



WWA_{wt} , w = 1, 2, ...4 being weightages assigned to availability parameters

WWL_{wt} , w = 1, 2, ...5 being weightages assigned to skill parameters

WWC_{wt} , w = 1, 2, 3 being weightages assigned to WF condition parameters

(–) refers to value during the period (t) relative to that of the base period (0).

t refers to time period

Fig. 3A Measure of workforce condition

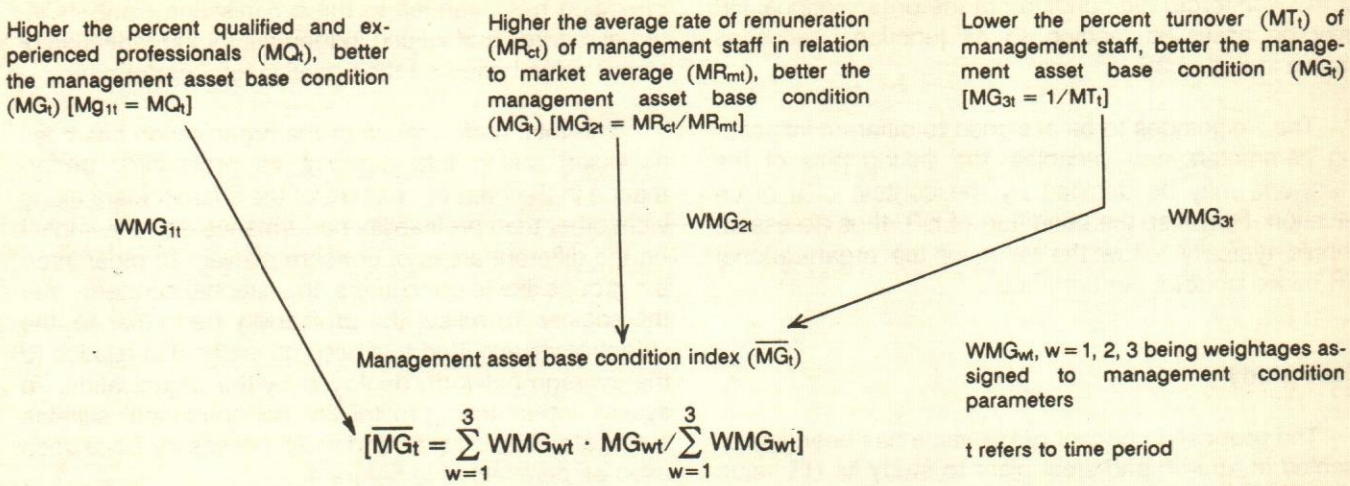


Fig. 3B. Measure of management asset base condition

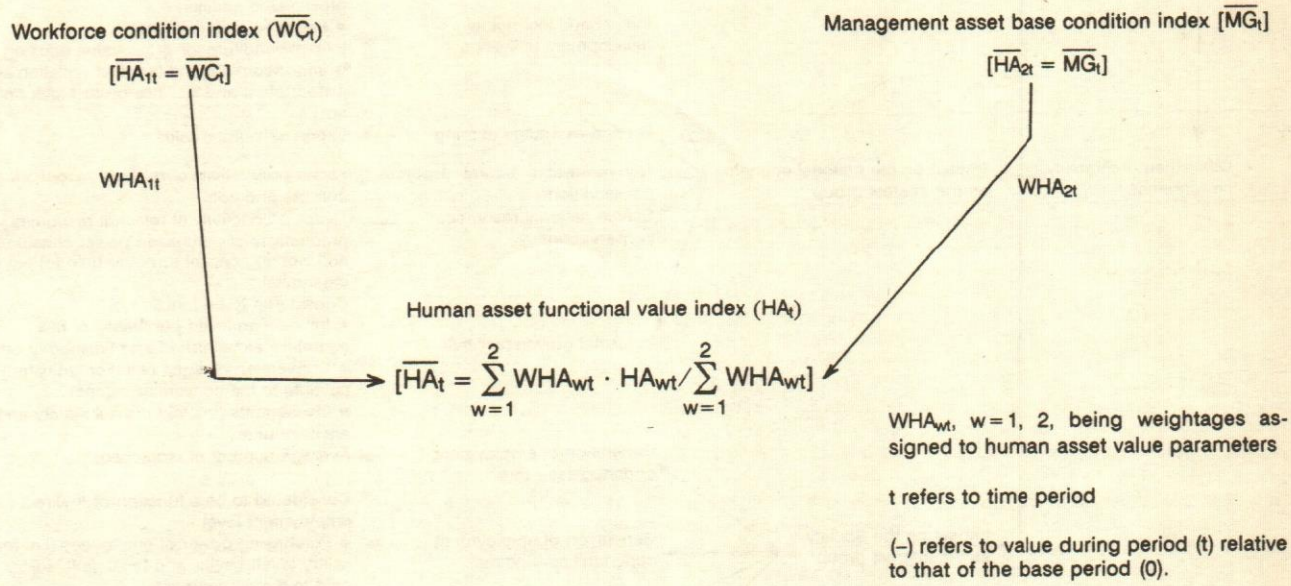


Fig. 3C. Measure of human asset functional value

Integrating the condition of management with that of the workforce, the condition of the organisational HR may be assessed leading to its functional value as shown in Figure 3C.

The weightages to be assigned to different influencing parameters and variables, the linking pins of the framwork, may be decided by the context of a given situation. However, the condition of HR, thus assessed, should typically follow the value of the organisational HR based on total performance.

Case study

The proposed concept of HR value has been implemented in an iron and steel plant to study its HR value for a ten-year period as compared to a chosen base period using the following steps and mostly using the information from its published annual accounts. However, the implementation of the framework to monitor the HR condition has been left to the organisation using its internal records and valued judgement for introspection of its HR value based on their relative total performance.

The total performance of the organisation has been assessed taking into account its profitability performance in the area of concern of the shareholders along with 'other than profitability performance' i.e., the impact on the different areas of concern relevant to other interest groups like te consumers, the national economy and the society. To reflect the profitability performance, the extent of value added has been considered in relation to the average networth deployed by the organisation. To assess 'other than profitability perforamance' suitable surrogate measures, as and when necessary, have been used as peresented in Figure 4.

Equal importance has been attached to the profitability and 'other than profitability performance', so

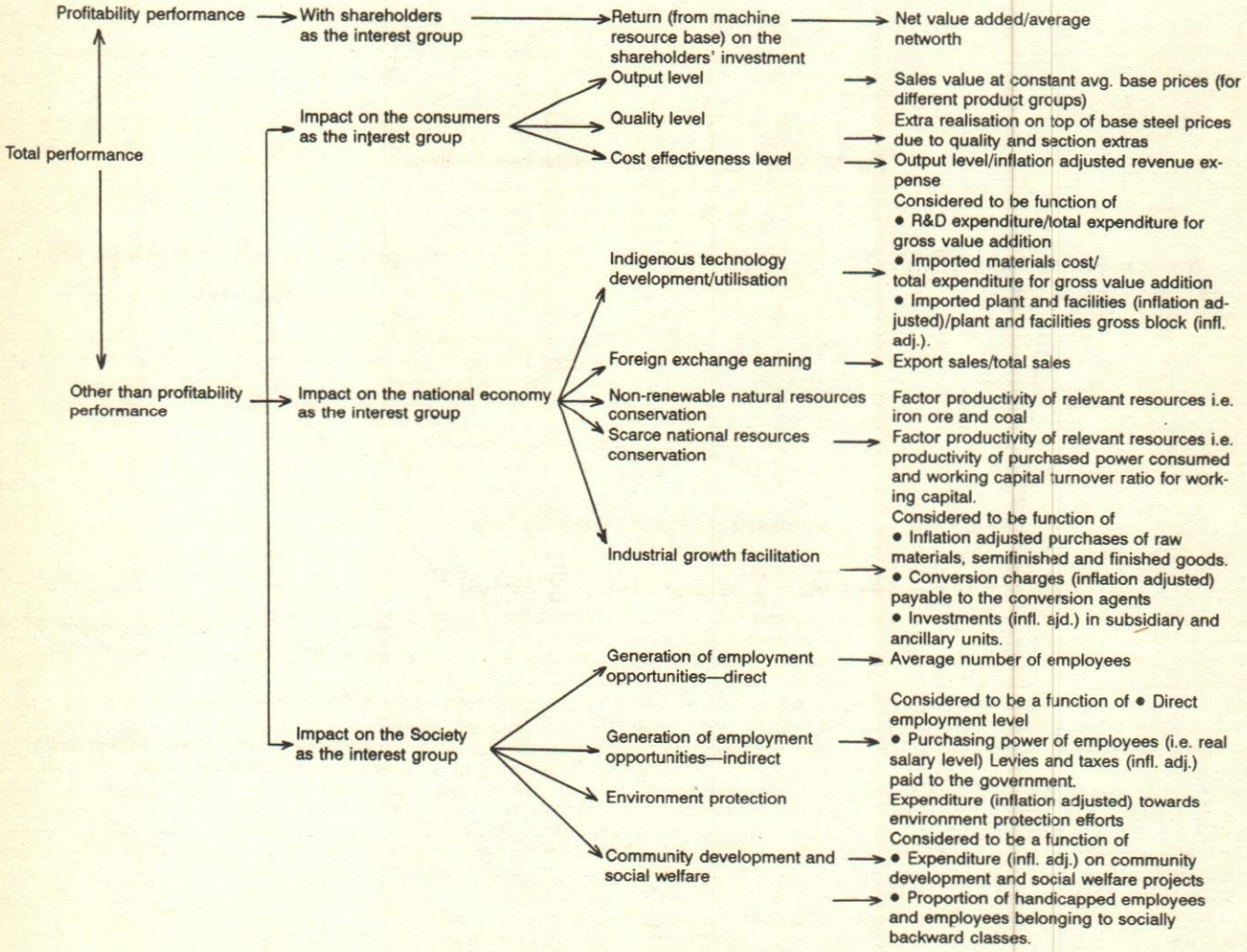


Fig. 4 Measure of Total Performance

also to the contribution of the different other interest groups and the different areas of concern within each interest group while assessing the total performance of the organisation.

The plant base refers to the plant and industrial building portion of the fixed asset. The inflation adjusted relevent gross block has been considered to reflect the plant base. A lag period of one year has been considered relevant between the commissioning of the plant and its normal level of operation leading to the development of plant base.

The productivity of the organisational HR during different periods relative to base period has been assessed based on the total performance in relation to the plant base deployed by the organisation.

The man-related cost has been considered to include the cost elements like :

* Manpower servicing cost i.e., salaries and wages.
* Manpower development cost i.e., training and development expenditure.
* Manpower maintenance cost in the form of different welfare measures.

The man-related cost has been considered to include the inflation adjusted above cost elements on effective annual cost principles.

The value of the organisational HR has been assessed based on the productivity of the HR in relation to the man-related cost.

Results of the study

The results of the study have been presented in table 2.

It is evident that the profitability performance has improved varying from 10 percent to 72 percent above the base year with the average for the ten-year period being 33 percent higher. The 'other than profitability performance' based on the total impact on the areas of concern of the consumers, the national economy and the society, with equal priorities attached to them, reflects an improving trend with the period average being 11 percent favourable. Integrating the twin aspects of performance, the total performance of the organisation, has though varying, improved over the years with the period average being 22 percent higher than the base year mark.

When the level of HR productivity is judged in relation to the increased level of man-related cost, the value of the organisational HR has been declining.

When the improved level of total performance is viewed in relation to the increased level of the gradually modernised plant base, the productivity of the organisational HR reflects not an encouraging trend, with the period average being marginally higher. When the level of HR productivity is judged in relation to the increased level of man-related cost, the value of the organisational HR has been declining, to 54 percent of the base level by the end of the study period.

Table 2 : Organisational HR values

Description	Base Year	Year-1	Year-2	Year-3	Year-4	Year-5	Year-6	Year-7	Year-8	Year-9	Year-10	Average for the ten year period
Profitability Performance Index	1.00	1.16	1.22	1.32	1.51	1.32	1.57	1.72	1.41	1.14	1.10	1.33
Other than profitability performance Index	1.00	0.96	0.99	1.04	1.08	1.04	1.03	1.22	1.23	1.23	1.25	1.11
Total performance Index	1.00	1.06	1.11	1.18	1.30	1.18	1.20	1.47	1.32	1.19	1.18	1.22
Plant base Index	100.00	102.05	105.34	107.42	109.16	113.00	122.32	128.85	132.33	138.08	146.09	120.54
HR productivity Index	1.00	1.04	1.05	1.10	1.19	1.04	0.98	1.14	1.00	0.86	0.81	1.02
Man related cost Index	100.00	104.00	109.00	110.00	115.00	117.00	124.00	127.00	136.00	140.00	151.00	123.30
HR value Index	1.00	1.00	0.96	1.00	1.03	0.89	0.79	0.90	0.74	0.61	0.54	0.85

Conclusion

Appreciating the difficulties associated with the available HR valuation models, the concept of total performance in relation to costs has been advocated as the value of organsiational HR based on the economic definition of functional value. The concept of total performance would be very much relevant in the present day context of liberalisation and such a value measure would facilitate interfirm comparison between different sectors of the economy for sustained success. While analysing the appreciating or depreciating value of organsiational HR, the framework to monitor its condition as presented might go a long way to facilitate the adoption of appropriate strategies in the area of human resrouce management.

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There can be no friendship without confidence, and no confidence without integrity.

– SAMUEL JOHNSON

Feature

Role-efficacy of First Line Supervisors – Experiences from Indian Railways

Anirudh Pandey

Most of the actions of supervisors in the present organisational set up are reactions only. If the supervisors become proactive and organisations assist them in defining their roles, it may be possible to increase the commitment, involvement in the human resources and productivity for the organisation, concludes this study.

