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Special Report

Economic Reforms in India & Competitiveness

S.S. Sharma & N.K. Nair

Coinciding with the introduction of economic reforms in several countries in Asia, Eastern Europe and Latin America, systematic efforts were undertaken to measure the international competitiveness rankings of important economies by reputed organisations. According to the latest reports of both WEF and IMD for the year 1999, India still continues to remain firmly stuck near the bottom of the list, in the company of virtually unknown and failing economies. While policy initiatives at the governmental are certainly needed to improve India's competitiveness, perhaps, what is more urgently needed is to effect micro level economic changes, which sharply brings into focus the immediate role of company managements, argues the paper.

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One of the distinct characteristics of the nineties is the shift in the economic growth paradigm from comparative advantage to competitive advantage. The essential difference between the two is that where as the former is derived from the resource endowment of the economy and is therefore external to the policy system, the latter is factor performance and technology driven and, thus, is alterable through policy changes and managerial action (Porter, 1990). With the successful conclusion of the Uruguay Round of negotiations which marked the commencement of WTO regime of international trade relations and following the collapse of erstwhile Soviet block (including eastern Europe), there was hope in the air that the transition from comparative advantage paradigm to that based on competitive advantage would be shorter and smoother. These hopes were reinforced by the remarkable economic performance of the east Asian tigers as also of China, which started its economic reforms in the late seventies.

Coinciding with the introduction of economic reforms in several countries in Asia, eastern Europe and Latin America, systematic efforts were undertaken by reputed organisations to measure the international competitiveness rankings of important economies among which the Geneva based World Economic Forum's (WEF) Global Competitiveness Report (GCR) and the Lausanne (Switzerland) based International Institute for Management Development's (IMD) World Competitiveness Year Book (WCY) are the best known. Others like Moody's and Standard and Poor (credit rating agencies), institutions like the Milliken Institute and consultancy organisations like A.T. Kearney (Times of India, Aug. 10, 1999) and Business Environment Risk Intelligence (BERI) also went into different aspects of competitiveness. Not only has India been ranked fairly low in these reports, its position has generally been declining particularly since 1995. The hope that progressive economic reforms and the consistently high rates of economic growth since 1992-93 would lead to a higher competitive ranking have also been belied. According to

the latest reports by both WEF and IMD for the year 1999, India still continues to remain firmly stuck near the bottom of the list, in the company of virtually unknown and falling economies. While policy initiatives at the governmental level are certainly needed to significantly improve India's competitiveness, perhaps, what is more urgently needed is to effect micro level economic changes, which sharply brings in to focus the immediate role of company managements. This is particularly so because although, to a certain extent, the international financial system is to be blamed for the Asian financial crisis (APO, 1998; Jeffrey Sachs, 1999), at its core the melt down stemmed from the micro level rot in these nations (Rajiv Kumar & Bibek Debroy, 1999) which remained unnoticed until it was too late. However, it is now widely realized even in the countries which were in the eye of the storm that prevention of recurrence of economic crisis, perhaps, does not come from shutting the doors of the economy to globalization, but more by ensuring that the micro level performance improves substantially and significantly to match the international norms including in disclosure standards.

> **What is more urgently needed is to effect micro level economic changes, which sharply brings in to focus the immediate role of company managements.**

Competitiveness Rankings

The definition of competitiveness and the methodology of its measurement are briefly reviewed by Sharma, Nair & Barman, (1999). It is important to note that all the eight countries which were ranked by WCY (1999) at positions lower than India viz. Czech Republic, South Africa, Poland, Slovak Republic, Columbia, Russia, Venezuela, and Indonesia, were ranked above India by GCR (1999). In addition, seven countries (Mauritius, Costa Rica, Jordan, Slovenia, El Salvador, Vietnam and Egypt) which were not considered by WCY (1999) were also ranked above India by GCR (1999) thus bringing India almost to the bottom of the table. Apart from Russia, there were only six less known countries viz. Ecuador, Columbia, Bolivia, Bulgaria, Zimbabve and Ukraine (Table 1) which are rated below India according to GCR (1999). This unviable image is despite that India is the fifth largest in terms of GNP in purchasing power parity (PPP) terms (World Bank, 1999), constitutes one of the fastest growing markets in the world and is also counted among the richest in regard to cheap skilled labour, scientific and technological resources and

Table 1: Competitiveness Rankings

	Global Competitiveness Report (WEF)		World Competitiveness Yearbook (IMD)	
	1999	1998	1999	1998
Singapore	1	1	2	2
United States	2	3	1	1
Hong Kong	3	2	7	3
Taiwan	4	6	18	16
Canada	5	–	10	10
Switzerland	6	8	8	7
Luxembourg	7	10	4	9
United Kingdom	8	4	15	12
Netherlands	9	7	5	4
Ireland	10	11	11	11
Finland	11	15	3	5
Australia	12	14	12	15
New Zealand	13	13	20	13
Japan	14	12	16	18
Norway	15	9	13	6
Malaysia	16	17	27	20
Denmark	17	16	8	8
Iceland	18	30	17	19
Sweden	19	23	14	17
Austria	20	20	19	22
Chile	21	18	25	26
Korea	22	19	38	35
France	23	22	21	21
Belgium	24	27	22	23
Germany	25	24	9	14
Spain	26	25	23	27
Portugal	27	26	29	29
Israel	28	29	24	25
Mauritius	29	–	–	–
Thailand	30	21	34	39
Mexico	31	32	36	34
China	32	28	29	24
Philippines	33	33	32	32
Costa Rica	34	34	–	–
Italy	35	41	30	30
Peru	36	37	–	–
Indonesia	37	31	46	40
Hungary	38	43	26	28
Czech Republic	39	35	41	38
Jordan	40	34	–	–
Greece	41	44	31	36
Argentina	42	36	33	31
Poland	43	49	44	45
Tokey	44	40	37	33
Slovak Republic	45	48	40	–
El Salvador	46	42	–	–
South Africa	47	42	42	42
Vietnam	48	39	–	–
Egypt	49	38	–	–
Venezuela	50	45	45	43
Brazil	51	46	35	37
India	52	50	39	41
Ecuador	53	–	–	–
Columbia	54	47	43	44
Bolivia	55	–	–	–
Bulgaria	56	–	–	–
Zimbabwe	57	51	–	–
Ukraine	58	53	–	–
Russia	59	52	47	46

Source: GCR (1999), WCY (1999)

entrepreneurial talents. True, that these rankings suffer from serious conceptual and empirical limitations (Tendulkar, 1997a). Yet they cannot be ignored because of the importance attached to them by the international business community.

A comparison of competitiveness rankings of a few developed countries since 1993 with those of some of the major Asian economies including India (Table 2) shows the following:

1. Throughout 1993-99, USA continued to top the list followed by Singapore and Hong Kong. Perhaps reflecting the impact of Asian financial crisis, Hong Kong, of late, seems to be drifting away.

2. Japan was rated as a highly competitive economy (No. 2) at the beginning of the decade. Its ranking has declined as the decade progressed and reached as low as 18 in 1998 and then recovered to 16 in 1999. Almost similar is the trend in the case of Germany and France. UK's has not been a stable and consistent performance during the period.

3. Taiwan and Malaysia had rather excellent positions at the beginning of the decade. Their performance deteriorated over time. Taiwan has managed to stay well above the average position throughout except in 1997. Although hit by the Asian financial crisis, Malaysia is only marginally below the world average in 1999. Similarly, Thailand and Korea started rather satisfactorily but went down to reach well below the average position in 1998 and 1999. Indonesia has been in the bottom quartile throughout the period. In fact, it fell to the last but one rank (next only to Russia) in 1999. While broadly reflecting a similar trend over time, these countries were ranked much higher by GCR (1999) with Taiwan occupying the 4th position in 1999 while Malaysia is at the 16th.

4. Both India and China were well below the world average to start with; India's position being lower than China's by 4 points in 1994. While China went on rapid improving its ranking to reach the middle position in 1998, India, despite some improvements during the mid nineties, deteriorated to reach as low as 41st position in 1998. China's rank fell to 29 in 1999, while India's improved, albeit by only two points. Political instability, coupled with the failure to maintain the economic reforms momentum seems to have accounted for India's inability to wrest competitive advantage from the rest of the world despite having recorded impressive rate of economic growth in 1996 and again in 1997 and 1998 although at a little lower rates.