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Role-efficacy as a framework for understanding the interactions of individuals with their roles and resultant outcomes has generated increasingly greater interest in the last two decades. It is defined as the perception of greater opportunity on the job. The concept of 'role-efficacy' in the Indian context was proposed by Pareek (1980a, 1980b, 1986, 1987 and 1993). According to him, if organisations assist individuals in defining their roles and if individuals are willing to share this concern through appropriate strategies, it may be possible to increase effectiveness in the work-place. Attempts have been made to establish role efficacy's relationship with personal and organisational dimensions. With regard to personal dimensions, it has a high and positive relationship with internal locus of control intra-persistive coping styles (solving the problem by one's own efforts), Cattell's cyclothemia (broadly speaking people orientation), surgence (broadly speaking, extraversion), adventureousness (broadly speaking, outgoing tendency), general satisfaction, role-satisfaction, job satisfaction and anality of worklife, (Sen, 1982; Surti, 1983; Gupta and Khandelwal, 1988. Role-efficacy has negative relationship with externality, and role-stresses as well as total role-stress, impunitive coping style, Cattell's dominance and Machiavalianis alienation and defensiveness (Sen, 1982; Surti, 1983; Singhala, 1985). It has several forms of correlation with age, experience, number of children and age of children (Sen, 1982; Surti, 1983).

On the organisational dimension, role-efficacy has an important moderating influence on dependent purposeful job-behaviour and independent variables such as demographic factors, organisational climate and role-stress. It shows a remarkable impact in relation to demographic and organisational clusters. Its inclusion or exclusion brings about 50 per cent change in the co-efficient of correlation (Das, 1984). Increased work-related tension has a negative correlation with

overall role-efficacy, personal attributes and job-demographics have an impact or role-efficacy (Sayeed, 1985). Operational and administrative roles, as also stations of posting have been found to have moderating impact on the role-efficacy of police-officers in Ireland (Moran, 1986). Conducive environment makes leadership efficient which ultimately influences the role-efficacy of organisational members and their productivity. (Sayeed, 1992 a). Strong linkage exists between role-efficacy and appropriate structure of position power/task structure (Sayeed, 1992 b).

Pareek (1987; 1993) after a review of researches conducted on role-efficacy recommended that organisations should carry out an audit on the perception of role-efficacy in various job-settings and embark upon an appropriate strategy to bring about a change in various segments of such perception through performance counselling and utility analysis. Most of the researches cited, have been conducted on managers. Nevertheless, they demonstrate the potentiality of role-efficacy in improving job-behaviour actions of all job occupants. Pandey (1993 a) conducted role- efficacy labs for a period of two years (July, 1991 to July, 1993) for motormen working in suburban trains in Bombay and found that role-efficacy was a means to bring about a positive change in the overall disposition to the job and the railway, and in preventing accidents. In another study (Pandey, 1993 b), role- efficacy was found to be determined by education and proper perception of signals.

Supervisors play a pivotal role in the functioning of the Indian Railways. In addition to being a link between the worker and the management, they have been assigned jobs like inspecting, coaching, monitoring, counselling and ensuring safe and efficient work-performance. Technological upgradation has complicated the job of the supervisors. The situation is further compounded by the facts of advancement in machines, lack of close contact with actual work, lack of power to deal with the staff and a general change in the attitude of the workers due to social changes. In such a changed scenario, the meaning the supervisor assigns to his job i.e. how he perceives his job becomes a matter of great concern not only to the railways but also to the general public. Faulty perception of his job is likely to be reflected not only in bad performance of workers but is also likely to invite danger to public life and damage to public property. Hence an attempt was made to audit the role-efficacy of supervisors diagnose weak segments therein and take remedial measures at micro-level HRM through counselling. Utility of the lab, after 5 days training and after one year was also checked.

Methodology

96 Supervisors/safety counsellors served as sample for the study. 52 of them were working in Jhansi, Jabalpur, Bhopal, Bhusaval, Solapur and Nagpur Divisions of Central Railway. They ranged in age from 34 to 57 years with a mean of 50.13 yrs, and SD of 2.13 yrs. In experience, they ranged from 1 to 23 yrs. with a mean of 10.17 yrs, and SD of 8.17 yrs. Excepting one supervisor having education upto IXth standard, majority of the subjects had studied upto Xth standard. Some of them had done a 3 year diploma course in different disciplines like Civil, Mechanical and Electrical Engineering. Some of them had studied upto graduate and post-graduate levels and some had acquired law degree also. The other sub-group of 44 subjects were working in Kota, Jaipur, Ajmer, Baroda, Rajkot, Bhavnagar and Bombay divisions of Western Railway. They ranged in age from 23 to 57 yrs. with a mean of 49.17 and SD of 7.89 yrs. In experience, they ranged between 3 to 33 yrs, with a mean of 14.65 and SD of 12.06 yrs. In education also, they ranged between Xth standard to graduate and post- graduate levels. The sample covered 5 states i.e., Uttar Pradesh, Madhya Pradesh, Maharashtra, Gujarat and Rajasthan. According to the numerical system of allotting the score of 1 for each year spent in getting education Means and SDs of Education numerical scores for Central and Western Railways were 13.32, 2.13, 12.72 and 1.88 respectively.

The subjects belonged to traffic, loco, carriage and wagon, signal and civil engineering departments of the two railways. All were connected with the supervision of various levels and types of workers of their discipline in train operation. While traffic supervisors were concerned with traffic staff i.e. Station master, Switchmen, Cabinmen, pointsmen, gatemen etc., the loco supervisors supervised drivers, assistant drivers, shunters and other staff connected with driving the train engines. Supervisors belonging to carriage and wagons were responsible for the supervision of workers in the maintenance of the same. Supervisors belonging to signal and telecommunication were concerned with workers connected with the maintenance and upkeep of that system. Supervisors belonging to civil engineering did the supervision of staff connected with track maintenance. It is to be reiterated that these categories of work are quite sensitive and even small lapses result in accidents. Moreover, as levels of education, job and understanding of the employees vary considerably, ensuring full and complete understanding and translating the same into work by the workers, pose a challenge to the supervisors.

Tools & Techniques: For diagnosing the role-efficacy of the subjects, Role-efficacy Scale (RES)

developed by Pareek (1980) was administered on the subjects, as a part of a few training programmes on 'Better Counselling' held at Zonal Training Schools, Bhusawal and Udaipur during the year 1993. The scale comprised 20 trial statements. It had 10 dimensions namely centrality, integration, proactivity, creativity, inter-role linkage, helping relationship, superordination, influence, growth and confrontation. Each dimension had two items. The respondent checked one statement in each triad, which described his feelings accurately. Each of the three statements was preweighted. A score of +2 was assigned for positive statement, +1 for useful statement and –1 for negative statement. On each dimension, thus, a respondent could get a maximum score of 4 and a minimum score of –2. Totalling the scores on 10 dimensions made the Role-efficacy Score (RES). Test retest reliability of the scale is reported to be at 0.68 significant at 0.001 level. (Sen, 1982). Validity of the scale for item-total correlations for 20 RES items on a total sample of 658 managers and for 11 organisations individually ranged between 0.16 to 0.51. The mean of the item- total correlations for 11 organisations ranged between 0.71 to 0.85 (Sayeed, 1985). Inter correlations between RES and its dimensions ranged between 0.15 to 0.72. Relationship between RES scores and personal interview score responses ranged between 0.57 to 0.73 (Pandey, 1992). The scale was factor analysed on a sample of 230 rail workers (Pandey, 1994). It was found to have six factors which have a total of 76.2649 per cent of variance factor from the matrix of RES. It can be seen that there is overlapping of variables in the factors but significantly almost all the variables have survived. Therefore, we rename and recluster these factors into three factors, namely Role-making comprising- integration, proactivity, creativity and growth, Role Centering comprising-centrality, superordination, influence and confrontation and Role-linking comprising inter-role linkage and helping relations.

Results

Diagnosis of inadequacies in various dimensions: Distribution percentage of the supervisors alongwith individual scores of 4, 3, 2, 1, 0, 01 and –2 on each dimension of the scale are presented in table 1 for Central and Western railways separately. It is to be recalled that 4 is the highest rating score on each of the 10 dimensions. In view of this, persons having a rating score of 4 on any dimension were supposed to have adequate role efficacy on that dimension. Based on this, persons having a rating score of 3 were supposed to have 75 per cent deficiency,

Table 1: Distribution percentages of supervisors along rating scores of 4, 3, 2, 1 and below on each of the 10 dimensions

Dimension	Rly.	n	4	3	2	1	below
1. Centrality	CR	.52	15.38	30.76	40.38	9.60	3.80
	WR	44	9.09	45.45	36.36	4.50	4.50
2. Integration	CR		76.92	15.38	1.92	5.76	0.00
	WR		65.90	18.18	4.50	4.50	6.80
3. Proactivity	CR		23.07	44.23	9.60	13.46	9.60
	WR		9.09	52.20	15.90	6.80	15.30
4. Creativity	CR		23.07	48.07	19.23	1.99	7.60
	WR		29.54	31.81	27.27	4.50	6.80
5. Inter-role Linkage	CR		59.61	28.54	1.92	7.60	1.92
	WR		38.63	31.81	2.27	25.00	2.27
6. Helping relation	CR		56.66	9.61	0.00	23.07	1.92
	WR		52.27	13.63	9.09	20.45	4.50
7. Superordination	CR		15.38	38.69	9.60	26.92	15.38
	WR		15.90	15.90	15.90	31.81	20.45
8. Influence	CR		3.84	48.07	21.51	11.51	15.38
	WR		18.18	50.00	18.18	6.81	6.81
9. Growth	CR		28.84	36.53	18.23	13.46	1.92
	WR		34.09	36.36	22.72	4.50	2.27
10. Confrontation	CR		67.30	19.23	1.92	7.69	3.84
	WR		72.72	18.18	6.81	2.27	0.00

those with 2, 50 percent deficiency, those having the score of 1 were supposed to have 75 percent deficiency, those with 0, 02, 01 or –2 were supposed to have 100 per cent deficiency in that dimension.

Macro-Analysis: In order to present an overall qualitative picture of role efficacy in both the railways as a whole averages of the percents of the incumbents along three qualitative categories were worked out. The rating score of 4.00 was renamed 'Adequacy', 3.00 as mild inadequacy and 2 and below named as 'major inadequacy'. Averages of the percents of the subjects were worked out and are shown in table 2.

Table 2: Distribution percentages of supervisors along three qualitative classes of Role efficacy.

Dimension	Adequacy	Mild Inadequacy	Major Inadequacy
Centrality	12	38	50
Integration	71	17	12
Proactivity	16	48	36
Creativity	26	40	34
Inter-role Linkage	49	30	21
Helping Relations	54	12	34
Super-Ordination	16	27	63
Influence	11	49	40
Growth	32	36	32
Confrontation	70	19	11

It can be noted that the highest percentage of subjects i.e. 71% were found to perceive adequacy with regard to the dimension of integration, followed by 70% with regard to confrontation, The third high ranking percentage was found in regard to the dimension of 'helping relations'. The lowest percentage of adequacy (11%) was in the dimension of 'influence' (12%) and super-ordination and proactivity 16%. Percentages of subjects having adequacy in the dimensions of inter role linkage growth and creativity being 49, 32 and 26 ranked in the middle i.e. at 4th, 5th and 6th position in the descending order.

With regard to the percentage of subjects having major inadequacies i.e., requiring immediate intervention, it can be seen that the highest percent of subjects (63%) was found in the dimension of 'superordination' followed by 50% in centrality, 40% in 'influence' and 34% both in creativity and helping relations. In this hierarchy, percentages of subjects being 32% for 'growth', 21% for inter-role linkage, 12% for 'integration' and 11% for confrontation came in descending order.

Discussion

The highest category i.e. (71%) of supervisors having adequacy in the dimension of 'integration' may be explained in terms of their long exposure to the organisation ranging between 1 and 38 years, majority of them working in the grades of Rs. 2000-3200 and Rs. 2375-3500 i.e. their earning per month amounting to the tune of Rs. 8,000-10,000 including the travelling allowance etc. In addition to this, since the majority of the subjects were educated upto standard X & XII and since there are ever increasing changes in the work place, which pose regular challenges to the incumbents they may be motivated to mobilize their experience and educational resources to meet the expectations of the organisation.

The second highest category i.e. 70% of supervisors having adequacy in the dimension of confrontation supports the point put forth for the integration dimension. It also gives an indication about their readiness to face any challenge and about the assertive style being practised by them in dealing with their subordinates. The third and the fourth highest categories (54% and 49%) of subjects on the dimensions of helping relations and inter-role linkage may be attributed to the interdependence of one department on the others. For example, when a train starts from a station, at least 7 to 9 departments of the railway work together. Besides, as the role-incumbents have to be out of their headquarters, they have to help each other with regard to job requirements as well as family commitments. The lowest categories of 11%, 12%, 16% and 26% on the dimensions of influence, centrality, proactivity and creativity are also attributable to the job-requirement and lack of opportunity for creative work. On the dimension of super-ordination also, the percent of subjects being only 16% gives a hint towards the prevailing neglect of the individual railways towards inculcating such a feeling in the worker.

The highest category (63%) of subjects having major inadequacies in the dimensions of super-ordination and centrality 50% give a hint perhaps towards the lack of programmes of awareness about the ethos and social service rendered by the Railways. A sizeable proportion i.e. 40% of the subjects had major deficiency in the dimension of influence. Percent of subjects having major inadequacies in the areas of proactivity, creativity and growth being 36, 34 and 32 are attributable to lack of opportunities for using their potentialities.

In view of the majority of supervisors (ranging from 43% to 71%), having adequate perception of their role or role-efficacy in the areas of integration, confrontation, helping relations and inter-role linkage, it becomes evident that they have developed some sort of involvement

and commitment to the job and are prepared to dedicate themselves to the achievement of the goals of the organisation. However, majority of them (ranging from 40% to 63%) having major inadequacy in the areas of super ordination, centrality and influences reveals an urgent need for embarking upon role-intervention strategies by the organisation. In such interventions how much social service is being rendered by the Indian Railways in general and in particular at the time of emergency, war, riot etc. are to be narrated and the image and ethos are to be inculcated in their minds.