India Vs China

The factor wise ranking of India and China is given in Table 3. China's edge over India is clearly discernable especially in regard to "economy", "internationalization", "government", "Science and Technology" and "people". While India marginally scored over China in "finance", it is roughly at level with China in "infrastructure" and "management".

1. Reflecting the consistently higher economic growth in comparison to India, China which started at a slightly higher level, steadily improved its position. Since China's high growth rates have been declining in recent years, its rank also declined, but India despite recording a slight improvement in 1994, 1995 and 1999, is now no where near to China.

2. In regard to "internationalization" of the economy (openness according to GCR), India was 4 notches above China in 1994 but since then China has been improving rapidly to reach as high as 18 in 1999. India's has been a journey in the reverse direction, deteriorating to a low 44.

3. In regard to the factor 'government', India and China were at almost comparable ranks in 1994 and 1995. While China recorded rapid improvements until 1998, India declined rapidly. Both India and China recorded steep decline in "government" rankings in 1999.

4. In "S & T" factor too, China maintained its edge over India throughout the nineties. While both the countries have been improving their relative positions, China's progress has been significantly faster than India's till 1998.

5. It is revealing that in regard to the attributes of "people" from a competitiveness point of view, China is now far ahead of India as it has been improving at a faster rate over the years. India has stagnated at the lowest level, by and large.

6. In 'finance' and 'management' India was placed better than China to begin with. Over the years, while India had either lost its advantage over China in regard to "management", it remained equal to China in regard to "finance".

7. In "infrastructure" both the countries were almost equal in 1994, but over the years, China has slightly improved its rank while India has deteriorated to occupy the next above the lowest position in 1999.

A diagrammatic representation of the performance of India and China relative to US on the eight input factors comprising the competitiveness index is shown in Fig. 1.

India's Weaknesses

India's weaknesses in competitiveness extend to a wide range of variables relating to all the factors representing the economic, social, infrastructure and even cultural facets of national life. For instance, the gross domestic product of China was $825 billion in 1997 which was more than two times India's and has been achieved through a sustained growth of more than 7 per cent per annum over the last two decades (Kelkar, 1999). India's achievements in the case of a select number of variables were far below those of China and Malaysia and were comparable only with Indonesia. (Table 4). Among them is the poor Indian score in an area like "image of the country abroad" despite being the biggest and a stable democracy in the world. Even in such areas as "corporate tax rate", "tax evasion", "transparency in govt. decisions" and "political system's adaptability", India is far below China. The country with a stock exchange for over 100 years lags behind China which until very recently had no stock exchange of its own in upholding the 'rights and responsibilities of the share holders'. In aspects like "improper practices by corporate boards", "share holder value generation", and 'insider trading' India has yet to reach the levels achieved by China and Malaysia. Similar is the case with 'customer orientation', 'marketing culture', 'entrepreneurship', and 'social responsibility' of managers'. The list could be expanded to cover such variables as 'population dependency ratio', 'school enrollment ratios', 'quality of life', 'computers per capita'.

Table 2: Competitive Ranking of Select Nations

Year	US	Germany	UK	France	Japan	China	India	Taiwan	Malaysia	Philippines	Thailand	Korea	Indonesia	Hong Kong	Singapore
1993	1	5	16	15	2	–	42	11	14	35	26	28	38	4	3
1994	1	6	14	13	3	34	38	22	18	37	26	32	36	4	2
1995	1	6	15	19	4	31	37	14	23	36	27	26	34	3	2
1996	1	10	19	20	4	26	38	18	23	31	30	27	41	3	2
1997	1	14	11	19	9	27	41	23	17	31	29	30	39	3	2
1998	1	14	12	21	18	24	41	16	20	32	39	35	40	3	2
1999	1	9	15	21	16	29	39	18	27	32	34	38	46	7	2

Source: World Competitiveness Year Book, various years

Table 3: Factorwise Ranking of India & China

Year	Economy		Internationali-zation		Government		Finance		Infra-structure		Manage-ment		S&T		People	
	India	China	India	China	India	China	India	China	India	China	India	China	India	China	India	China
1993	35	–	42	–	22	–	34	–	42	–	35	–	35	–	45	–
1994	30	3	37	41	15	14	30	39	44	43	34	45	34	23	45	38
1995	32	2	39	34	14	12	26	38	42	43	30	41	34	27	44	37
1996	32	2	41	23	14	9	30	37	43	40	32	30	33	28	44	35
1997	31	24	14	43	29	31	6	37	45	40	39	34	30	20	45	31
1998	18	5	42	20	28	5	33	42	46	40	32	30	29	13	45	24
1999	28	6	44	18	16	33	34	36	46	42	40	36	30	25	44	27

Source: World Competitiveness Year Book, various issues.

'Internet connection', 'telephone lines' and so on.

That the reasons for the poor countries being not able to catch up with developed countries lie more in the way they are governed rather than in their natural disadvantages or unfair treatment by the rich, has been brought out by Fraser Institute (1996). Using an Index of economic freedom based on 17 measures such as legal protection of property rights, extent of government regulation and trade barriers to economic activities, inflation rate etc. the Institute ranked 123 countries in which India appears only at a low 85th position just below Russia and just above China and slightly ahead of Pakistan which appears at the 89th position. The conclusion drawn is that the freer the economy, the higher is the growth and the richer the people. The concept of economic freedom as developed by the Institute should not be mistaken as an argument for *laissez-fare*. On the other hand, it is a much broader concept requiring a highly pro-active approach by the government in setting a clear and predictable regulatory and macro-economic climate; protecting property rights, enforcing the law, avoiding inflation and, just as importantly, a low cost and efficient government, besides creating an environment which gives the people incentive to invest not only to build factories and clearing land for farming but also for educating children and training of workers, among others. It has been observed that although India has some of the pre-requisites of economic freedom and its

score has improved since 1990, the continued use of licensing rules, price controls, state ownership of crucial underlakings, currency control, high barriers to trade and the like along with rampant corruption have been perceived to still stand in the way of India's progress towards higher competitiveness levels. To this, must be added political instability which seems to have become endemic since 1996.

One of the major causes behind the Asian economic crises which overtook a number of east Asian and south east Asian economies in 1997 has been identified as corruption and cronyism (Shang-Jin Wei & Sara E. Sivers, 1999). India is widely perceived, both within the country and outside, to be seriously afflicted with the malady of corruption (e.g. Transparency International, 1998) which makes it among the most corrupt countries in the world. Even according to the Bribery Payers' Perception Index (BPI) arrived at by Transparency International in 1999, India is ranked at 72nd on a list of 99 countries (Economic Times, 4th Nov, 1999). No longer is a certain degree of corruption considered to be benign and treated synonymous with speed money to expedite decision making or greasing the wheels of progress. It is now unanimously agreed that corruption not only leads to misallocation of scarce resources but is perceived by international business community as an additional cost of doing business in the country akin to an extra tax. Some of the prescriptions to control corruption include setting up of the institution of Lok Pal and Lok Ayukt with sufficient teeth, and adding further bite to the institution of Chief Vigilance Commissioner. "Corruption has become a no risk high profit business", says N. Vittal (Observer, Oct. 29, 1999). Increased transparency in government functioning at all levels including a major revamping, if not total scrapping, of the Official Secrets Act, adoption of Citizens Charter by every government; drastic reduction in administrative delays which more often than not leads to corruption, by institutionalizing greater responsibility, accountability, decentralization of decision making and public acces-

Fig. 1. Country Competitiveness Structure

LEGENDS

USA ——————
China ------------
India ——————

Table 4: Ranks obtained by India, China, Malaysia and Indonesia in select variables

Criteria	India		China	Malaysia	Indonesia
	1998	1999	1999	1999	1999
Parallel Economy	43	39	40	35	26
Consumer Price Inflation	33	33	27	31	44
Cost of Living (rent)	33	33	25	6	7
Restructuring of the Economy	34	41	16	19	44
Balance of Trade	31	28	10	20	7
Current Account Balance	26	39	10	4	33
Exports (% of GDP)	43	43	38	3	25
Tourism Receipts (% GDP)	42	42	38	10	1
Exports Credit & Insurance	34	35	31	20	47
Protectionism	42	42	46	41	43
National Culture (open to foreign influence)	28	34	24	37	36
Image of the Country Abroad	43	42	10	30	45
Central Govt. Domestic Debt	37	33	4	24	2
Central Govt. Budget surplus/deficit	42	45	21	5	9
Management of Public Finance	32	42	25	33	44
Corporate Tax Rate	40	46	16	7	11
Tax Evasion	37	39	27	12	33
Transparency in Govt.	40	39	10	12	45
Political System's adaptability	41	38	30	14	47
Bureaucracy	35	41	46	16	39
Improper Practices	40	41	39	27	47
Labour regulations	42	43	25	6	19
Cost of Capital	33	37	31	21	45
Country Credit Rating	38	40	29	28	46
Access to foreign capital markets	41	41	47	42	39
Factoring	45	41	42	34	35
Venture Capital	45	41	32	28	43
Shareholder's Rights & Responsibilities Protection	39	40	36	32	42
Insider Trading	39	39	35	29	44
Price/Quality Ratio	38	40	38	16	41
Corporate Credibility	35	29	35	15	42
Corporate Boards & Improper Practices	39	37	22	32	44
Shareholder Value generation	36	41	19	33	43
Worker Motivation	33	32	21	20	44
Total Quality Management	46	41	37	22	45
Customer Orientation	44	37	27	23	45
Marking Culture	42	31	17	26	44
Entrepreneurship	39	41	17	29	45
Social Responsibility of Managers	40	41	18	22	43
Research Cooperation between Business & Universities	43	44	23	24	45

(Table 7 Contd.)

(Table 4 Contd.)

Criteria	India		China	Malaysia	Indonesia
	1998	1999	1999	1999	1999
Financial resources for Technological Development	36	34	33	24	44
Securing Patents Abroad	34	33	29	23	–
Intellectual property Protection	41	43	17	32	46
Population Dependency Ratio	44	41	9	43	33
Life Expectancy at birth	46	47	38	35	45
Female Labour force (% of total labour force)	45	45	3	42	40
Brain Drain	44	45	40	25	32
Secondary School Enrollment (% relevant age group)	40	35	33	–	30
Pupil-Teacher Ratio (I level)	46	47	33	25	33
Pupil-Teacher Ratio (II level)	41	44	29	35	22
Public Expenditure on Education (US$ per capita)	43	47	46	32	45
Illiteracy	46	47	44	41	43
Quality of Life	42	42	40	22	45
Equal Opportunity	39	42	36	38	46
Computers per capita	45	47	46	32	45
Computers Power per capita	44	45	44	30	43
Internet Connections	46	47	46	35	44
Information Technology	39	38	41	16	47
Telephone Lines	46	46	43	35	45

Source: WCY, Various Years

sibility of government functionaries, increased speed of decision making through reduction in the levels of hierarchy and adoption of modern aids like IT and auto-mation in office and the like have long been debated but with little or insufficient action so far. Considering that corruption is a rot which starts from the top, two aspects need very serious consideration. First, increase the cash compensation package of ministers and top officials that will enable them to resist temptation. A reasonable yardstick which is found to have worked in countries considered to be both highly competitive and much less corrupt is to link civil service pay to what equivalent levels are getting in business and industry. Second, provide legitimate source of funding for politi-cal parties to fight elections.

> India is widely perceived, both within the country and outside, to be seriously afflicted with the malady of corruption which makes it among the most corrupt countries in the world.

Wignaraja (1999) recommended a strategy based on high export growth rate of manufactures especially of high technology manufactures, and attracting export oriented FDI to enhance competitiveness of developing countries like India. While noting that India had a reasonable export growth performance of 11.1 per cent during the period 1980-86 (as against 12.2 per cent in the case of Pakistan and 18.5 per cent in the case of Sri Lanka, albeit on a much smaller base) and that the share of high technology exports at 10 per cent stood out as an exception as compared to the rest of South Asia (3 per cent), it is still well below the average of East Asia (15.5 per cent growth in exports, per annum with 46.8 per cent share of high tech items in it) as well as that for Latin America (14.4 per cent growth in exports per annum with a 21.5 per cent share in high tech items). A holistic approach to National Competitiveness Policy suggested by him has two broad elements involving a three way national partnership between the government, private sector and labour organisations for taking complimentary actions and following, a "liberalisation plus strategy" in-volving an optimal mix of policy instruments broadly clas-sified into (a) incentive policies to remove economic distortions that discourage private sector growth and competitiveness and (b) structural policies to overcome

market inefficiencies standing in the way of acquiring competitiveness by firms. Among the notable sugges-tions in the list of actions to be taken by the government for enhancing competitiveness (Table 5) are establishing a National Competitiveness Council to formulate a strategy and monitor implementation, abolishing QRs immediately followed by tariff reductions in stages to achieve low and uniform protection, establishing over-seas investment promotion offices as a joint venture with private sector, evaluating EPZ incentives against com-petitiors, abolishing requirement for approval for foreign investment, introduction of competition in the banking sector, conducting a survey of future skill needs and assisting industry associations to launch training centres and tax deduction for investment in training, improving industrial productivity to international standards, liberalis-ing air and sea cargo entry to foreign operators, and commercialisation/privatisation of infrastructure parasta-tals within an effective regulatory framework. Among the complimentary actions suggested on the part of private sector are those related to helping the government to plug the information gap about the emerging competitive

Table 5: Government Actions for Competitiveness in a Developing Economy

Policy Area	Constraint	Suggestion
Policy Management	Lack of a coordinating vision and mechanism	Establish a national competitiveness council to formulate strategy and monitor implementation
Incentive Policy		
Macroeconomic Policy	High inflation & large fiscal deficit	Develop a plan to reduce fiscal deficit within a specified time
	Appreciating real exchange rate	Adopt a more aggresive approach to exchange rate management
	Lack of policy credibility	Implement reforms and involve private sector in pre-budget consultations
Trade policy	High and variable effective protection	Persist with import liberalisation to achieve low and uniform effective protection
	Weak export drive	Revamp trade promotion organisation to become more pro-active and allocate more funds for overseas marketing
	Long delays in refunds on imported inputs	Streamline bureaucratic procedures and introduce computerisation at customs
Foreign investment policy	Unfocussed foreign investment promotion strategy	Develop a pro-active foreign investment promotion strategy which targets a few realistic sectors and host countries
	Poor international image/lack of contact with potential investors	Establish overseas investment promotion offices as a joint venture with the private sector
	Uncompetitive EPZ package	Evaluate EPZ incentives against competitors and change offer to attract flagship multinationals
	Cumbersome foreign investment approval process	Streamline procedures and eventually abolish approvals altogether
Structural Policies		
Industrial finance	High interest rates and an oligopolistic banking system	Manage prudent monetary policies and introduce competition into the banking sector
	Anti-SME bias in credit allocation by banks	Introduce training for bank staff on assessing SME credit and specialist SME funding windows
Human resources	Skill gaps in potential areas of comparative advantage	Conduct a survey of future skill needs benchmarked against competitors and a prioritising of future skill needs
	Inefficient public sector training institutions	Introduce partial cost recovery of services for public institutions & assist industry associations to launch training centres
	Limited enterprise training	Introduce an information campaign to educate enterprises about skill gaps and a tax deduction for training investments
Technology Support	Weak quality standards in industry	Provide part-grants for SMEs to obtain ISO 9000 certification
	Low industrial productivity	Establish a productivity centre to improve industrial productivity to world standards
	Inadequate linkages between technology institutions & industry	Introduce partial cost recovery of service for public institutions
Infrastructure	High costs of sea and air frieght	Liberalise air and sea cargo entry to foreign operators
	Long delays in accessing utilities connections	Consider commercialisation/privatisation of infrastructure parastatals with an effective regulatory framework

Source: Wignaraja (1999)

threats and new market opportunities. Also suggested are: private sector participation in national policy making bodies and international trade negotiations and carrying out regular surveys of enterprise confidence and obstacles to competitiveness; augmenting government capabilities in areas like modern management, financial, marketing and technical skills through short term programmes from private sector to the government and undertaking joint public private sector overseas investment promotion missions to improve the country's image as a favourable destination for FDI and participation in joint venture infrastructure projects with government through BOT and DBFO type of arrangements. Helping weak firms particularly SMEs in areas like enhancing export capabilities, productivity and quality through benchmarking exercises and awareness training, developing effective marketing strategies, and transfer of technology and skills through active sub-contracting and supplier relationship are important complimentary actions. On the other hand, an active labour organisation is essential to improve the poor industrial relations situation which has a high social cost, and low productivity.