Increasing Role-efficacy

In order to increase efficacy in each of the 10 dimensions ideas were generated from the subjects in the group settings. Actions to be taken by the role-incumbents were mutually agreed upon. Each of the participants having rating score of less than 4 on any dimension was counselled in the group setting to take action to improve his perception. Number of participants in the group sessions was restricted to 10. Actions to be taken by the role-incumbents in each of the 10 dimensions are summarised as follows. As these were decided by the participants themselves, adoption is supposed to have no problem.

Centrality

The importance of the job of a supervisor in the organisational set up of train operations was discussed in detail especially in the wake of ever changing technology. Some of the supervisors regretted the non compliance of the staff when that managers give orders for adoption of new technology. At such moments, supervisors have to ensure correct compliance and reinforcement. If the employees acknowledge the authority of the supervisor centrality can be increased. Role-efficacy in the dimension of centrality can be increased if the following actions are taken by the supervisors:

- Perception about the centrality of the job can be increased by the self suggestion of the supervisor in making employees understand the new ways of working.
- Such self-suggestion can be generated by acquiring knowledge and expertise in the skill of performing the job in the best possible and most effective way.

Integration

A revealing exercise of self analysis of one's strength, weakness, opportunities and threats (SWOT) was carried out. Through this exercise, many possibilities for integration emerged. Some of the ideas generated were as follows:

- One has to know about himself from his superiors, colleagues and subordinates in order to be aware of his strengths and weaknesses.
- Experience is the best teacher. Therefore, one has to tell his experience to others and learn from the experience of others.

Proactivity and Creativity

The process of acting being preceded by two other levels i.e. feeling and thinking was explained to the respondents. Participants agreed that most of their actions in the organisation are reactive. It was also explained that with the growing technological advancement and variety in organisational behaviour, organisations expect them to apply their past experience to current problems and to take action beyond the immediate concern. For increasing efficacy in these dimensions some of the ideas generated, were as follows:

- One has to develop a habit of thinking ahead i.e. anticipating what is likely to happen. Expectations of the superiors, colleagues and subordinates are always to be kept in mind.
- One has to correct and rectify his perception by applying an analytical approach, using past experience in current problems, planning action in advance, trying out new ideas and taking feedback.

Inter-Role Linkage and Helping Relations

In his role-set a supervisor has to have linkages at all the three levels: the higher level (with his officers), lower level (with the employees working under him) and horizontal level (with his peers in his own and other departments). It was explained that these linkages have four important bases i.e. common goals, interdependence, empathy and crisis management. If through these linkages emotional linkages of empathy, support and sacrifice are created in the mind of supervisors, then the quality of working life will be definitely improved. With regard to actions to be taken by the supervisors, following suggestions emerged:

- One has to be consistently engaged in planning new ways of inspection and counselling

employees in order to correct their erring behaviour.

- One has to develop new posters and slogans for increasing safety and efficiency on the railways.
- One has to be frank in expressing his views in meetings.
- One has to develop a proper sense of empathy and has to communicate with other departments freely and frequently.
- For being effective in the organisation, one has to help others and take help from others.

Super Ordination

To create a proper sense of perception with regard to the dimension of super-ordination in a group setting of 10 persons, persons having rating scores of 2 or less were asked to speak about the importance of their job in the context of social and national development. Their referals were confined to self sustenance only. On the other hand, the participants who had scored 4 or 3 on this dimension were fully aware of the importance of the railways in social and national development. On hearing such lectures by their peers, the participants with deficiency showed a positive change in their outlooks. Several action suggestions were generated:

- One has to learn more about the corporate objectives of the railway and the social purpose of linking north to south, west to east for social and national development.
- One has to learn about the crucial role played by the railways at the time of wars, riots and other emergencies.
- One has to read railway publications like Indian Railway year book.
- One has to identify some areas in which he can contribute for the larger cause of the society.

Influence & Growth

In order to bring about a change in the perception about one's capacity to have an impact on he others and the perception about learning new things in everyday working, a group exercise was conducted. The persons scoring low had some inhibition about their capacity to influence others.

- One has to be always aware as to how much he has learnt from experience.
- One has to develop adequate competence in dealing with persons at the higher, lower and equal levels.
- One has to be conscious of his achievements.
- One has to develop a self-monitoring system in the context of his achievements in the two dimensions.

Confrontation

As Indian Railways is the biggest public sector organisation, the style of management and leadership being followed is of the autocratic type; as unless a supervisor has adequate assertiveness he cannot function well. Approximately 70% of our subjects had adequacy, 19% mild inadequacy and only 11% had major inadequacies. For removing the inadequacies the participants suggested the following steps:

- One has to try to deal with the subordinates himself and try to avoid sending the reports to higher ups.
- One has to study the pros and cons of the problem before confronting.

Utility Analysis

The role-efficacy labs were organised as a part of the training programmes 'on counselling better' with the specific objective of bringing about a positive change in the role-perception of supervisors by diagnosing deficiencies in various dimensions of role-efficacy and counselling them towards correcting their erring behaviour. At the end of each training programme 95% of the participants expressed better perception of opportunities than they had stated in the expectation scale before the commencement of the course. All the officers under whom the respondents are working reported a positive change in their outlook and disposition to the job. This role efficacy exercise might have indirectly contributed to the achievement of the safety shield of Indian Railways for years 1992-1993 and 1993-94 by the Western and Central Railways respectively.

Conclusion

The results of the case study conducted on a limited number of supervisors of Central and Western Railways give an insight into the probable benefit of role-efficacy interventions for railway supervisors. There appears to be an urgent need to conduct such labs for all supervisors to raise the morale and motivation of the staff in addition to increasing productivity.

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The way to secure a company's position within its industry is to find the most demanding customers, determine their needs, and serve them better than competitors do.

— STALK & HOUT 1990, 272

Social Costs of Public Distribution System: The Case of Andhra Pradesh

S. Ravishankar Rao

In an effort to ensure provision of adequate essentials of basic food items to the poor and needy, the government has evolved a public distribution system entailing heavy subsidies. But how much of the budgeted subsidy actually reaches the target is a moot point. The author quantifies the operational–distributional costs involved and presents a few policy implications.

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The Public Distribution System (PDS) in India provides food safety which not only benefits the consumers and Fair Price Shop (FPS) dealers but also producers and a large number of intermediaries such as transporters, merchants, and thousands of government employees. The Food Corporation of India (FCI, 1991) alone employs about seventy thousand personnel and the Andhra Pradesh State Civil Supplies Corporation (APSCSC, 1993) employs about one and half thousand, other government employees in the Ministries of Civil Supplies. Definitely, different sections of society are gaining from the PDS at a social cost. The social costs here refer to expenditure incurred directly and indirectly by the central and state governments. A well known fact is that costs incurred by the government are borne by the tax payers. As the PDS imposes heavy burden on the exchequer, it is pertinent to look at its functioning from the angle of governments. Therefore, a study was undertaken to enquire into the cost structure of the PDS, budgeted subsidy and fraction of the subsidy actually percolating to the consumers. This study is based mainly on secondary sources of information and in part on primary data collected from a sample from Andhra Pradesh (AP) state. It is essentially a macro level study of India with special reference to AP state. Recent year is considered for estimating costs, for which break up data were available.

PDS Operations : Agencies Involved

Both the central and state governments are equally important in the planning and execution of PDS. While the Central Government assumes the responsibility of procuring necessary stocks of essentials, the onerous task of implementing the scheme to benefit the targeted consumers is assigned to the state governments. Under the direction and financial assistance of the Ministry of Civil Supplies, Government of India, the FCI is the agency to Union Government with regard to food safety net and its counterpart in AP is the APSCSC.

The Government of India, based primarily on the recommendations of the Commission on Agricultural Costs and Prices (CACP), has been announcing on the eve of sowing seasons, Support Prices which are also called Procurement Prices since 1973-74. These prices are supposed to cover full cost of production including imputed value of family labour. When compared to open market prices, they are definitely higher in surplus states and vice-versa. A scrutiny of procurement prices and wholesale market prices reveals that the former lags behind the latter by about 10% to 20% (Radhakrishna & Indrakant, 1987). Although the FCI alone is authorised to procure foodgrains throughout India, in AP based on an understanding between the FCI and AP Government, The APSCSC also procures additional requirements of rice for its own PDS. A procurement target for each state including AP is fixed by the Central Government. After ensuring the required quantity for the central pool, the APSCSC procures additional quantities because the allocation made by Government of India falls short of its requirements. In times of procurement of rice, generally the APSCSC pays a price which is marginally higher than the procurement price of the FCI. Issue prices are fixed in two states. First the Government of India fixes issue prices to the states at ex-factory FCI godown cost. The state governments have the freedom to suitably modify the central issue prices. The APSCSC based on the state government policy, refixes issue prices to the PDS outlets alongwith end-retail prices to the consumers. It would certainly be of interest to note that the issue prices of the FCI are lower than its procurement prices and the market prices. Again the issue prices of foodgrains fixed by the AP Government are lower than the FCI issue prices. The lower issue prices, needless to say, are meant to protect the interests of vulnerable sections of the consumers. The implications are obvious. Subsidies creep into the system both at the FCI and state levels.

Structure of Costs and Subsidies

Negotiated & Procurement Prices

The procurement prices for paddy are announced for three varieties viz. common, fine and super fine. However, for wheat only one price is fixed. Sometimes to induce producers to sell higher quantities, both the central and state governments offer a bonus. For example, in the years 1991-92 and 1992-93, the bonus offered by the central and state governments for wheat was twenty rupees and five rupees per quintal (qn) respectively. The procurement prices for three varieties of paddy in 1992-93 were Rs. 310, Rs. 330 and Rs. 350 and for wheat Rs. 350 per qn.

The government of Andhra Pradesh through its APSCSC also procures rice. This is in view of insufficient allocation from the central pool. Since AP is one of the few states in India implementing universal PDS, it needs additional quantity of rice. For this purpose, there is an understanding between the state government and rice millers in the state to supply rice at a "negotiated price". The procurement price fixed by the FCI is marginally lower than the negotiated price.

Procurement & Distribution Costs

Having paid the major cost item of price to the producers (procurement/negotiated price), a variety of costs are incurred at various stages commencing from the point of purchase to final destination to consumers. These costs are classified broadly under procurement costs and distribution costs. Tables 1 and 2 give an account of the two types of costs. (Due to lack of readily available published data for 1991-92, 1989-90 data has been presented in the tables. Procurement costs refer to all the incidentals from the point of purchase to the point of stocking in godowns. Distribution costs are incurred in connection with allocation and distribution of pooled stocks to various parts of the country from the stock points of the FCI.

Table 1 : Procurement Costs – FCI (1989-90)

(Rs./qn)

Cost Element	Wheat	Paddy	Rice
	1	2	3
Marketing Charges	7.03 (17)	8.77 (24)	-
Market Labour	1.73 (4)	1.44 (4)	-
Forwarding Charges	0.51 (1)	0.31 (Neg)	1.63 (9)
Internal Movement	3.95 (10)	7.33 (20)	0.59 (3)
Storage Charges	1.95 (5)	-	0.01 (Neg)
Interest Charges,	3.95 (10)	-	0.29 (2)
Wage Bill	4.02 (10)	-	3.32 (7)
Purchase/Sales Tax	6.57 (16)	2.63 (7)	2.86 (16)
Gunny	10.55 (26)	16.83 (45)	11.40 (63)
Others	0.05 (Neg)	-	-
Total	40.31 (100)	37.31 (100)	18.10 (100)

Source : FCI Annual Report 1989-90.

Notes : (1) Figures in parantheses are %s.
(2) Neg = Negligible.

Procurement costs are composed of ten items. The single biggest item is cost of gunny which accounts for 26% for wheat, 45% for paddy and 63% for rice in the total procurement costs. The next major item is market

charges followed by internal movement charges. However, in the case of wheat, purchase tax is the third major item. In brief, during 1989-90, to procure one qn of wheat, Rs. 40.31 were spent and the corresponding for paddy and rice were Rs. 37.31 and Rs. 18.10.

Table 2 : Distribution Costs – FCI (1989-90)

Cost Element	Amount (Rs. Crore)	Rate (Rs./qn)	% to Total
	1	2	3
Handling Expenses	119.8	7.80	10
Storage Charges	153.3	9.98	13
Interest Charges	214.2	13.94	18
Freight	491.0	31.97	42
Wage Bill	124.2	8.09	11
Transit Storage	58.0	3.77	5
Storage Shortage	12.0	0.78	1
Total	1172.41	76.33	100

Source : FCI Annual Report 1989-90.

Distribution costs. On an average, to distribute one qn of wheat, rice or paddy, Rs. 76:33 were incurred in 1989-90. At this rate, for the total quantity distributed (about 15 mt), the FCI incurred over Rs. 1172 crore (table 2). Freight charges are the major component forming 42% of the total distribution costs. The other main elements of the costs are interest charges (18%), storage charges (13%) and wage bill (11%) in that order. As to the operational costs of handling levy sugar, FCI incurred Rs. 98.25 per qn or a sum of over Rs. 112 crore in 1989-90. The details are given in the appendix table.

Total Unit Cost & Unit Revenue of FCI Operations

In computing the total unit cost and the unit revenue of the FCI related to purchase and sale of one qn of PDS goods, the analysis is restricted mainly to rice and wheat. To work out total unit cost, we have to add procurement price per qn to unit procurement and distribution costs. From this total unit cost, by subtracting issue price, one can know the loss to the FCI or subsidy given to the state per qn of sales. Table 3 provides an idea of the variables involved in the computation. In the total unit cost of rice, procurement price accounts for three-fourths and the operational costs a fourth. As to wheat and sugar, over three-fifths and four-fifths are the respective shares of procurement prices. Central issue prices may be treated as unit revenue. Issue prices of rice and wheat cover approximately two-thirds of the total unit cost implying loss to the extent of a third. What is loss to the FCI or the Government of India, is implicit subsidy supposed to have accrued to the state Public Distribution System.

Issue prices of rice and wheat cover approximately two-thirds of the total unit cost implying loss to the extent of a third.

Table 3 : Unit Cost and Unit Revenue – FCI (1989-90)

(Rs./qn)

Particulars	Rice	Wheat	Sugar
	1	2	3
Procurement Cost	18.10 (5)	40.31 (14)	24.05 (4)
Distribution Cost	76.33 (20)	76.33 (25)	74.20 (12)
Procurement Price	277.50 (75)	183.00 (61)	540.42 (84)
Total Unit Cost (1+2+3)	371.93 (100)	299.64 (100)	638.67 (100)
Central Issue Price	244.00 (66)	204.00 (68)	525.00 (82)
Loss/Implicit Subsidy (4–5)	127.93 (34)	95.64 (32)	113.67 (18)

Sources : FCI Annual Report & Economic Survey.
Note : Figures in parantheses are %s.

The Government of India, incurred a loss of Rs. 127.93 per qn sale of rice, and Rs 95.64 for wheat. To this extent, the PDS clientele are deemed to have been benefited or received subsidy from the Government of India. But this inference is not true, for the states sell the PDS goods at prices less than the central issue prices. In fact, the consumer subsidy is much higher because the state governments too subsidise the PDS sales. Turning to sugar, as the issue price forms 82% of the unit cost, the loss to the government appears to be 18% of the unit cost or Rs. 113.67 per qn of sale. However, available break up data do not unambiguously inform procurement and issue prices of levy and levy-free sugar.

Magnitude of Subsidy

The FCI as an agent of the Government of India, assumes the responsibility of procuring, transporting, stocking, allocating and distributing the PDS goods to states for onward distribution to the final targeted consumers. However, it has no freedom either in fixing the procurement prices or the issue prices to the states. Hence, it can not function as a business enterprise as the issue price falls behind the full cost. Therefore, the Government of India gives consumer subsidy to the FCI

equal to the excess of economic cost over issue price (FCI, 1991). By adding procurement price, procurement costs and distribution costs the economic cost is derived.

In 1989-90, the FCI was given Rs. 1774 crore as consumer subsidy, of which 57% account for rice and 43% for wheat. The FCI was also given Rs. 167 crore towards carrying cost of 10 mt buffer (FCI, 1991). Thus in all (on rice, wheat and buffer stocks maintenance), the FCI in 1989-90 was given Rs. 1879 crore which also included adjustment relating to previous year. This figure of Rs. 1879 crore is at variance with the summary figure of Rs. 2476 crore (GOI, 1992) food subsidies shown in the budget documents. The difference of Rs. 597 crore may be explained in terms of wage bill of the Ministry of Civil Supplies and other related expenditure. The purpose of these details is to avoid wrong interpretation of Rs. 2476 crore food subsidy shown in budgets as "consumer subsidy" or benefit given to consumers. We do not deny the expenditure of Rs. 2476 crore on food safety. What we deny is that the consumers actually did not receive the entire benefit but only a fraction.

The consumers actually did not receive the entire benefit but only a fraction.

Expenditure on PDS : AP

We now proceed to compute the unit cost and unit revenue of APSCSC, after having estimated the subsidy given by the government of India. Here it is worth observing that the responsibility of the Government of India is limited to the spheres of procurement, transportation, stocking and distributing the pooled stocks to the states. Once it allocates and fixes the issue prices, its responsibility virtually ends. It is for the states to lift the allocated quotas by paying the central issue prices and allocate the same (as well as additional stocks procured by them separately) at prices deemed to be fair based on their finances and perception of welfare. In other words, the states have the freedom to modify the central issue prices and refix issue prices separately for the PDS outlets/Fair Price Shops and consumers. The latter issue prices are called end- retail prices.

Unit Revenue & Unit Cost—APSCSC

The first step goes in the direction of working out unit operational costs in order to estimate the burden of subsidy borne by the AP Government. They may be classified under five sub-heads as shown in table 4. In the recent three years, interest and freight charges are the principal cost components which together constitute two-thirds of the total operational costs. It is of some interest to note that there is a quantum jump in the share of wage bill in 1991-92. This is due to the merger of Andhra Pradesh State Essential Commodities Corporation (APSECC) with APSCSC. On the whole, per qn of transactions, the unit cost works out to a little over Rs. 20 in the recent three years (last Row). To this we have to add the procurement price to obtain cost of one qn of PDS commodities. But before we do the arithmetic, let us note that in AP rice is the staple food and subsidised rice scheme has been in operation from the 80s. Therefore, the present analysis focuses on estimation of costs related to rice.

Table 4 : Procurement and Distribution Costs—APSCSC

(Rs./qn)

	1989-90	1990-91	1991-92
Storage	1.84 (9)	3.07 (12)	0.46 (3)
Handling	1.60 (8)	3.09 (13)	1.08 (5)
Wage Bill	2.71 (13)	2.15 (9)	5.08 (25)
Freight	6.24 (29)	5.41 (22)	7.86 (39)
Interest Charges	8.87 (41)	10.95 (44)	5.55 (28)
Total	21.26 (100)	24.67 (100)	20.03 (100)

Source : APSCSC Annual Reports

Note : (1) Figures in parantheses are %s
(2) Interest Charges refer to interest other than on sugar.

PDS in AP—Magnitude of Loss/Subsidy

Table 5 reveals an idea of the cost, revenue and loss/subsidy implicit in the rice scheme of AP. Two variants of total unit cost are shown. The reason is that AP meets its total PDS requirements partly from the central pool and in part direct purchases from the millers at a negotiated price. Generally, the latter is marginally higher than procurement price announced by the Government of India. A scrutiny of volumes of procurement in the recent years reveals that about two-thirds of the needs of AP are met from the central pool. Over 90% of the total unit cost is accounted for by procurement price and the balance by operational costs. A look at Rows 4 & 5 reveals that the issue price of rice in AP to the PDS outlets covers 65% of the costs. The implication is obvious. The APSCSC incurs a loss amounting to about Rs. 102 per qn of rice sold. This loss is recouped by way of subsidy from the AP Government.

Table 5 : Estimated Loss/Subsidy – PDS in AP (1989-90)

(Rs./qn)

Particulars	Purchases from FCI	Direct Purchases from Millers
	1	2
Operational costs of APSCSC	21.26 (8)	21.26 (7)
Procurement Price	244.00 (92)	328.88 (93)
Total Unit Cost (1+2)	265.26 (100)	350.14 (100)
Weighted Total Unit Cost	294.12	
Issue Price of Rice to PDS Outlets in AP	192.62	
Loss/Implicit Subsidy (4–5)	101.50	

Sources : Tables 3 & 4.

Notes : (1) Weighted unit cost is arrived at by multiplying 265.26 and 308.76 by 0.66 and 0.34 respectively. These weights are based on proportions of the purchases from the FCI and direct purchases in the total purchases of the APSCSC.

(2) Figures in parantheses are %s.

Social Costs & Monetary Gains

While analysing PDS subsidy given by the Government of India, it was observed that consumers actually received only a fraction of the publicised food subsidy. The same holds good for the AP state as well. Year after year, total subsidies as also food subsidies are on the rise. The Central Government and AP State Government are allocating larger sums for food subsidy as is evident from table 6. The issue is whether the consumer gains are equal to the subsidy allocations shown in the budgets. In 1991-92, while the central food subsidy was Rs. 2850 crore, the corresponding for AP state was Rs. 420 crore.

Assuming that the unit cost data of 1989-90 remain constant and the entire food subsidies allocated were spent on rice and wheat foodgrains, we now estimate indirect monetary gain deemed to have accrued to the consumers. The procedure adopted to estimate the gain is detailed in table 7. The estimates shown in the table are for the year 1991-92. To the extent of Rs. 111 per qn at all India level and Rs. 81 per qn at AP state level, consumers do not gain. Based on PDS off-take, the absolute value of the gain not accrued to consumers amounts Rs. 2120 crore for India and Rs. 170 crore for AP state. The same is deemed to have been accrued to various intermediaries such as merchants, transport agencies, warehouses, government officials engaged in PDS operations, etc. By deducting this amount from the budgeted subsidy, when consumer gain is worked out it is alarming to note that in the name of consumer three-fourths of the budgeted subsidy at the all-India level is cornered by the middlemen and only a fourth is passed on to the consumers. In absolute terms, PDS consumers in India are deemed to have secured Rs. 730 crore benefit and the AP consumers obtained an additional gain of Rs. 250 crore. The combined estimated gain of Rs. 980 crore appears as substantial. However, in terms of per qn of purchase by the consumers from the PDS, the average gain is just Rs. 38 and the consumers in AP were fortunate to get an additional benefit of Rs. 119. In other words, in the states which also subsidise out of their own finances, the gain to PDS consumer is not insignificant. To be specific, taking the example of AP, an average PDS consumer gained Rs. 157 per qn of foodgrain purchases. In another detailed investigation (Ravishankar Rao, forthcoming), it was estimated that in 1992 an average poor household gained from the PDS rice and sugar purchases to the extent of Rs. 45.50 and a non-poor household Rs. 14.50 per month. This benefit, though not substantial, is surely a welcome addition to the meagre incomes of the poor. It should be conceded that the estimates are crude as they are based on loaded assumptions and inadequate firm data. Nonetheless, they do broadly reflect the real state of affairs.

Table 6 : Food Subsidies

(Rs. crore)

Year	Government of India		AP State Government Food Subsidy
	Total Subsidies	Food Subsidy	
	1	2	3
1989-90	10474	2476	317
1990-91	12158	2450	369
1991-92	12253	2850	420
1992-93	12043	2801	402
1993-94 (RE)	12400	5200	582
1994-95 (BE)	9463	4000	685

Sources : Union Budgets and Commissioner of Civil Supplies, AP.

In the name of consumer, three-fourths of the budgeted subsidy at the all-India level is cornered by the middlemen and only a fourth is passed on to the consumers.

Table 7 : Estimated Monetary Gain to Consumers from PDS Subsidies (Rice & Wheat) (1991-92)

Particulars	India	AP
	1	2
Total Weighted Unit Cost of Operations (Rs./qn)	105	21
Excess of Weighted Issue Price over Procurement Price (Rs./qn)	6	60
Total (1+2) (Rs./qn)	111	81
PDS Off-take (lakh t)	1910	21
Gain not accrued to Consumers (3x4) (Rs. Crore)	2120	170
Subsidy Shown in Budgets (Rs. Crore)	2850	420
Total Gain Accrued to Consumers (6-5) (Rs. Crs.)	730	250
Gain to Consumers per qn of Purchase from PDS (Rs.)	38	119

Sources : Tables 3, 5 & 6.

The high magnitude of unit cost of operations is a reflection of inefficiency and malpractices at various levels in implementing the PDS. Unless the costs of operations are reduced. PDS can not be effective in conferring social justice with tolerable social costs.

By way of conclusion, we may draw attention to a few observations and policy implications of this inquiry. PDS confers both qualitative and quantitative (monetary) gains. The qualitative gain of assured regular supply of a few essential goods serves as a sort of insurance to the vulnerable classes of the society who are the victims of famines and scarcity conditions. Consumers also gain from the PDS in monetary terms to the extent of Rs. 38 per qn of purchase at the all-India level (and in AP Rs. 157). However, as the unit cost of PDS operations is about Rs. 200 per qn, three-fourths of the budgeted food subsidy is eaten away by the intermediaries including government officials and consequently only a fourth of the subsidy percolates to the consumers. Paradoxically the PDS meant for the consumers blesses them with only a fraction of the food subsidy and a huge chunk of it is pocketed by the middlemen. The high magnitude of unit cost of operations is a reflection of inefficiency and malpractices at various levels in implementing the PDS. Unless the costs of operations are reduced, say from the present share of 75% to 50% (in the total subsidy), PDS can not be effective in conferring social justice with tolerable social costs.

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Appendix

Operating Costs of FCI – Levy Sugar

Cost Element	Rs./qn	Total (Rs. Lakh)
	1	2
A. Distribution Costs	74.20	8484
Freight	52.01	5946
Handling Charges	8.14	930
Wage Bill	9.44	1079
Other Charges	1.07	124
Other Direct Expenses	0.15	18
Storage Charges	3.39	387
B. Other Operating Costs	24.05	2750
Interest	14.73	1684
Losses	9.32	1066
Total (A + B)	98.25	11234

Source : FCI Annual Report - 1989-90.

Feature

Maintenance Management—A Quest

Siladitya Ghosh

Maintenance function has come to be recognised as vital for enhancing productivity in industry. The author traces the emergence of preventive and predictive maintenance from the age old practices of break-down repairs. He illustrates the regime for condition monitoring and concludes that it is not a luxury but a necessary part of daily routine in industries aspiring for success.

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Among the many functions in industry, maintenance is the most misunderstood and neglected one: the Government, the industrialists, the top management, the educationists and the engineers themselves are guilty of the above crime. Maintenance function is very complex in any country, more so in an old society and a developing country like India.

In a highly populated country, labour is cheap and the owners are not required to maintain machines and vehicles themselves—numerous workshops cater to that need. This is a problem of tradition and attitude. Compounding the issue is the dearth of informative books except on maintenance. When a young mechanical or electrical engineer starts out on his career his choice is to join production, design, management or even public administration but not the maintenance line. A person taking up the maintenance line, has no clear idea about how he should go about it as guidelines do not exist. He gets busy attending to breakdowns and chasing after spares (those available are not required or useless, what is necessary, God knows, when it will be made available!). He depends on his commonsense and achieves due to sheer hard work. This goes on and he gets some raises or promotions. Possibly, he attends a few training programmes which do not help him as he can't apply those principles. The young engineer has become a part of the system. In a few years' time, he becomes a middle manager, but works essentially as the same junior engineer. He does not plan, does not control, does not develop; he only organises and leads from one breakdown to another.

Emergence of Preventive Maintenance

Of late, the concept of preventive maintenance (PM) has spread among industries. The disadvantages of breakdown maintenance are well-known. Earlier routine maintenance and services replacement were carried out. However as Murphy's Law states, if something is going to fail, it will fail at the worst possible time. Hence, a stitch in time saves nine. PM consists of inspection, lubrication, adjustment and repair periodically. It invariably boils down to some chart-based programme and is not cost-effective;

breakdowns don't stop; maintenance engineers are still called up during nights and taken to task why their PM is not producing results. This is the depressing scenario repeating in a random fashion in may industries around the world.