> An active labour organisation is essential to improve the poor industrial relations situation.

Macroeconomic Reforms

That macroeconomic reforms, are necessary to enhance competitiveness is by now accepted widely. Being crisis induced, the initial phase of reforms in India focussed on macro economic stabilisation. Simultaneously reforms were carried out in such aspects as industry policy, trade, exchange rate and foreign investment alongwith tax, financial sector; and public sector reforms. These measures produced immediate and unprecedented favourable outcomes (e.g. stepping up of growth rate to over 7 per cent in a short span). Although lower than those achieved by the east Asian countries, India's growth rate at 6.6 per cent during the 1992-97 period was significantly higher than not only that recorded by all the developing nations (2.7 per cent) but also exceeded its own record during the pre-reform period. Thus, India's performance in stabilising the economy was commendable by any standards (Ahluwalia, 1999). Kelkar (1999) found that in 1998, India achieved one of the highest growth rates in the world and in 1999, the growth rate is expected to be higher than the previous year. In terms of other macro economic indicators such as the rate of inflation or exchange rate stability, the performance of Indian economy in recent years has been commendable.

> India's performance in stabilising the economy was commendable by any standards.

True that there had been a slowing down of the growth rate in 1997 and 1998. That a growth rate in excess of 5 per cent has been achieved despite the economy entering into a period of downswing and growth deceleration with the onset of political instability and the Asian financial crisis, is in itself quite commendable. This has been achieved in the context of a slow down in the world economy and has been sustained along with a remarkable build up of foreign exchange reserves (Chelliah, 1999).

Some studies pointed to the immediate deterioration in the poverty situation on the ground that the fiscal crunch that followed the structural adjustment programme affected the capacity of the government to carry on with the anti poverty measures (e.g. Gupta, 1995). The situation, however, changed very fast. Even though there was some deterioration in the poverty situation in both the urban and rural areas during the two years immediately following the initiation of economic reforms, the incidence of poverty declined during the next year (Tendulkar, 1997b). In fact, Chelliah & Sudarshan (1999) found that the reforms have not reversed or altered the trend of steady fall in the head count ratio since 1973-74.

By all accounts, economic reforms programme in India is far from being complete. First, the fiscal deficit, although brought down to significantly lower levels than what used to be at the beginning of the decade, still continues to be high by international norms. The excessive preemption of the community's savings by the government leads to the potential crowding out of the requirements of the enterprise sector. Currently, almost 80 per cent of the private financial savings are being absorbed by the public sector including the govt. Despite the current inflation rate being perhaps the lowest in two decades, the high fiscal deficit can still generate pressures on real interest rate in addition to the continued rise in interest payments on account of government debt. There is indeed a strong case for immediate reduction in fiscal deficit. Recent studies place

> The fiscal deficit still continues to be high by international norms.

the extent of direct and indirect subsidies at as high as 16 per cent of GDP (eg. Kelkar, 1999). Reduction of the fiscal deficit would require considerable squeezing of the large hidden subsidies associated with the pervasive under pricing in crucial areas such as power, irrigation, urban transport, and higher education. Food and fertilizer subsidies are the other major areas which require immediate refocusing and beneficiary targeting (Joshi & Little, 1996; Jeffery Sachs, Ashutosh Vashney and Nirupam Bajpai, 1999). Bulk of the subsidies go to people who are not so poor. This is true even in the case of food and fertilizer subsidies.

Second, the tax structure in India still remains highly complicated with high rate of taxation in regard to both direct and indirect taxes. In the area of direct taxation while the personal income tax is now broadly in line with those elsewhere in the world, corporate taxes are still high. It should be recalled that the personal income tax rates were unduly high until the beginning of the current decade. Largely because of the progressive replacement of the 'high rate – low compliance' income tax regime with a 'low rate – high compliance' system the number of income tax payers sharply increased from less than ten million at the beginning of the decade to as high as 25 million now (Economic Times, Sept. 21, 1999). Personal income tax collection increased from 0.9 per cent of GDP in 1991-92 to 1.2 per cent in 1998-99 (Economic Survey, 1999). There still remains considerable scope for expanding the tax base including by imposing agricultural income tax. There has not been any significant progress towards value added tax (VAT). Besides, octroi needs to be eliminated since it obstructs free movement of goods within the country. State governments continue to levy sales tax, the rates of which are still not uniform. Import duties are still high and need to be brought down considerably. Further, consumer goods imports are severely restricted under the current trade regime (Nirupam Bajpai, 1999).

> **The tax structure in India still remains highly complicated with high rate of taxation in regard to both direct and indirect taxes.**

Third, the foreign investment regime in India is still highly restricted. Foreign ownership that exceeds 51 per cent of equity still requires a long procedure of government approval and the government's approach to such approvals is not only not transparent but even arbitrary in some cases. Moreover, expeditious translation of the approved FDI into actual investment requires more transparent policies and a drastic reduction in time con-

suming red tape implicit in the multiplicity of approvals and permissions required from a variety of authorities at the federal, state and local levels driven by conflicting goals and purposes. Although vastly improved from what it used to be in late eighties and early nineties, India's ability to attract FDI is still nowhere near to even Indonesia not to speak of the highly successful China (Table 6). This is despite India being the sixth best investment destination globally; after USA, China, UK, Brazil and Mexico (Fig. 2). This is also despite India's country risk being lower than of Malaysia, Thailand, Indonesia and the Philippines, according to the world's leading credit information agency Dun & Bradstreet, (Economic Times, 16 Sept. 1999). In this context, a target of US $10 billion of FDI seems to be a modest one, considering that FDI worldwide has been increasing and is currently of the order of US $640 billion annually. However, when it comes to the actual inflow, A.T. Kearney study (1999) ranked India only at a low 25th position. India's poor record in FDI should be a thing of the past, if the business sentiment shifts shown in Fig. 3 are any indication.

> **The foreign investment regime in India is still highly restricted.**

> **India's ability to attract FDI is still nowhere near to even Indonesia not to speak of the highly successful China.**

Table 6: Foreign Direct Investment

	% of Gross Domestic Investment		% of GDP	
	1980	1997	1980	1997
Brazil	3.5	11.3	0.8	2.4
Chile	3.7	26.1	0.8	7.0
Hong Kong, China	—	—	—	—
India	0.2	3.7	0.0	0.9
Indonesia	1.0	7.0	0.2	2.2
Japan	0.1	0.0	0.0	0.1
Korea Dem. Republic	—	—	1.	—
Malaysia	12.5	12.1	3.8	5.2
Pakistan	1.4	7.6	0.3	1.2
Philippines	-1.1	6.0	-0.3	1.5
Singapore	22.8	24.0	10.5	9.7
United Kingdom	11.2	14.1	1.9	3.0
United States	3.1	6.0	0.6	1.2