If something is going to fail, it will fail at the worst possible time.

We have now another concept: predictive maintenance or better known as condition monitoring. No two machines are identical. Hence, PM is not based on any pre-conceived schedule but planned on the basis of reported condition and performance. Suitable parameters are chosen: vibration, lubricant quality, temperature, thickness, performance characteristics such as flow, pressure drop, leakage rate, etc. These are either periodically or continuously monitored and maintenance actions are decided. A related term is corrective maintenance; repair actions in order to correct or redress the incipient faults.

About twenty-five-years back, alarmed by frequent breakdowns in the steel plants and other public sector units, the Government of United Kingdom set up a Working Party in Maintenance Engineering. The report submitted by this Party was very illuminating. They pointed out that the maintenance function in industry had to be integrated with other functions such as design, manufacturing, installation, commissioning, operation, purchase, etc. A total approach to maintenance was suggested and a new name was proposed: terotechnology. Tero is a Greek word meaning taking care. Maintenance was now Terotechnology – the technology of care, repair and maintenance. The concept acquired various names such as life-cycle management, logistics, womb-to-tomb or cradle-to-grave approach etc. There have been net gains. Universities and Polytechnics have introduced Maintenance courses of various durations and topics. Maintenance Engineers formed Associations and Societies which are doing useful work. New books and journals have appeared in this field. Management, manufacturers, users and administrators have made some attempts to understand and improve maintenance.

A Senior Mechanical or Electrical Engineer who becomes a Maintenance Personnel is no different from a Senior Personal or Administrative Officer. He has to set objectives, plan, organise, lead, measure, control and develop. Maintenance engineers neglect the planning aspect, naturally, they are unable to control. Development of people is neglected by every function; maintenance is no exception.

Some particular factors have further vitiated the maintenances field. Because of turnkey projects and lack of standardisation, the variety in equipment and machines has become a nightmare. There are innumerable manufacturers and suppliers. If the Maintenance Engineer is not careful, he is invariably trapped-by obsolete designs or frequent changes therein, and lack of after sales service – spare part lists and drawings are not provided; supply of spare parts in time and at reasonable price is not guaranteed. Lack of infrastructure is another big problem. Workshop facilities, tools and tackles of lockers and washing facilities, etc. are often non existent. Maintenance workload is never uniform. Happily there are some periods when breakdowns are less and maintenance workmen are not fully engaged. This is the time when these people have to be engaged in making fixtures and spares. A maintenance engineer requires a good workshop for this purpose and of course, he had to adopt good planning procedures.

A Senior Maintenance Personnel has to set objectives, plan, organise, lead, measure, control and develop.

Equipment need not and should not be allowed to decline in performance with age. The notion of "tired, old machines" is promulgated by abusers and accepted by those who do not understand mechanisms. We should not think of replacements and scrapping in developing countries on the other hand, we should redraw the lifecycle of the machines.

Guidelines for Preventive Maintenance

Most machinery is designed to be maintained at certain minimum specifications. An automobile engine, for example, is designed to produce certain horsepower at a specified RPM and rate of fuel consumption. That the crankshaft is somewhat worn has no effect, the engine should still perform to specifications. A good mechanic knows the wear limits on that crankshaft, and he regrinds the journals before failure occurs. Likewise, he replaces the air filter before engine performance falls below specifications, and certainly before outright failure. This is called preventive maintenance (PM).

Thus PM is done either when wear limits suggested by the manufacturer are reached or when performance falls below design specifications. For simplicity, the manufacturer may state PM schedules in terms of operating hours in "normal use"; e.g., change oil every 10,000 kilometers. When breakdown and maintenance are costly,

or where equipment is used under severe conditions, smart users analyse wear rates and set new PM schedules accordingly. For instance, companies that operate vehicle fleets often have engine oil analysed to find the optimum type of oil, filtration and replacement interval. This is condition monitoring (CM).

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Optimum PM is best illustrated by commercial air carriers. Air safety records show that crashes are rarely caused by equipment failure, even though the equipment is in nearly continuous use. We can cite here the case of the crash of a scheduled US airliner caused by equipment failure on 25 May 1979. An American Airlines DC-10 lost an engine on take off at Chicago's O'Hare International Airport. The engine literally fell off, because the crew failed to follow exact maintenance procedures. They had thought that they had found a legitimate shortcut to simplify engine removal. In fact, their short cut caused hidden cracks in the mountings.

Advantages of Condition Monitoring

Condition-based preventive maintenance is always better than breakdown repair-for several reasons. PM can be scheduled for times when equipment is most easily taken out of use such as at night or when spares are made available. The Management decides when the equipment is to be shutdown, and plans accordingly. Otherwise, Murphy's law will operate: failure will occur at the worst possible moment, when people will be injured, production is shut down and spares are unavailable. In fact, equipment is most likely to fail when most urgently needed, simply because it is used hardest then.

Scheduling maintenance allows more efficient use of maintenance personnel. They can be scheduled for steady continuous work with minimum inventory of spare parts. The alternative is having repair personnel always available, but mostly idle.

Replacing worn out parts before they fail prevents secondary damage to the equipment. For instance, if a worn bearing is pushed on to failure, the shaft supported by that bearing and other related parts are often damaged; Operators are in danger if the shaft breaks or locks up, and metal particles released by the disintegrating bearing can cause widespread damage.

Real cost savings from preventive maintenance are not immediately apparent. After all, the argument, "why fix it it's not broken?" seems irrefutable. When budgets are tight and skilled personnel few, it makes sense to do only what you must. Breakdowns have to be repaired. PM seems a luxury. A decision not to conduct PM is immediately rewarded with reduced upkeep costs—for a while. When the costs do come (as surely they must) many are hidden in downtime, reduced operating efficiency, defects and scrap—none of which are reported as maintenance expenses, but instead are charged to production. The production department pays, and, unfortunately, maintenance department pays also.

Relief was only temporary. Now, they have more repairs to make,and more serious repairs, than before. Maintenance personnel become so busy that they have no more time for prevention.

Conclusion

In a well-conceived maintenance programme,nearly all equipment service is schedule PM. (In a few, special cases, repair is intentionally withheld until broken down. Such a plan should be justified by records proving lower cost.) Breakdowns, by definition, are programme failures. Causes of failure are: equipment misuse, PM programme omission, PM done improperly, or defective part. Breakdown records are kept, the causes of breakdowns determined and corrective action is taken. thus, maintenance is never static—it is always being improved, costs are always being decreased, and breakdowns become less and less frequent as the management learns how best to operate and maintain equipment.

In a well-conceived maintenance programme, nearly all equipment service is scheduled PM.

Perhaps the most significant aspect of maintenance management is discipline. Discipline means conforming to rules, procedures and standards or performance. All successful enterprises begin with discipline and are sustained by discipline. Equipment operations are particularly sensitive to their state of application because equipment cannot forgive misuse and neglect. If management cannot keep their equipment serviced, what can they ever hope to do?

Improved Productivity in Processing of Pulses – Priorities & Preferences

S.D. Kulkarni

Because of the fact that the production of pulses has been almost stagnant during the last 30 years, the food legume (Pulse) processing/ milling in India has drawn considerable attention of those who intend to meet the protein needs of our population adequately. The possibility of attaining near theoretical dal yield level during processing has been explored by various organisations. The author discusses the many aspects to be covered for achieving higher productivity in terms of dal out- turn during milling for making it available to the needy population.

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On the food front India is apparently self sufficient. However, protein needs are yet to be met adequately owing to heavy post harvest losses coupled with insufficient production of pulses – the main protein source for vegetarians and the poor. The estimated per capita availability of pulses is 24 g/day (Kulkarni, 1991) against the moderately recommended allowance of 45 g/day (ICMR, 1984). Loss of over 10 per cent edible portion during milling accounts for lowering the per capita availability of main protein source of the poor by 3 g/day. For proper processing, it is imperative to have knowledge of existing practices, mechanical and physical operations and the mechanisms and kinetics of the conversions that take place during processing and storage.

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Pulse Processing

In India, pulses are mostly converted into splits – commonly known as dal – and consumed in the from of gruel after cooking, as a complementary food to cereal. Pulse grains are first subjected to pretreatment followed by drying, dehusking in abrasive roller, pretreatment and splitting in attrition mill or under runner disc sheller. Milling losses (10-12%) divert the edible portion for uses other than for human food (Kulkarni, 1994). Careful study of the pulse processing industry and research work for reducing losses reveal a vast gap between what is being recommended and what is being followed. For gainful utilization of pulses, it is highly essential to minimize the gap between the theoretical dal yield and

dal yield obtained actually by the pulse processing industry. Unless the pulse processing industry of India works hand-in-hand with the research groups and machinery manufacturers for problem oriented projects as well as for adoption of new research findings, it is impossible to get effective outputs in terms of improved milling technologies and thereby added quantity of good quality edible portion for human consumption. A typical example can be given to the engineering properties of pulse grains which serve as a basic information in design of processing machinery and technologies. Information on engineering properties of pulses is scanty. Non-availability of necessary information normally leads to faulty design of processes, technologies and equipment. The usual approach of researchers has been to generate the data/information needed for the narrow range of moisture content and other grain conditions. Data thus generated either remains with the researchers or is published in various journals to which everyone doesn't have access. Engineers working in the field are thus deprived of the information and left with the choice of making assumptions arbitrarily. Such attempts further reduce the recovery of edible portion. To get the benefit of research for improved productivity, it is imperative to screen almost all the varieties of pulses grown in India for their engineering and related properties.

Non-availability of necessary information normally leads to faulty design of processes, technologies and equipment.

Some of the major aspects which need sincere research attempts, with the support of industry, have been put forth in the form of the following priorities, which take into account the prevailing factors.

Priorities for Research

* Determination of engineering properties of pulses for wide range of moisture content and varieties.
* Understanding the mechanics of dehusking and splitting of different pulses.
* Investigating the effect of interactions between machine, crop and environmental factors during milling.
* Finalization of time and energy efficient pretreatment preferably without use of edible oil.
* Establishment of drying characteristics for mechanical drying of pulses and development of drying systems for industrial applications in pulse processing.
* Identification of effect of gums and husk properties on dehusking characteristics.
* Identification of reasons for long cooking time of pulses and establishment of remedies/ solutions there of.
* Standardization of pulse milling machinery with regard to design and operational factors for low energy needs of different capacity plants.
* Design of efficient dehusker for low percentage of a mixture of whole grains and dehusked whole grains (gota).
* Screening of all pulse grain varieties and types for milling and cooking quality.
* Modification in conventional dal mill plants for reducing modernization costs.
* Development of a separator for effective separation of by-product fractions.
* Designing of packaging system for safe storage and handling of dal and pulses.

Pulse processing industry being involved in food raw material processing, it is equally important to take into account the less attended but more important functional and operational parameters and aspects. These can be briefly elaborated as operational priorities/ aspects.

Operational Priorities

Apart from the improvements needed for increasing dal out-turn, some other equally important aspects neglected at present by the processing industry can play a major role in providing the suitable environment needed for food industry. Pulse milling units being of varied capacities ranging from 1-100 q/day, a variety of approaches are followed by them. Though, these do not require/demand huge amount of money for proper upkeep and chanalization, they are normally neglected/ less attended by the industry. The following aspects therefore, need consideration:

Design of waste disposal systems: The waste in the form of dockage and dust amounts to about 3-5 per cent of the raw material and forms a big lot. In the absence of obligatory guidelines, proper waste disposal is rarely carried out. In the drying yard transfer by wind from the waste lot to the material under process deprives the consumer of clean dal.

Layout of the plant vis-a-vis labour and energy requirement: Most of the dal mills are equipped with a common shaft and flat belt-pulley system for power transmission from prime mover to the individual process machine. Apart from the power loss due to slippage, such arrangements need extra space for installation of plant machinery. Infact, proper plant layout may facilitate provision of independent prime mover for each machine thereby avoiding the operation of main (common) prime mover when only one machine is to be operated. Common shaft arrangement requires excessive energy for performing the milling operation. Labour requirement is also enhanced owing to scattered machine locations and more material handling needs. Appropriately designed plant layout coupled with a separate prime mover for individual machine can help in efficient utilization of energy and reducing labour requirements.

Worker's Safety: Unprotected/ uncovered flat belts or 'v' belts are generally common in conventional dal mills. It poses a danger to worker's safety and creates an environment of insecurity. Laborers exposed to such hazardous situation are neither adequately compensated nor assured of any compensatory insurance. Therefore, the safety arrangements in the mill, which do not add appreciably to the cost need to be made obligatory on the part of the processor.

Hygienic conditions in and around the plant: Periodical cleaning of the premises in and outside the plant is seldom a practice. It in turn gives leads to spoilage of grain lots in processing. Keeping dal free from dust, dirt and foreign matter should be carried out as a part of daily routine in pulse processing plants.

Preventive maintenance scheduling (PMS): Non-existence of preventive maintenance schedule is quite often seen in small and cottage scale industries including pulse milling/processing industry. It frequently disturbs the time-motion plans. Conventional pulse milling involves premilling treatment to grains involving 1-2 day duration. In the absence of PMS the grain lot which has received the premilling treatment is subjected to delayed processing owing to breakdowns thereby lowering the quantity and quality of end product. Preventive maintenance costs can be optimized by following the guidelines in Fig. 1.

Standardization of energy requirement: Studies of the energy use pattern in dal mills (Kulkarni, 1988) reveal inconsistent power ratings with plant capacity. The picture, which is not different today, is mainly because of the fact that the pulse milling machinery is manufactured in organised as well as unorganised groups. Energy requirement of such units is decided by

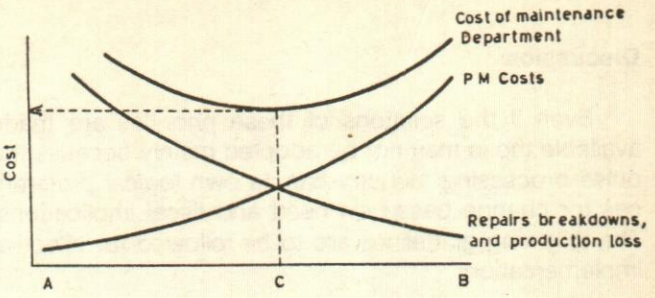

Fig. 1. Level of Maintenance through PMS (Preventive Maintenance Scheduling)

individuals without much experience of fabrication/ manufacture/commissioning of dal mills. Through screening of the pattern, identification of faulty prime mover- machine combination and rectification of these would pave the way for efficient energy use in pulse processing industry of India.