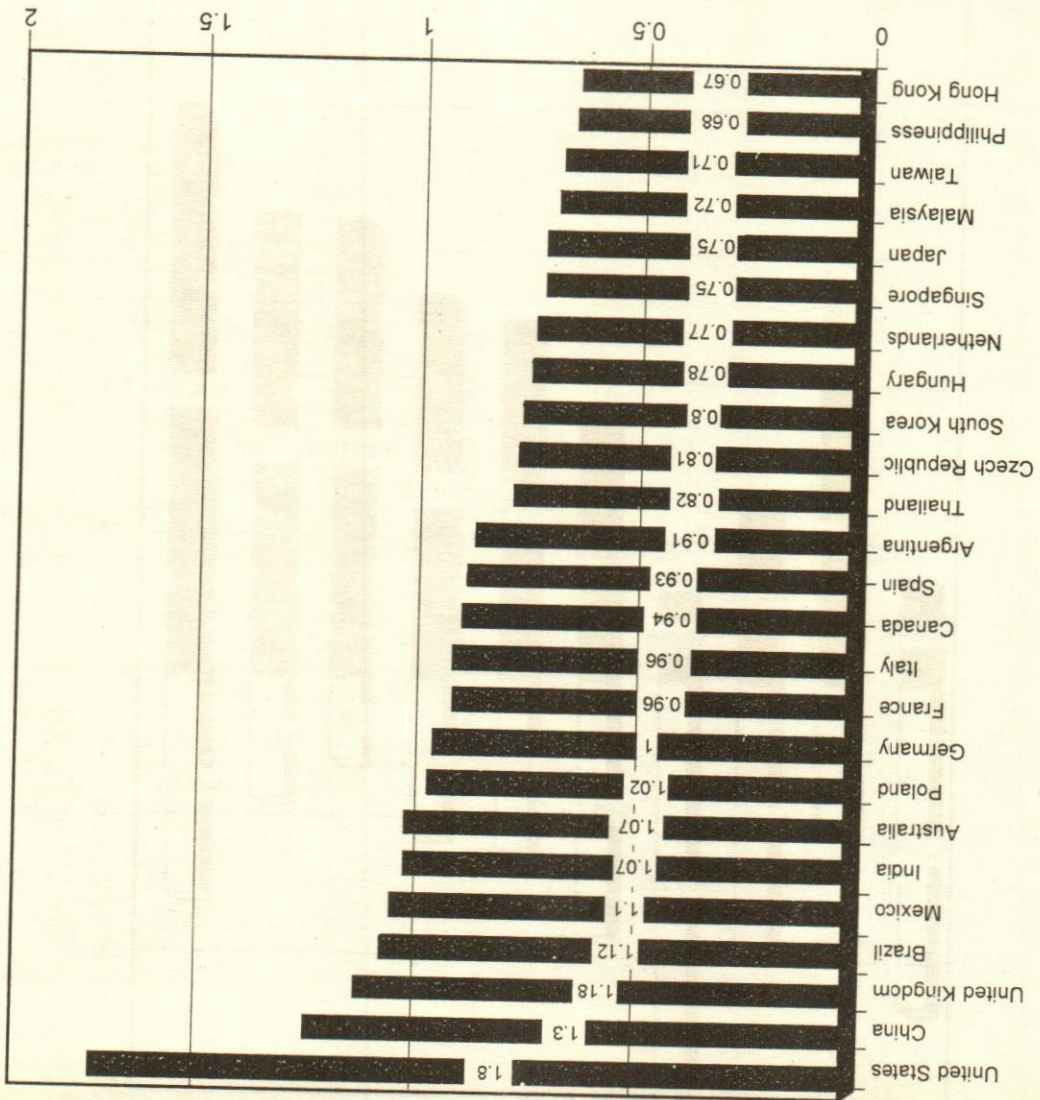*Source:* World Development Indicators, World Bank, 1999

Fifth, labour policies would appear to militate against creation of more employment in some areas.

Fourth, for almost five decades, the small sector in India has been heavily protected through reservation of over 800 product lines. The continuation of such a policy stifles large scale industrial expansion, especially in those technologies which are viable only if economies of size are guaranteed. Signals towards dereservation have already been given while some product lines from the food processing sector were liberated from the reserved list in 1997. Since then, however, there is no progress despite the Abid Hussain Committee Report (1997). India's approach to industrialization through small scale units is guided more by idealism than by techno-economic realism. Speedy dereservation of the list would be a progressive step towards faster and heal-thier industrialisation of the country.

The new and emerging technologies and the rapidly changing market trends including increasingly shorter product life cycles require flexibility in operations, so that organisations can respond with speed to changing market conditions. A bankruptcy policy embracing retrenchment, restructuring of ailing firms and liquida-tion of closed units is urgently needed to align Indian industrial environment with those comparable elsewhere in the world. The currently available rehabilitation route through BIFR is both slow and difficult. BIFR's is a con-sensus approach which in most cases is extremely slow because trade unions as a group are opposed to restructuring. The strong resistance by the employees of State Electricity Boards and banking and insurance sectors to economic reforms is an illustrative example. State governments have also generally followed very rigid practices and are opposed to closure of sick units mostly because of the resistance by the highly influential

Source: A.T. Kearney

Fig. 2. FDI Confidence Index, TOP 25, 1999

Country	Value
United States	1.8
China	1.3
United Kingdom	1.18
Brazil	1.12
Mexico	1.1
India	1.07
Australia	1.07
Poland	1.02
Germany	1
France	0.96
Italy	0.96
Canada	0.94
Spain	0.93
Argentina	0.91
Thailand	0.82
Czech Republic	0.81
South Korea	0.8
Hungary	0.78
Netherlands	0.77
Singapore	0.75
Japan	0.75
Malaysia	0.72
Taiwan	0.71
Philippiness	0.68
Hong Kong	0.67

employees of the organised sector. The slow moving judicial process also created barriers to restructuring. It is important to note that in most of the variables underlying labour force evaluation measure (LFEM) developed by BERI (1999), as a surrogate for national competitiveness, Indian work force was rated unfavourably in international comparisons (Table 7).

Indian work force was rated unfavourably in international comparisons.

Sixth, while significant progress has been achieved

Table 7: Labour Force Evaluation: India's Rank out of List of 50 Countries

Labour Force Evaluation Measure (LFEM)	1980	1990	1996	1997	1998
Legal Frame Work	18	12	9	15	14
Relative Productivity	39	33	35	34	34
Worker Attitude	33	28	37	38	35
Technical Skills	19	26	25	25	25

(LFEM row values: 35 27 30 32 31)

Source: BERI (1999)

Fig. 3. Countries Experiencing the Sentiment Shift Compared to December 1998

Source: A.T. Kearney

Countries: South Korea, Malaysia, India, United States, Japan, Argentina, China, Russia, Indonesia, Brazil

Values: 22.90%, -7.90%, 10.10%, 19.20%, -13.30%, -21.70%, 27.80%, -6.50%, 17.90%, -18.70%, 12.00%, -25.40%, 10.90%, -27.20%, 5.60%, -32.60%, -33.10%, 8.50%, 15.40%, -40.30%

in regard to opening up of infrastructure to the private sector, full results are yet to come forth. The state governments are unable to settle infrastructure projects with foreign investors, since approvals are required from the Central Government. New legal regimes at the federal level that give state governments greater autonomy to attract FDI are urgently required for the speedy development of roads, power and other infrastructure sectors.

Seventh, although much talked about, effective public sector reform is yet to start in India. "There is no doubt that more than half of the public enterprises of the centre and the states taken together cast a very heavy burden on the economy. There are a large number of loss making unviable public enterprises. Even among public enterprises that are making profits, many are inefficiently run, are overstaffed and are subject to political interference and patronage" (Chelliah, 1999). The government monopolies in banking and insurance and infrastructure sectors need to be abolished and loss making state owned enterprises need to be closed or privatised. It is important that the disinvestment proceeds are not diverted to cover the revenue deficit, they should be used to retire high cost public debts. These funds also may be used to support voluntary retirement schemes of employees of PSUs including the managerial staff which suffer from acute over employment.

> **Effective public sector reform is yet to start in India.**

Eighth, rural areas need a better deal. There should be a reliable supply of infrastructure services (roads, water, power, basic telecom) at commercial prices rather than unreliable and grossly inadequate arrangements given free of charge or at highly subsidised rates. (Nirupam Bajpai & Jeffery Sachs, 1998). Both sound economic sense and past experience dictate that unless charges are levied on a realistic basis, it would not be possible to deliver these essential services satisfactorily.

Microeconomic Changes

Since at its core, competitiveness involves a mind set to be globally competitive, fundamentally, it could be brought about only by the nation's enterprises. Competitiveness is what the firm enjoys in the market place which grows out of the value a firm is able to create for its buyers in excess of its costs. Value is what the buyers are willing to pay for and superior value stems from offering prices lower than of the competitors' for equivalent benefits or from providing unique benefits that more than offset a higher price (Porter, 1985)." A nation's competitive advantage is as good as its business leaders are', as Sumantra Ghoshal, the noted management expert from London Business School, commented in a recent Conference on National Competitiveness Policy organised by NPC.