Functional Aspects

In addition to the operational priorities, some functional aspects also play an important role in regulating the wastage, energy use and availability of extra quantity of good quality dal for human consumption.

Design for lower transportation cost: Primary processing, if adopted in villages, has the potential of reducing transportation costs by 3-5 per cent by the way of removal of the dockage.

Small scale energy efficient pulse processing plants: Processing of pulses at village/town level to meet the local needs to dal may improve the job opportunities locally and help avoid the transportation costs owing to movement of raw material to cities and finished product back to rural areas for consumption.

Identification of a target areas: States like Madhya Pradesh, Maharashtra, Uttar Pradesh and Rajasthan which contribute to over 50 per cent of total pulse production should be identified for efforts in modernization of pulse processing industry and modifications in plants for improvements in dal recovery.

Efforts to avoid use of colours for dal polishing: Though the use of poisonous colours for dal polishing, has been drastically reduced by the efforts of law enforcing agencies, it is some times seen in practice. Use of colour is preferred by the processor to make the product attractive and appealing at the cost of

consumer's health. It therefore needs to be tackled strictly.

Discussion

Even if the solutions of these priorities are made available those may not be adopted mainly because the pulse processing industry has its own logical preferences for change based on need and fiscal implications. The following guidelines are to be followed for effective implementation:

* Industry should not be forced toward complete replacement of existing set-up.
* Change if any, should be through replacement of a few key components/ units in the existing dal mill set-ups.
* Premilling treatments should be less time consuming and independent of weather conditions at affordable cost.
* Value addition should be through less costly equipment with assurance of increased output.
* Space requirement of plant must be minimum.
* Only new entrepreneurs must be recommended the adoption of modern mill set-up in full with guarantee of dal yield claims.

To build-up confidence among the processors, it is imperative to adopt a compromising approach i.e. at first partial modifications in existing dal mill setups may be considered. Ultimately, the target should be to maximize dal yield with the cooperation of over 10000 pulse grain processors. To do this requires, a broad based strategy, never seriously tried before, namely a comprehensive approach that combines financial implications invoked in replacement or modifications in processing unit, proposed changes that not only consider reduction in losses but also take into account all possibilities and interactions in pulse processing, inculcating awareness of the importance of basic research in machine design pretreatment selection/ adoption to get positive results and ensuring the cooperation of processors and processing machinery manufacturers. There exist many research efforts which the pulse processing industry may not appreciate at their face value as being of great productivity importance to the industry itself. Pulse processing industry and machinery manufacturing groups being in unorganised sector, lack in collective efforts for improvement. Their respective associations must come closer to research groups for adoption of improved technologies for reducing the losses.

Respective associations must come closer to research groups for adoption of improved technologies for reducing the losses.

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Comparative Productivity Levels in APO Member Countries

NPC Research Division

The Asian Productivity Organisation has been compiling the comparative information on labour productivity levels in member countries since the last one decade or so. APO's compilation provides information on comparative labour productivity in member countries for the purpose of making evaluations and comparisons at regional, national and sectoral levels. The period covered is from 1985 to 1993. Data for this compilation are drawn from the Key Indicators of Developing Member Countries published by the Asian Development Bank (ADB) and the Annual Report on National Accounts, 1994, published by Economic Planning Agency, Government of Japan. For measurement purpose, labour productivity in this compilation has been defined as a simple ratio between output and input. In measuring labour productivity at the national level output is given by the Gross Domestic Products (GDP) of the country, whereas the input is measured by the total number of persons employed/engaged. Sectoral level gross domestic product has been used as output measure in the case of agriculture and manufacturing sectors. All output measurements have been in terms of current US dollars and 1985 constant US dollars. Member countries covered in the compilation are : Bangladesh, Republic of China, Fiji, Hong Kong, India, Indonesia, Japan Republic of Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka and Thailand. The Islamic Republic of Iran and Mongolia are not included because of the non-availability and incompatibility of data due to differences in definitions. In terms of economic sectors, this compilation undertaken is limited to labour productivity statistics of the respective national economies, as well as their agriculture and manufacturing sectors. This is basically similar to the same classification of labour figures as in the ADB's Key Indicators of Developing Member Countries.

The comparative labour productivity data thus available are given in Tables 1-6.

Table 1: Productivity Levels in Constant (1985) US dollars in APO member Countries – National Level

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	561	496	–	–	333	354	–	–	–
China, Republic of	8357	8961	9704	10298	10883	11380	11966	12469	13072
Fiji	12591	13816	13209	13603	13420	13918	13610	13899	13844
Hong Kong	12250	13403	15070	16114	16598	17381	17636	18519	–
India	755	801	825	885	881	908	–	–	–
Indonesia	1398	1353	1377	1417	1502	1581	1675	1714	1997
Japan	22917	23067	24074	25186	26114	26938	27277	27088	–
Korea, Republic of	6301	6785	7171	7740	7928	8432	8935	9214	9587
Malaysia	5547	5528	5559	5866	6190	6496	6812	7117	7451
Nepal	328	339	351	370	386	412	–	–	–
Pakistan	975	1033	1028	1084	1098	1115	1218	1261	1263
Philippines	1552	1543	1594	1647	1720	1713	1671	1615	1612
Singapore	14325	14829	15559	16436	17169	17517	18216	18679	20330
Sri Lanka	1132	–	–	–	–	1489	1519	1563	–
Thailand	1505	1542	1635	1741	1868	2068	2214	2286	–

Table 2: Productivity Levels in Constant (1985) US dollars in APO member Countries – Agriculture

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	364	358	–	–	190	204	–	–	–
China, Republic of	2767	2915	3373	3771	4125	3655	3415	3562	3939
Fiji	72473	106232	119518	102985	108849	–	–	–	–
Hong Kong	3973	4154	3936	5098	4488	6282	5719	5293	–
India	355	362	371	413	405	431	–	–	–
Indonesia	594	595	584	611	626	610	609	612	702
Japan	6489	6521	6834	6733	7059	7185	6853	7182	–
Korea, Republic of	3155	3206	3321	3825	3918	4125	4103	4269	4577
Malaysia	–	–	–	–	–	–	–	–	–
Nepal	211	216	220	238	256	274	–	–	–
Pakistan	550	528	548	551	578	567	659	686	655
Philippines	779	761	813	841	873	848	842	809	801
Singapore	14761	11853	9669	15559	14529	13431	18248	14762	18010
Sri Lanka	560	–	–	–	–	715	809	711	–
Thailand	348	362	400	425	422	412	464	447	–

Table 3: Productivity Levels in Constant (1985) US dollars in APO member Countries – Manufacturing

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	531	490	–	–	235	111	–	–	–
China, Republic of	9378	10523	10936	11279	11410	12233	13371	13670	14562
Fiji	6862	8135	8931	7191	6323	–	–	–	–
Hong Kong	7404	8512	9548	10176	10530	10790	10219	10322	–
India	1222	1303	1377	1511	1584	1681	–	–	–
Indonesia	2408	2760	2824	3166	2727	3189	3367	3535	4195
Japan	26853	26267	28545	30556	32338	34277	35324	34227	–
Korea, Republic of	7899	8458	8330	8968	8894	9148	9590	10161	10883
Malaysia	–	–	–	–	–	–	–	–	–
Nepal	1783	1850	1642	1602	1291	1287	–	–	
Pakistan	1135	1278	1223	1432	1440	1531	1743	1784	1775
Philippines	4024	4133	4035	4066	4191	4517	4116	3797	3969
Singapore	13294	14739	15650	16517	17012	17833	18453	18732	20817
Sri Lanka	1487	–	–	–	–	1822	1928	2161	–
Thailand	4126	4749	4485	5357	5521	5529	5630	5830	–

Table 4: Productivity Levels in current US dollars in APO member Countries – National Level

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	561	501	–	–	408	425	–	–	–
China, Republic of	8357	9758	12658	15087	17786	18954	20788	23932	24401
Fiji	12591	14659	13672	12924	12702	13747	14429	14761	15143
Hong Kong	12250	13771	16667	19397	22364	25434	28591	33177	–
India	755	808	872	949	906	938	–	–	–
Indonesia	1398	1172	1079	1162	1286	1399	1526	1636	1776
Japan	22917	33481	40538	48028	47068	47122	51322	56323	–
Korea, Republic of	6301	7005	8335	10790	12686	14065	15836	16276	17228
Malaysia	5547	4860	5281	5618	5924	6405	6802	8116	8791
Nepal	328	317	361	386	373	400	–	–	–
Pakistan	975	1021	1017	1134	1094	1119	1260	1363	1333
Philippines	1552	1450	1596	1762	1948	1959	1971	2215	2212
Singapore	14325	14615	15979	18638	21135	24569	27741	30804	29788
Sri Lanka	1132	–	–	–	–	1603	1758	1868	–
Thailand	1505	1619	1837	2107	2360	2777	3154	3403	–

Table 5: Productivity Levels in current US dollars in APO member Countries – Agriculture

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	364	354	–	–	233	236	–	–	–
China, Republic of	2767	3175	4400	5524	6742	6088	5933	6836	7352
Fiji	72473	112716	123699	97847	103025	–	–	–	–
Hong Kong	3973	4268	4354	6136	6047	9192	9272	9482	–
India	355	365	392	443	416	445	–	–	–
Indonesia	594	515	457	501	536	540	554	585	624
Japan	6489	9201	10661	12231	11973	12033	13014	14039	–
Korea, Republic of	3155	3310	3860	5332	6270	6880	7273	7540	8226
Malaysia	–	–	–	–	–	–	–	–	–
Nepal	211	202	227	248	247	266	–	–	–
Pakistan	550	522	542	577	576	568	682	742	691
Philippines	779	695	802	877	981	953	916	1064	1047
Singapore	14761	11229	9561	16854	16237	16239	23935	20970	22204
Sri Lanka	560	–	–	–	–	770	937	850	–
Thailand	348	380	450	514	534	553	661	665	–

Table 6: Productivity Levels in current US dollars in APO member Countries – Manufacturing

	1985	1986	1987	1988	1989	1990	1991	1992	1993
Bangladesh	531	478	–	–	247	117	–	–	–
China, Republic of	9378	11459	14265	16523	18647	20375	23228	26237	27181
Fiji	6862	8631	9244	6832	5984	–	–	–	–
Hong Kong	7404	8745	10560	12248	14189	15790	16567	18491	–
India	1222	1315	1454	1619	1629	1738	–	–	–
Indonesia	2408	2390	2212	2597	2335	2824	3068	3375	3731
Japan	26853	38856	47283	56167	54877	55549	60232	63766	–
Korea, Republic of	7899	8732	9683	12502	14232	15260	16997	17949	19557
Malaysia	–	–	–	–	–	–	–	–	–
Nepal	1783	1730	1689	1674	1246	1247	–	–	–
Pakistan	1135	1263	1209	1499	1435	1535	1803	1928	1873
Philippines	4024	3862	4005	4338	4608	5029	4808	5031	5251
Singapore	13294	15237	16935	19618	21633	25568	28774	31263	30442
Sri Lanka	1487	–	–	–	–	1962	2232	2583	–
Thailand	4126	4988	5038	6482	6977	7425	8017	8677	–

Hazardous Waste Generation in India – Jammu & Kashmir State

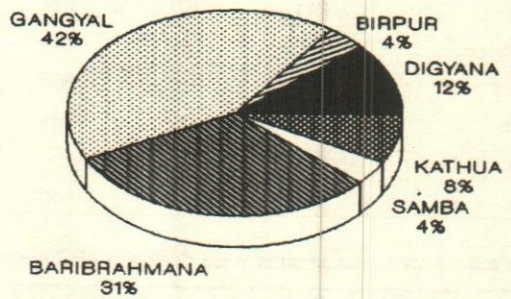
NPC Environment Division

One of the major consequences of industrial development is the generation of wastes which may be hazardous in nature depending upon the type of raw materials used in processing and the type of product produced. The treatment of industrial effluent and emissions may also lead to generation of hazardous solid wastes. Such wastes have to be managed in a scientific manner in order to protect the environment. Realising the importance of the matter, Ministry of Environment and Forests, (Government of India) has promulgated Hazardous Wastes (Management & Handling) Rules in 1989.

For the effective implementation of these rules in any region, an inventory of hazardous waste generation has to be prepared followed by quantification and characterisation. For safe disposal of hazardous wastes, Environmental Impact Assessment Studies have to be carried out for landfill sites identification. The site has to be designed, constructed, operated and managed scientifically in order to avoid indiscriminate disposal of hazardous wastes. Keeping this in view, the Central Pollution Control Board (CPCB) entrusted the Environment Division of National Productivity Council (NPC) to carry out a survey in major industrial estates of industrialised districts of Jammu and Kashmir state.

Hazardous Waste Generating Sectors

As per the information gathered from various agencies, it was observed that the major industries are centered in Jammu and Kathua Districts of Jammu province, therefore, the inventorisation of hazardous waste generation is restricted to Jammu province only in J & K State. The predominant industrial sectors in selected districts and industrial estates are Engineering followed by Chemicals and Textiles, according to the discussions with various Industries Associations and J & K State Industrial Development Corporation (SIDCO) and Small Scale



100% = 26 numbers

Fig. 1: Industrial Estate-wise Distribution of Hazardous Waste Generation Units in J & K.

Industries Development Cooperation (SICOP). There are a total of 404 operating units in Jammu province. Out of these, only 26 units generate hazardous waste. The industrial estate-wise distribution of Hazardous waste generating units in Jammu and Kathua Districts is shown in Figure 1.