> **A nation's competitive advantage is as good as its business leaders are.**

Competitive advantages stem not necessarily from the quality of physical assets and structural position of the industry but increasingly from the intangible assets based on skills and capabilities. Competitive advantage is not static and results from the capacity to improve and innovate. In addition to labour and resources, the sources of competitive advantage include technology, new market segments and strategies. The outstanding companies from the global markets place more emphasis on intangible assets than on the tangible ones. It is the value placed by the market on a company's ability to sustain superior performance in new, as yet under-developed businesses that is the essence of intangibly looking to the future (Rajat Gupta, 1998). If examples are required in regard to competitive advantage, Japan tops the list followed by Taiwan, Korea, Hongkong, Singapore and also the newly industrialised nations from South East Asia. From Europe too, we have illustrative cases like Switzerland, Sweden, Finland, Netherlands and more recently the Ireland. If the resource based comparative advantage was any indicator of the growth potential of the economy, then Brazil, Argentina, Mexico and India would have been on the top of the list of developed nations by now, which obviously did not happen (Ohmae, 1989).

> **Outstanding companies from the global markets place more emphasis on intangible assets than on the tangible ones.**

The microeconomic foundations of competitiveness rest on two inter related areas: (1) the sophistication of operations and strategies with which companies compete and (2) the quality of micro economic business environment. In the case of Microeconomic Competitiveness Index (MICI) India ranked higher than China, whereas on the broader competitiveness index China,

received higher ranking when compared to India (Table 8). In both China and India, the macro fundamentals are in place to support higher levels of GDP per capita (Porter 1998). If micro foundations could be preserved or enhanced while macro environment is further improved, the situation offered wholesome promises. A subset of variables that related directly to productivity growth as well as its current level consisted notably of macro aspects like intensity of local competition, buyer and supply quality, business information availability, intellectual property protection, R&D, quantity and quality of infrastructure and financial markets sophistication. Micro variables like innovation capacity, attention to staff training, control of international distribution channels and breadth of international markets were also found to be highly significant in explaining the variations in the levels of per capita income across the countries. Table 9 gives the top three competitive advantages and disadvantages India is perceived to be having relative to income level in the two areas viz. company strategy and national business environment.

A pre-requisite of the process of transformation is the shifting of goals and mindsets.'' What were strengths in traditional ways of competing become weaknesses at more advanced levels ... changes are often resisted because past approaches were profitable and because old habits are deeply ingrained in companies" (Porter, 1998). The most basic change is to accept the inevitability of competition and embrace its value in stimulating improvement and expanding the market. Rather than aspiring to a dominant share of a small market, the mentality must shift to expanding the market itself both domestically and internationally. If competitive success is the ultimate destination of business, the journey cannot be restricted to geographic and political confines. Liberalization sans globalisation is destined to push the economy back to economic

> **Changes are often resisted because past approaches were profitable and because old habits are deeply ingrained in companies.**

Table 9: India's Micro Economic Advantages & Disadvantages Relative to Income Level

Competitive Advantages	Competitive Disadvantages
Company Strategy	
Marketing expertise	Extent of regional sales
Breadth of international markets	Value chain presence
Attention to staff training	
Professionalism of senior management recruitment	
National Business Environment	
Domestic supplier quantity	Negotiation of cross-border ventures
Adequacy of private sector legal recourse	International direct dial communications
Stock market access	Costs of Road, infrastructure and quality

Source: Porter (1999)

Table 8: Micro Economic Competitiveness Index (MICI)

	Company Ranking		Business Environment Ranking		MICI Ranking		Competitiveness Ranking	
	1999	1998	1999	1998	1999	1998	1999	1998
USA	1	2	1	1	1	1	2	3
Germany	5	1	5	8	6	4	25	24
UK	13	9	8	5	10	5	9	4
France	6	6	11	13	9	11	23	22
Japan	4	7	19	19	14	18	14	12
China	31	35	50	44	49	42	32	28
India	48	50	43	42	42	44	52	50
Taiwan	17	16	22	21	19	20	4	6
Malaysia	25	34	31	26	27	27	16	17
Philippines	34	41	46	45	44	45	33	33
Thailand	43	37	39	36	39	37	30	21
Korea	27	24	30	28	28	28	24	19
Indonesia	47	52	52	51	53	51	37	31
Hong Kong	24	17	18	11	21	12	3	2
Singapore	14	12	12	9	12	10	1	1

Source: Porter (1999)

mediocrity, from where it is seeking desperately to come out. As of now, only a small proportion of world's economic activity is carried out by global level companies. Estimates put it between 15 and 20 per cent, concentrated mainly in manufactured goods. This is set to change fast. The next wave of globalization is likely to increase the globally contestable market to over 60 per cent (Rajat Gupta, 1998).

Indian companies must make choices about where to compete and make commitments to mastering competition in the chosen industries. To support rising wages and increasing profits, operational effectiveness must improve. Typical priorities, although by no means exhaustive, are rationalization of facilities, redesigning the processes, introduction of information systems and upgradation of management methods. During the past one decade or so, advanced management techniques like business process re-engineering (BPR), total quality management (TQM), lean organisations, Total Productive Maintenance (TPM), Supply Chain Management (SCM), Benchmarking and the like were brought in to India by the network of management institutions and promotional organisations, including the National Productivity Council. International standards like ISO 9000, ISO 14000, QS 9000 are also propagated by these agencies. If anything, the response of Indian business could be described only as lukewarm. For one thing, the rate of adoption has been extremely slow. As of now, the ISO 9000 standard has been secured by only a little more than 3000 Indian companies. There are not many instances of serious attempts at adopting TQM or BPR. While world wide successful organisations accepted that competitiveness requires thinking beyond Benchmarking, Indian organisations are yet to adopt the concept even as a starting point. For another, even those who adopted them tended to mistake these techniques and standards as substitutes for managerial decision making for performance improvements. Most of them have been unwilling to incur required investments in the new systems and practices and train their cadres. Those who acquired the standards and techniques and who also trained their work force and managerial cadres were unwilling to part with the outdated and even archaic organisational structures and processes; they continued with their old styles and centralized command systems. This is especially so in the case of PSUs. In short, there is no change in the

mindset in India, especially at the top management level.

Highly productive operating practices and more distinctive strategies may require sustained investments in not only the equipment but also the human resources and market development, especially in such areas as basic employee training, modern equipment and information systems and the capacity to absorb new technologies. As the company develops and becomes concentrated on core areas, further investments must be necessary in opening up new marketing channels, building new brands and improving products and processes. To a large extent, Singapore's high level of worker productivity (BERI, 1999; IMD, 1999) can be attributed to its success in promoting a productivity conscious environment through a mass productivity movement. On an average, one in every three workers is being trained annually under the auspices of the Skill Development Fund (SDF) (CSC, 1998). Companies' own investments in training have risen from about 1 per cent of the pay roll in 1986 to 3 per cent in 1997. The accepted yardstick for being rated as an excellent company on training is an expenditure of 4 per cent of the pay roll. In other words, constant training and retraining is essential to building and sustaining competitiveness in the era of knowledge driven economy. Indian organisations should embrace this principle whole-heartedly. It is important to note that India has been ranked among the lowest in regard to 'in company training'.

As of now, the value chain of most of India's corporate sector is concentrated on production and distribution, thus limiting the ability to develop distinctive strategies or penetrate new markets. For instance, barring a few, many PSUs did not develop further or deviate very much from what had been designed some four decades ago at the stage of commencement of foreign collaboration. To become internationally competitive, Indian companies must widen their capabilities in activities such as marketing, logistics and service. At more advanced stages, product development, service delivery and information management tend to be the decisive elements.

Successful businesses compete aggressively. They improve their performance continuously, through adapting ideas and techniques developed outside the busi-

ness and promoting co-operation with in the industry. Even businesses that were regarded as world class have made extra ordinary improvements in productivity and profitability from benchmarking and as a result of changing the way they worked. In the knowledge driven economies of the future, partnership is essential to achieve competitive success. This is because:

• Few companies have all the skills needed to develop and market technologically complex products and services

• Businesses should increasingly involve suppliers and allies in the entire manufacturing value chain

• The most powerful process a company can adopt which delivers immediate measurable and sustained productivity improvements is the transfer of best practice.

This constitutes the main argument for Indian organisations to be fully and seamlessly integrated with the rest of the world, leveraging on international capital, knowledge and technology.

As Indian manufacturing becomes increasingly globalised, it must be ensured that productivity is not outstripped by growth in business costs. This does not seem to happen in India at a rate that would enable the economy to reap cost advantages over their foreign rivals. For instance, out of the 101 private sector companies, whose data are available, only 60 recorded decline in expenditure-sales ratio in 1998-99 over 1997-98 (Economic Times, June 12, 1999).