Based on the type of raw materials used, products manufactured and production technologies, the following have been identified as Hazardous Waste generating sectors:

1. Textile Processing
2. Drugs & Pharmaceuticals
3. Pesticides Formulations
4. Paints Formulations
5. Vanaspati
6. Lead Acid Battery
7. Organic Chemicals (LABS)
8. Brass Alloy Pickling
9. Resins and Terpenes

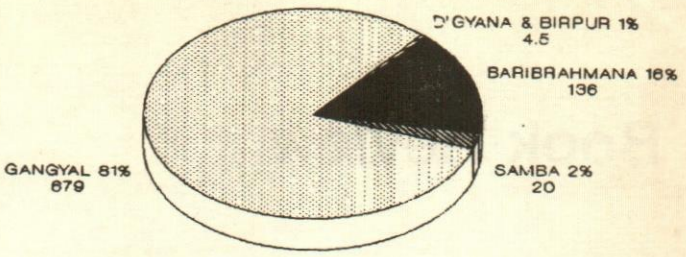
Inventorisation of Hazardous Waste Generation

Based on the survey conducted in the selected districts, an inventory of hazardous wastes generation has been prepared. It has been estimated that approximately 840 tons per year of hazardous waste is generated by the 26 units in 7 industrial estates of Jammu province. The major contribution of hazardous waste generation is 81% in Gangyal Industrial Estate followed by 16% in Baribrahamana Industrial Estate as shown in Figure 2.

The Industrial Sector-wise Hazardous waste generation in the surveyed districts is presented in table 1.

Inventory of Hazardous Waste Generation in Jammu Province

The total quantity of hazardous wastes generated in all the seven industrial estates of Jammu province, from 26 hazardous generating units, has been computed to be about 840 TPA. The contribution of hazardous waste generation in Gangyal and Baribrahamana has been estimated to be 81% and 16% respectively. The remaining 3% hazardous waste is being generated from Digyana, Birpur, Aknour, Samba and Kathua industrial estates of Jammu province.



100% = 840 TPA

Fig. 2: Industrial Estate-wise Contribution of Hazardous Waste Generation in J & K

Table 1: Industrial Sector-wise Hazardous Waste Generation in Jammu province

Sl. No.	Industrial Sectors	No. of Units	Type of Waste	Qty. (TPA)
1.	Textile Processing	2	ETP Sludge	54*
2.	Pharmaceuticals	6	Off-Spec. Prod.	1.9
	– Paracetamol	1	– Iron Sludge	20
			– Spent Carbon	0.15
	– Antimetic Drugs	1	– Spent Carbon	0.60
			– Spent Alumina	1.20
			– Process Res.	0.10
3.	Pesticides Formulation	2	Discarded empty Containers	4
4.	Organic Chemicals (Linear Alkyl Benzene Sulphonate-LABS)	1	Spent Acid Slurry	600
5.	Lead Acid Battery	2	– Slag Contaminated with Pb	15
			– Spent H_2SO_4	18
6.	Brass Alloy Pickling	1	ETP Sludge with Cu & Zn Hydroxide	0.2*
7.	Paints and Varnish	3	Discarded Empty Containers	1
8.	Vanaspati	3	– Spent Ni catalyst	10
			Spent Bleach earth	34
9.	Rosins and Terpenes	4	Tarry Waste	132
	Total	26		837.95

(*) : Estimated

Compiled by
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Book Review

***Privatisation in the Third World* by R. Mandal, Vikas Publishing House, New Delhi, 1994, pp.183 Rs. 250.**

The present book explains that privatisation has been inducted by developed countries as a strategy to infuse competition led efficiency, and has resulted in three-fold benefits: generation of resources, reduction of losses in loss making enterprises, and reduced need for further investment. The book has eight chapters besides the appendices on 'The Report of the C. Rangarajan Committee on Disinvestment of Shares in Public sector Enterprises' and the 'Discussion Paper on Economic Reform: Two Years after The Task Ahead'. There is a brief description of privatisation in developed and developing countries and main features of measures initiated towards liberalisation. Privatisation in Britain is reported to have earned sizable revenue, set the competition in motion, sustained the industries and benefited the public from the purchase of shares. France is reportedly the most successful country in the world in privatising water supply and sewerage treatment facilities as also the best in waste disposal.

The author elaborates on the diverse modes and techniques of privatisation. Management/Employee buy out, a technique of privatisation is described as a 'relatively new' and 'a noble method' of privatisation. Lease and Management contract are the other methods of privatisation. Boot, Affirmage, Gerance, Ancillary operations are schemes involving the private sector. Boot has been described as the appropriate method of privatisation for the development of infrastructure.

The author while arguing that privatisation, in one form or other, may be the answer to the problems faced by the developing countries states that "The situations under which the developed countries were forced to resort to privatisation exist in developing countries in general and in India in particular. It will therefore be relevant for them to go in for privatisation for faster recovery of the economy" The study concludes that "privatisation is the need of the hour and by no means it is a sell out. If anything, it can be a boon in the long-run".

The capital market is not only in its infancy in india, it is also generally confined to the urbanised sector with heavy concentration in the capital cities and with a very insignificant percentage of population.This base needs to be widened through education and training. The study also suggests that public sector units "need an aggressive marketing strategy to educate people about the organisation, their performance, and potential so as to have an encouraging response to their issue of shares".

At times, there are intriguing statements. Discussing privatisation in developing countries, the first chapter reads that "India has been lagging far behind in this respect although the only hope is the announcement made by the present government....", while Chapter seven on achievements of reforms. states that "steps taken towards liberalisation in India compare favourably with the other countries and in fact in some areas India is somewhat more liberal than others." Arguing for privatisation that it helps government in getting rid of inefficient, unproductive, loss making enterprises and reduce their burden of making further investment, the study reads, "the capitalism started spreading amongst the people at large and the poor became better off, whereas the rich who were denied large share allocations were not benefited from privatisation in equal measure". On the other hand, referring to the fear of concentration of wealth and income, it is stated that, "a handful of private companies will corner the market and exert a monopolistic approach. This may defeat the very basic objective of privatisation. Wealth concentration will result in income concentration and therefore will benefit the well-to-do and managerial group of people in the higher income group resulting in income skewness".

Referring to the disinvestment in U.K. the statement that the "proceeds from such disposals accrued to the Government and earnings from the sale of the sub-

sidiaries and assets of the holding companies were retained with concerned companies", is not easy to comprehend. On the whole the book is a simple digest on privatisation concept and experiences and contains valuable references for the serious readers.

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***Research & Development in Indian Industry* by G. C. Beri, Concept Publishing Company, New Delhi, 1993, pp 128, Rs. 150.**

In the context of modern societies aspiring for technological advancement of its applications for achieving progressive economic development. The importance of Research and Development (R&D), is well recognised. Close look at the developed economies all over the world suggests a positive relationship between their vigorous R&D drive and the level of development achieved. In contrast and. notwithstanding an explicit Technology Policy (1983) supporting promotional efforts for R&D as well as the recent growth in R&D activities in the Industry sector, the Indian achievements in R&D are yet to be visible. In this perspective and at a time when India is poised for a rapid industrial growth in the wake of the economic reforms. attempts to examine the state of affairs in R&D in industries, therefore, become very relevant. Govind Chand Beri's book under review is indeed a very timely and well-researched original contribution on the subject of R&D in Indian industries. Comprehensive in coverage and based on analyses of relevant primary and secondary information, the book presents a critical assessment of the state of recent industrial R&D activities in India within the framework of the nature and trends in the industry initiatives, institutional collaborative supports and the overall R&D policy directions.

The book begins with a discussion on the conceptual basis and the intricately linked process aspects of 'research' development' and 'technological change' in addressing the objectives of economic performance. This is followed by a recent trend analysis of the R&D activities in India based primarily on the available statistics of R&D expenditures in all sectors including industry. The findings indicate that both on its own strength and internationally compared, the total R&D activities in India seen at a macro-context are yet too insignificant to be able to contribute meaningfully to technological change and economic development. Again, although R&D in industry accounts for about one-fourth of all R&D expenditure, a declining trend in this share is noted during the decade of 80s.

Within this scenario, however, some encouraging performance in R&D has been noted by the author in a few selected Indian industries with in-house R&D units, as revealed through 5 case studies. An attempt for generalisation points to some critical factors that have contributed to the success of R&D efforts in these industries. It is noted at the same time that industry hardly undertakes any basic and fundamental research. The author then probes (through a mailed Opinion Survey) into the perception of industrial R&D managers about several important factors conditioning the current in-house industrial R&D activities in India. Although the sample size has been rather small due to non-response of several addressees, the generalised findings related to the use and application of several facilitating, procedural and management factors in the in-house R&D activities in Indian industries are not so discouraging.

The importance of Institutional collaborations is recognised and the current status in this realm in India is examined. There are wide varieties of R&D organisations and laboratories in the country supported by the Central and the State Ministries and Departments as well as those supported by specific industry associations. Also, there are the IITs. universities and the National Research Development Council (NRDC). The assessment, however, brings out that there is much to be achieved yet in this realm of institutional collaborations in R&D activities in India, particularly in directing the institutional R&D thrusts to respond to the needs of the industry. The technology policy of the government also does not appear to be very sensitive to the need of promoting and sustaining a vigorous industrial R&D climate in India. On the contrary, it is generally considered to be restrictive in nature thereby precipitating technological obsolescence. There is also a recognisable absence of integration in the technology policy and the industrial policy of the government. Equally deficient is the current direction and the coverage of the R&D statistics in India which in no way can be considered useful for a proper assessment of the R&D activities in all the critical facets and, for providing meaningful directions in planning for relevant R&D. The final section of the book presents the conclusions emerging from the research. The author offers several useful suggestions for consideration of the government and the industry in promoting and pursing more vigorous and well-directed R&D activities. particularly in the context of the changing business environment.

Notwithstanding the limitations of the related data and information (which the author himself also admits)

and, the reluctance of several industries to respond to the survey conducted by the study, the concern for Research and Development in Indian Industry has indeed been positioned very objectively by Dr. Beri. In the context of very few empirical work on the subject in India, Dr. Beri's work is, therefore commendable. While the policy-makers and the direction-setters in the government should take cognizance of the findings in the book for promoting the desirable R&D thrust, the industry can certainly derive immediate benefits from several of the suggestions in making their in-house R&D efforts purposive.

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***Managing Irrigation Together : Practices and Policy in India*. Clarence Maloney and K.V. Raju, Sage Publications New Delhi, 1994, pp. 334, Rs. 325.**

Water use efficiency is essential for increasing food production and for the sustainable and equitable distribution of the water-resource itself. The nature of irrigation system in India involving large number of claimants, the basic question is, how to organise people for use-efficiency, equity and sustainability of the water resource at local levels. This book explores several alternative ways in which all the claimants of the water could be organised (themselves) in order to manage the irrigation system. Contents of the book are divided into 15 chapters, each of which deals with different issues concerning irrigation management. Detailed exposition of concepts, problems, failures and also success stories on water management both in india and outside has been presented in the book.

Experiences with regard to successful management of traditional irrigation systems by local people have now become part of history. However in some cases, due to unforeseen factors, and due to policies of colonial government in others, the local institutions disappeared and the users' involvement gradually tapered off. In India during 1950's, management of tank and surface irrigation was handed over to the irrigation department. This was the beginning, wherein more importance was given to the technology. rather than the socio-economic concerns at the grassroots (users/ farmers) level.

According to this book, it is a misconception that farmers are beneficiaries, instead it is argued that they should be viewed as the clients to whom the irrigation agencies deliver the product (water) and to whom they are accountable. Further, the authors continue their exposition on the concepts such as: Farmers participation (1980's), Farmers organisation (later half of 1980's) and farmers management and turn-over (latest 1991), This brings out various common terminologies used viz, farmers organisation (Sri Lanka), Water user associations (Pakistan and South East Asia), Water association or water user group (Nepal), Water districts (Mexico. Brazil and USA) and water management associations (India). Basically the form and the complexity of organisation should have the following characteristics, viz. developed spontaneously, structured, authoritative and responsible, to support, implement and raise funds to manage its affairs. Given the background, the authors enumerate various principles governing an organisation for managing water, which could be considered as a model for spontaneous development of the water management organisations (WAM).

The colonial irrigation administration still persists in indian irrigation system even after 45 years of independence. viz., centralised administration, control by engineers, non-recognition of local land community water rights and sharing of water by land area and crop (not the rational way). The book documents the traditionally developed and maintained irrigation systems viz,. Kuhals of Himachal Pradesh, Phads of Maharashtra Hydraulic civilization (Indus Egyptian etc. Kaveri canal system and Vijayanagara channel. Have these institutions survived for a long time? What was the role played by the users? What was the role of the state/king? Who was accountable to whom? These are some of the issues which the authors have looked into in this book. The authors also give an insight into government take-over of community management (Tamil Nadu), British policy in India and the Panchayats Act. Further, they probe into the concept of decentralization of powers as practised today and the importance of reviving the age-old institutions which were set up for community management of water resource.

In the context of the changing development scenario, the irrigation system should be looked at more as a social and organisational system than as purely a technological system. However, for quite some time it has been organised and managed as a technological system. Hence the approach has been top-down planning and implementation of the project with no involvement of the local and actual clients. The authors plead that this system should be changed and all the planning and implemention decisions should be bottom up, through the involvement of farmers at local levels.

The book also identifies the importance of rural participatory appraisal (PRA) techniques for catalyzing people's own assessment, planning and implementation. The authors also recommend a few techniques of PRA that have been used for tank rehabilitation, irrigation, watershed management, forestry, environmental management and agriculture besides health, family planning etc. The authors emphasize the importance of people's initiative, economic autonomy of WMA and reorganisation of the irrigation agencies by reallocation of budgets and personnel.

This is rather a right step towards the decentralization of irrigation system and involving people into policy planning and implementation at doorstep (bottom-up) It gives more freedom to the actual users/clients to decide about the use and maintenance of irrigation system. This would reduce the burden on the part of the state/nation in terms of establishment cost of the complex system. However, the operationalisation of the concept of WMA is only dependent on farmer's acceptance to forego huge subsidies in the irrigation which is also guided by political and administrative will to accept WMA as a node.