Towards World Class Companies

Cost reduction apart, manufacturing growth must be driven by innovation as has been the case elsewhere in the developed world. India's record in innovation is not at all encouraging, eg. bicycles industry (Table 10). Indian organisations must build strong manufacturing capabilities in niche areas, especially in the emerging sectors such as automobiles and parts, electronics and assemblies, machine building and machine tools, cotton textiles and wearing apparel (including readymade garments) leather and footwear etc. In some of these areas, India already has some presence in the world market, although at the lower end of the market. The gains due to such a presence have not yet been consolidated in to competitive advantages because of our failure to develop required level of capabilities in all parts of the manufacturing value chain. (R&D), design, logistics, marketing, after sales service, etc.). India's long term stakes in manufacturing are too big to be tagged on to

a few internationally known marketing majors. Beyond doubt, the country should establish itself in the value chain in the international market by investing in quality and design capabilities of international standards, brand building and distribution channels.

Table 10: Innovation lags in Indian Bicycle Industry

Innovation	Year First Introduced	
	Abroad	Indian
3-Speed internal gear hub	1925	1965
Narrow spring saddles	1960	1975
Narrow Tires	1962	1974
Downward bent handlebars	1962	1988
5-10 speed derailleurs	1966	1980
Rat trap pedals with reflectors	1967	1987
Light Alloys	1969	1985
Flat handles	1973	1987
Caliper Brakes	1981	1989

Source: Porter et al (1994)

This, however, is easier said than done. This would necessitate conversion of locally based companies in to global players. World class companies are front runners in their respective fields, incorporating state-of-the-art management and technological practices in keeping with environmental changes. They also enjoy global and diversified operations and are among the top market sharers in their respective business areas. A world class company is one that can meet the highest standards anywhere in the world in order to command resources and operate beyond the borders, eg. Nokia of Finland, Ericsson of Sweden, Motorola of USA. There are not many examples from India; perhaps the nearest are Infosys Technologies in the software sector and Reliance in some categories of petrochemical products.

> **World class companies are front runners in their respective fields, incorporating state-of-the-art management and technological practices in keeping with environmental changes.**

The process of building up local companies in to world class organisations should be kick-started straight away. Given the size, financial depth, core capabilities and experience, many of the domestic companies have the potential to grow in to world class companies. Through the process of mergers, acquisitions, joint ventures, the co-operation of global players should be

secured by Indian organisations (including the PSUs) in this effort. Of course, this process pre-supposes drastic restructuring of many of the enterprises, the hurdles to which are yet to be cleared by the government, a sound Merger & Acquisition code, for instance. For a developing country like India, instead of concentrating all energies and resources to increase exports to developed countries consisting almost entirely of raw materials/intermediate goods, components manufactured to the buyer's design and specifications in which the bargaining power is heavily skewed in favour of the large and powerful foreign buyer, trade and exports of complete products to neighbouring countries in the region and other developing countries can provide an excellent platform for a strong presence in the highly competitive international market eventually.

Quality of Governance & Institutional Reforms

As observed earlier, India is rated rather low on the factor "Government" which is significantly contributing to its low competitiveness, both at macro and at firm levels. Competitiveness is rooted in the rule of law and a civil and just society characterised by respect for law and law enforcement agencies. The poor public image of the police and the extremely low rate of conviction in criminal cases (only around 6 per cent) are matters of extreme concern. It is a matter of common knowledge that not more than 50 per cent of conviction in criminal cases ends up in Courts as prosecution cases. The conviction rate is a miniscule percentage of the actual incidence of crime, making it along with corruption, "a low risk high profit business". A particularly worrying dimension is the growing political-criminal-bureaucrat nexus, graphically described in the Vohra Committee Report, and the increasing criminalisation of politics to which pointed attention has been drawn by the Chief Election Commissioner citing the increasing number of persons with criminal background entering the State and Central legislatures in successive elections. A major reform of the police and judicial system is urgently called for if we are not to be reduced to the level of Russia, Colombia, or Pakistan where organized crime calls the shots or has rendered the state ineffective with economic growth and competitiveness taking a back seat.

> A particularly worrying dimension is the growing political-criminal-bureaucrat nexus.

> A major structural weakness is the low and

declining productivity, efficiency, quality and public responsiveness of the country's public systems characterised by poor work culture and almost a total lack of accountability further compounded by the outdated systems, tools and methods of working. There may also be a serious shortage of competence and skills in the areas in which the government needs to be more proactive in order to create conducive conditions both at the macro (policy) level and at the micro management for the competitiveness to take roots and grow. A beginning towards this can be made by giving a serious consideration to several useful suggestions given by the Fifth Pay Commission, apart from creating a greater sense of accountability by somewhat diluting the virtually iron-clad job security at present available in government service and strengthening the skill and abilities in areas like modern management, finance, marketing and technical skills in which it is weak through short-term secondment of experts from the private sector into government.

Speedy contract enforcement and dispute resolution are absolutely critical for competitiveness creation, for which the extreme dilatoriness of the country's judicial process is a major impediment. The Government, the legal fraternity and the business community would need to put their heads together and come up with solutions to modernise and speed up the judicial process. Considering that the Indian judicial system is patterned after the Anglo-American system and based on English jurisprudence, this is not too difficult a task as more successful models are readily available to learn and adapt from.

Perhaps the most important point for successfully carrying out the kind of fundamental reforms envisaged is the need to maintain a credible social contract which ensures that the interest of the poor and the weak will not suffer under the new dispensation. Although there is a lot of empirical evidence in support of the premise that high economic growth promised by competitiveness strategies and policies lead to reduction in poverty, the process may lead to greater inequalities, and in the short term, even increase in poverty levels during the structural adjustment period unless the policies are deliberately tailored to take care of this problem. The latter is only of academic interest now, as India carried out most of the structural adjustment needed during the first phase, the policy planners nevertheless need to be on guard to see that the social fabric is not strained on account of the temporary problems ensuing from the reforms and globalisation process lest it should get derailed or get a major set back due to lack of sufficient care and sensitivity to the pressing problems of the poor and the weak.

Summary

Not only that India has been ranked fairly low by the competitiveness studies undertaken by the international-ally reputed organisations in recent years, its position has been characterised by a declining trend also, particularly since 1995. Despite the economic reforms programme since the early nineties, albeit incomplete, and in spite of the high growth rate of the economy, especially since mid nineties, India continued to remain firmly stuck near the bottom of the list of important economies in regard to competitiveness. Political in-stability coupled with the failure to maintain the economic reform momentum seems to have accounted for the country's inability to wrest competitive ad-vantages over the competitors. While intervention at governmental level is immediately called for to sig-nificantly improve India's competitiveness, what is more urgently needed is to effect micro level changes, which sharply brings in to focus the role of the company managements.

India's weaknesses in competitiveness cover a wide range of variables relating to all the major factors con-sidered by the various studies. These variables repre-sent economic, social, infrastructure, political and cultural facets of the country's national life. Although India has some of the pre-requisites of economic freedom and its score has improved since 1990, the continued reliance on licensing rules, price controls, state ownership of crucial undertakings, currency con-trols, high barriers to trade and the like is perceived to stand on the way of progress towards higher competi-tiveness levels. To this should be added political in-stability and a high level of perceived corruption.

Areas of economic reforms, needed on an urgent basis are:

1. Significant reduction in fiscal deficit through squeezing the burgeoning direct and hidden subsidies (eg. under-pricing of power, irrigation, urban transport, higher education; food and fer-tilizer subsidies).

2. Simplification of indirect tax structure and reduction in corporate tax, and indirect tax, substitution of sales and other taxes (eg. Octroi by Value Added Tax (VAT).