This book is a valuable addition to the literature on the subject of managing irrigation system and the authors deserve encomiums for producing such a useful work for the benefit of students, social scientists and irrigation administrators of our country.

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The Indian Economy, 1947-1992, Volume I, Agriculture **by V.M. Dandekar, New Delhi, Sage Publications, 1994, pp. 405, Rs. 350.**

The volume under review presents a lucid picture of the present agricultural scenario in the country. The book consists of six chapters. It discusses the issue of transforming traditional agriculture into a commercially viable proposition. The author describes the problems faced by Indian agriculturists today. He reveals that the majority of people engaged in agriculture strive towards increasing net capital consumption rather than net capital creation. To overcome the problems faced by Indian agriculture, he stresses the need for an upward shift in the ceilings of land holdings and lease market in land. Further, he advocates that surplus population can be withdrawn from agriculture and recommends capital flow from other sectors to agriculture to speed up transformation.

The book traces the development of agricultural research from First to the Seventh Five Year Plan. The author stresses the need for an enlightened adult education oriented programme to promote the necessary scientific attitude among farmers. Further, he recommends creation of facilities and opportunities for technically and scientifically oriented personnel to perform their functions.

The importance of food security is brought out through an account of food administration from 1951 to 1990. The author puts forward a proposal to integrate the whole Indian foodgrain marketing into a single market whereby prices will be determined by competitive market forces. The author expresses dissatisfaction over the functioning of fair price shops. Increasing corruption and misuse of fair price shops are the ongoing problems. He recommends that it is better to increase wages and income levels rather than keeping people poor and subsidising basic needs. Those readers who might not have time to read the book, could read the chapter on "Agricultural Marketing and Prices" as it gives a new direction to the Indian marketing system.

The author advocates reorganisation of rural credit markets. Increasing state control over cooperatives leads to the loss of their democratic character. He recommends that the entire operation of credit cooperatives must be decentralised. He also suggests that concessional credit to non viable sectors should be gradually phased out. The author finally formulates a future agricultural policy considering several aspects like new agricultural technology, domestic fiscal problems and external balance of trade. The book in its present form fulfils a long felt need of agricultural economists and the author deserves commendation for formulating a new agricultural policy needed to lead the nation into the 21st century.

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Fixed Assets Re-Valuation Practices **by Nand Dhameja, Manas Publications, New Delhi, 1993, pp. 151, Rs 150.**

The issue of re-valuation of fixed assets assumes special importance, when it is linked with financial implications and flow of financial information rather than used as a simple accounting practice to represent the true worth of assets at current market price in the balance sheet. Because of its financial implications, different views exist on dealing with the subject.

The study covers the accounting practices associated with fixed assets, revaluation, its financial implications in terms of debt-equity, tax-liability, income measurement and capital maintenance. Based on critical reviews and coverage of the study, analysis of information and data, and its presentation, Professor Dhameja deserves appreciation for undertaking this research work and contributing to the existing literature of Accounting Practices followed in India and abroad. The book will help persons interested in knowing the pattern and magnitude of revaluation of fixed assets, basis of revaluation, its disclosures among indian companies and financial implications.

The presentation of the book has been made in two parts. Part one covers four chapters, After introduction of the subject, the book deals with interpretations of currant values with reference to economic value, net realisable value, replacement cost or value to the business in terms of combinations of all the three or any two. It also explains in detail with illustrations various approaches of valuation mechanism – permanent revaluation reserve method and depreciation – split method, the former showing the excess of revalued amount over the original cost with its applications. The conceptual understanding has been supplemented with professional and legal view points. The task of the readers would have been made more easy in the context of clarity and continuity of thoughts, had the author presented another table (as given in 3.2 for various Acts) summarising the views of various contributors on the literature. However, the author has presented in detail the views of International accounting standards. In addition, the legal requirements as per Indian Companies Act and Income Tax Act (Section 115) for valuation of shares of business in case of the transfer or takeover has been covered. The discussion relating to Section 115 of Income Tax Act is more theoretical as it was introduced by Finance Act of 1987 and deleted by the Finance Act 1990. However the author has made an attempt to explain how revaluation has been used us a strategy to reduce tax liability under Sec 115.

The second part of the book presents the Indian scenario in four chapters. The intensive study has been carried out covering 90 joint stock companies as sample. As the companies are of different sizes and are drawn from various industries, a note on the methodology of selection of the samples as an annexure was desirable. These chapters present useful information on practices followed in India by the corporate sector with reference to the pattern and trend of revaluation. Types of assets revalued and size of revaluations. The outstanding contribution of the author is to supplement this with detailed analytical presentation with the help of a few typical cases highlighting the special features. A similar approach has been adopted to deal with the financial implications of revaluations in terms of debt-equity structure and tax liability.

This volume is a useful contribution and can be used as good reference material by researchers and academicians and is therefore recommended for libraries.

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Multinational Enterprises and Industrial Organization: The Case of India **by Nagesh Kumar, Sage Publications, 1994, pp. 203, Rs. 230.**

The book is an attempt to assess the role of multinational enterprises in the context of the ongoing economic reforms in India. This book is really a thesis in hardcover. It is an updated version of a study first published under the title 'Multinational Enterprises in India: Industrial Distribution, Characteristics and Performance' (1990) which incorporated the author's doctoral dissertation. The book is a commendable piece of in-situ research.

The present study analyses the industrial distribution, distinguishing characteristics and relative performance of multinational enterprises (MNEs) in Indian manufacturing. The book is divided into eight parts. The first part provides a brief overview of the evolution of the government policy towards foreign direct investment (FDI) and its impact on the trends and patterns of FDI. The study finds that the government policy towards foreign collaborations has been marked by a selective attitude throughout most of the post-Independence period with significant variations in intensity over time. Then the author deals with the economic significance of foreign controlled enterprices (FCEs) in the Indian manufacturing sector and reviews the existing estimates of the economic significance of FCEs in India and presents their shares in 54 three-digit manufacturing industries. This part has examined the place of FCEs in Indian industry in terms of their shares in industry sales, assets and profits.

The author analyses the determinants of inter-industry distribution of foreign shares. The determinants of variations in shares of FCEs in sales across 49 manufacturing industries in India has been analysed. The empirical results suggest that FDI has concentrated in those branches of manufacturing which are characterized by a

high degree of product differentiation and in branches that are intensive in the use of idiosyncratic knowledge. The R & D intensity of local industry has been found inversely related to intensity of FDI but positively related to that of licensing. FDI is also found to have concentrated in import-competing sectors.

The distinctive characteristics of FCEs are discussed with the reasons for expecting differences between FCEs and their local counterparts in terms of different aspects of conduct and performance. The results show that there are five major differences between foreign and local enterprises. These are: the scale of operation, the profit margins, the proportion of employees in high income categories, the degree of vertical integration, and liquidity ratio.

The determinants of profit margins of FCEs and local firms (LCEs) in 43 Indian manufacturing industries are analysed to seek explanations for the superior performance of the former. The findings support the proposition that FCEs and LCEs belong to different stratigic groups in an industry and that the former are more protected by the entry barriers than their local counterparts. The determinants of export performance of FCEs and LCEs in 43 Indian industries are then analysed to find out whether FCEs help the country to export products which would not have been exported in their absence. However, no statistically significant difference is found through study either in export performance or industry characteristics of exports of FCEs and their local counterparts in Indian manufacturing.

The author summarizes the major findings of the study and their implications for further research and indicates their policy applications. He comments upon the new foreign investment policy in the light of the empirical findings of the study as well as other recent findings. The study concludes that the recent liberalisation has brought about a considerable change in the posture of the government towards FDIs from one of passive approver of the proposals to an active seeker.

The book suggests that in the present scenario, the imperative for India is to focus on attracting a greater magnitude of export oriented FDI rather than trying to maximise the overall volume of FDI inflows. As there is intense competition among developing countries to attract export-oriented FDI, India should use her advantages over her competitors (such as low cost, trained manpower and large domestic market) more effectively to attract export oriented FDI. Further it emphasises the need to enter into a preferential trading arrangement in atleast one of the triad markets. Finally, the author recommends a professional approach to the promotion of export oriented FDI.

The book would be an interesting reading for policy-makers, industrialists and scholars in the fields of international economics, development-economics, industrial organisations and business studies.

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Beyond Management **by U. Pareek, Oxford & IBH, New Delhi, 1994, pp. 435, Price Rs. 350.**

As indicated by the publishers, this second edition is an enlarged version of the original book with the same title. It is a collection of essays that revolve round the theme of institution building as different form managing organizations. About one third of this second edition is drawn from the earlier one and is presented in six parts with other additions. The concept of Institution Building (IB) is depicted as a wheel needed by the organizations to ride on the uncertain, uncharted terrain of the present day. The distinction between 'Management' and Institution Building' is founded on the premise that management has primary concern on efficiency i.e. accomplishing tasks with minimum resources and Institution Building is concerned with continued growth and development and its impact on a segment of the society.

Part I of the book consists of five papers from the earlier edition dealing with the concept of the wheel of Institution Building and the process of movement from organization maintenance to building institution. The shift includes movement :

- From measuring performance of its profit and output to evaluating its ability to move towards the goals that it has set.
- From uniformity of practices to emphasis on explorations into various directions without inhibitions.
- From preparing detailed plans and achieving the results to an approach of experimentation and plans built around successful experiences and people
- From centralism—decision at top to involvement of people from grass root level to plan and execute

- From control by owners and too much involvement to dispossession by owners – i.e. personal responsibility is taken for all actions but is not perceived as ownership.

This shift presumes certain reorientation of values and management processes. The author describes this as the movement form elitism to populism whereby growth of all concerned is emphasized. In this framework, the focus moves from the organization to the society at large, and from few individuals in the organization to all at various levels. The processes highlight the importance of involvement of all concerned in deciding the goals and the emphasis on creative thinking and problem solving.

Another paper spells out the propositions for institution building relating to goals, people structure, leaders and culture. The interview with Ravi Matthai in a way reiterates the concepts covered in part I with special relevance to his experience in institution building at IIM, Ahemadabad,

The second part titled 'self' the fulcrum (of the wheel) is a collection of papers dealing with the importance of self- awareness and self-correction. Since the foundation of institution building is on involvement of all concerned, the motivation and development of each member are of vital importance. The three dimensions about self-development emphasized through examples and experiences are openness, perceptiveness and communication. Though not directly related to institution building, the examples drawn from health, poverty and deprivation are successful in highlighting the relevance of developing self reviewing capabilities. The extrapolation of the idea required here is that if individuals or a group of individuals in these cases have achieved self-renewal, the same can be done by an organization. The enlightened and reflective executives are expected to see this relevance, even though the chapters *per se* are highly conceptual. Since these papers are merely reproduced, they do not explicitly talk about the extension of this logic.

The second fundamental shift in the paradigm from organization to institution is the focus on process work within an organization. Pareek very aptly has depicted this as the spokes of the wheel without which the wheel cannot maintain its identity as well as functioning. Part III summarizes the application of behavioural sciences in India since 60's. The chapters pose thought provoking questions to academia with respect to the application and relevance of behavioural sciences, specifically psychology.

Part IV deals with providing 'The Energy' for this wheel and focuses on the most obvious action strategies for the executives who are convinced about the movement towards institution building. This part of the book covers basic concepts about power bases and the effectiveness of sharing power. This is visualized as the key strategy to make the individuals and organisations more powerful to move on. The papers clarify the myths related to decentralization and delegation suggesting them to be effective empowering strategies. The vitality of the leader in the process of providing the power to the wheel by sharing the "traditional" power resting in him is convincingly established.

As conceptualised by the author, the ultimate aim of institution building is to influence the larger society. The various papers included in the part V of the book deal with how the organisations need to become continuous learning organisations, through their success and failure experiences; how they need to plan for innovations and interventions and what processes can be introduced to achieve this within the organisations. While highligting these aspects, the author has covered a number of concepts related to education and work. The last paper in this part comprehensively illustrates the HRD processes and systems with examples from industries. Two papers independently deal with the 'mid wifery' role of intellectuals in the transition of India and the role of institutions in changing the community around.

Besides making references to the cultural context in earlier chapters, the author had devoted a full section to deal with this aspect which he has titled as 'The Rim' of the wheel. Since the institutions are to influence its environment, what exists there and what is the development in this environment form the outer boundary of this wheel. In this part, the author has elaborated on the three important dimensions of development, namely, generation of resources, equity in sharing these resources and an emphatic commitment to human dignity. He further argues, that few aspects of societal culture could be disfunctional and therefore need to be changed. He addresses the dilemma whether societal culture should prevail in the organisational culture. His answer to this comes in the form of the desired OCTAPACE culture in the organisation. In this opinion, to build such a culture, some modifications may be required in the Indian culture. He has illustratively highlighted the strengths of the Indian culture with reference to accepting pluralism. In this context, he explains the concept of synergetic pluralism which can be obtained by adequate emphasis on accepting different identities, providing equal status to all these and ultimately providing a superordinate goal. According to the author, this would be possible by moving from the traditional Indian concept of self- realization which is abstract to self-realization which is concrete i.e. the per-

son, his feelings, emotions, relationships, prejudices etc. The last two chapters are reflective thoughts about the role of behavioural science and the author's own process of learning and change in style.

A few general observations can be made. Most of the papers are reproduced or modified versions of papers published in late seventies; however, since they deal with some basic concepts, their relevance is not lost. Secondly, since these papers have been published for various Conferences of target groups there is a substantial over lap of ideas among the papers in a given sub-section. For a serious reader this overlap would help in clarifying issues and concepts but a general reader may find them to be repetitive. Eventhough the majority of the papers directly relate to educational institution building, it is implied that any organisation could move towards being an institution. The enlightened reader will have to make conscious efforts to see these implications. To learn lessons it has to be given a serious reading.

The second edition thus is a comprehensive, in depth reading for the academic community as well as the executives. For academics it poses a challenge to develop applications of concepts and for the executives it challenges to implement ideas that are convincing and conceptually sound. Both ways it would mean giving momentum to the wheel.

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