3. Automatic approval of more than 51 per cent foreign ownership in all sectors, except those specified.

4. Expeditious de-reservation of sectors currently reserved for small scale sector.

5. Reducing labour market rigidities through simplification of labour laws, including enacting a bankruptcy law.

6. Greater autonomy to state governments in order to achieve faster development of in-frastructure sector.

7. Public sector reforms including expeditious dis-investment of government's ownership of PSUs.

8. Reliable supply of infrastructure in rural areas at commercial rates.

Microeconomic reforms are equally important as macroeconomic policy changes; without micro reforms growth in GDP per capita would not be sustainable. A pre-requisite of the process of successful transformation in to competitiveness is the shifting of mind sets. Chan-ges are often resisted because past approaches were profitable and because old habits are deeply ingrained in companies. Even businesses that were regarded as world class have made extra ordinary improvements in productivity and profitability through benchmarking. In-dian organisations need to be fully and seamlessly in-tegrated with the rest of the world leveraging on international capital, knowledge and technology. As In-dian manufacturing becomes increasingly globalised, it must be ensured that productivity is not outstripped by growth in business costs. In addition manufacturing growth must be driven by innovation. Indian organisa-tions must participate in all the areas of the manufactur-ing value chain. This would however, necessitate conversion of locally based companies in to global players. Given the size, financial depth, core capabilities and experience, many of the domestic companies have the potential to grow in to world class companies.

Acknowledgements

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Venture Capital Industry in India
—An Agenda for Growth

L.K. Singhvi

The Venture capital has a very important role to play in the industrial and economic development in an emerging economy. In particular, the venture capital finance is commonly associated with providing seed capital to small and medium size undertakings with high potential for growth but which could not entail high risk. Therefore it is a high-risk high-return invest-ment. The assistance is provided to innovative entre-preneurs and rapidly growing companies that have reasonable potential to develop into profitable ven-tures but with uncertainties. Venture capital financing therefore is very different from the traditional sources of investment by the development financial institu-tions. The venture capital business demands skill, at-titude and system that are very different from those of traditional financial intermediaries. The emphasis is on the evaluation of personal skills and potential for growth.

> The venture capital business demands skill, attitude and system that are very different from those of traditional finan-cial intermediaries.

The venture capital financing has been in vogue in India in different forms from time to time. The in-dividual investors and development financial institu-tions had played a key role of venture capitalists in the absence of an organised venture capital industry. The new entrepreneurs have substantially depended upon the public offerings and lending by the financial institutions for starting new ventures. Though the need of organised venture capital activity was often felt but for the first time in 1973, a Committee on Development of Small and Medium Enterprises (also called Bhatt Committee) was set up, which high-lighted the need to foster venture capital as a source

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Realising the importance of venture capital financing, the government in association with SEBI has suggested several regulatory measures for new small and medium sized undertakings which have potential for growth but cannot sustain high risk. The purpose and scope of these measures are examined in the present paper. The new policy guidelines can play a very important role in the growth of Indian economy in several key sectors and facilitate more and more venture capital funds from abroad flow into India. The paper highlights the growth potential in the vital IT sector with emphasis on software development.

Venture Capital in India

The emergence of venture capital in India was essentially influenced by the developments in the western countries. Though India has a fairly well developed network of specialized financial institutions, which provided long terms finance to new industrial projects, a gap was felt in the area of equity financing to new projects, especially those involving a higher degree of risk due to the technology being new and untried. The venture capital guidelines of 1988 focussed on relatively narrow areas of venture capital activity, namely equity oriented finance for the commercialization of relatively new technologies promoted by new entrepreneurs

> India has a well developed network of specialized financial institutions, to finance new industrial projects, but a gap was felt in the area of equity financing to new projects.

of funding new entrepreneurs and technology. The Committee suggested setting up of a fund of Rs. 1 billion for this purpose. The first formal funding agency for risk prone high technology projects was formed by the Industrial Finance Corporation of India (IFCI) in 1975 as 'Risk Capital Foundation'. However, the activity of the venture capital did not catch the momentum, as the thrust was on high technology oriented projects only. In 1985, the Industrial Credit and Infrastructure Corporation of India (ICICI) set up a Programme for Advancement of Commercial Technology (PACT) for commercialisation of technologies in joint venture with partners from the U.S.A. under the aid of US$ 10 million. Credit Capital Finance Corporation set up the first venture capital fund in the private sector in 1986 with equity participation from the Asian Development Bank and Development Capital Group, London.

World Bank has undertaken a study to examine the possibility of developing venture capital in the private sector. Based on the implications of its Report, the Government of India took a policy initiative and announced guidelines for venture capital funds in India in 1988. However, these guidelines restricted the setting up of venture capital funds by the banks or the financial institutions only. The four select venture capital companies, were set up in 1990, with the assistance of the World Bank, domestic financial institutions and banks. Thereafter Govt. of India issued the guidelines dated 20th Sept. 1995 for overseas investment in Venture Capital in India.

Regulatory structure

The venture capital industry in India is relatively in a nascent stage. The Securities and Exchange Board of India (SEBI) was granted statutory powers in 1992 with the main objective to regulate and develop the Indian securities market. The SEBI Act empowered SEBI to inter-alia regulate the venture capital funds, as these funds are part of the overall securities market and is a source of capital. It announced the regulations for the venture capital funds in 1996, with the primary objective of protecting the interest of investors and providing enough flexibility to the fund managers to make suitable investment decisions. Since this is perceived to be a high-risk high-return business, the participation by very small investors has been restricted and only high net-worth individuals and institutions, both domestic and foreign, are allowed to participate with a minimum investment of Rs. 0.5 million.

A venture capital fund can be constituted in the form of a trust or a company. Venture capital fund appoints an asset management company to manage the portfolio of the fund. A venture capital company may take up the activity of venture capital fund and an asset management company. The Government of India had announced tax concessions for investments by venture capital funds subject to compliance with the guidelines issued by the Central Board of Direct Taxes (CBDT). The Reserve Bank of India (RBI) regulates the flow of foreign currency into and out of India.

The overseas venture capital funds can also make investment in India subject to the compliance of the Government of India guidelines dated 20th Sept. 1995 for investment by overseas venture capital funds. As per these guidelines and the guidelines issued by the CBDT, a venture capital fund can invest upto 40 per cent of the paid-up capital of the investee Company or upto 20 per cent of the corpus of the fund in one undertaking.

The SEBI Regulations and the guidelines issued by CBDT requires that at least 80 per cent of the corpus of the fund should be invested in unlisted equity shares of the venture capital undertakings. The Regulations permit investment by venture capital funds in listed securities of sick industrial undertakings. All the Government of India guidelines and the guidelines issued by CBDT, though relaxed from time to time, as it removed the conditions of time bound investment by the venture capital fund and also the requirement of a lock-in period of three years, need to be harmonised and a single regulatory body

climate is created for them.

Overseas investment in venture capital industry committed so far amounts to US$ 1.2 bn which is likely to increase dramatically if right kind of investment climate is created for them.

So far 18 venture capital funds have been registered with SEBI and they have committed Rs. 5.64 billion out of which they have invested Rs. 1.15 billion across 139 projects upto September 1999.

The investment of Rs. 12 billion by the domestic venture capital funds till 1998 has been in various projects, which included industrial products and machinery to the extent of 23.5 per cent, computer software & hardware to the extent of 25.8 per cent and consumer related products to the extent of 11 per cent. In 1998, the total of the investments in computer software and hardware put together exceeds investments in industrial products and machinery. It clearly shows the global trends that the IT industry is attracting greater attention as compared to other industries.

Sources of Investment funds

The major sources of funds for the domestic venture capital funds used to be from the financial institutions, banks and high networth individuals but of late overseas investors contribute largely to the domestic venture capital funds. Though accurate and complete data are not readily available as the investments are made by various investors directly in various forms, as per the information provided by the Indian Venture capital funds Association pertaining to their members till 1998, Rs. 29.8 billion were committed for the domestic venture capital of which 50 per cent was contributed by foreign investors. The domestic financial institutions and banks had contributed to the extent of 26 per cent only which is far less than their share of 50 per cent in 1993. The pool of inevitable money available to venture capital has grown by Rs. 36 billion since 1996 (Rs. 14.02 billion) and currently estimated to be at around Rs. 50 billion.

> The SEBI Regulations and the guidelines issued by CBDT requires that at least 80% of the corpus fund should be invested in unlisted equity shares of the venture capital undertakings.

should be empowered to regulate venture capital activity in India.

Problems

SEBI initiated a process of dialogue with the participants from the industry by convening their meeting to identify impediments in the speedy growth of the venture capital activity in India. The Finance Minister also in his budget speech for the financial year 1999-2000 announced that the Government of India will take initiative to boost first high technology sectors and to support first generation entrepreneurs through venture capital activity. He also announced that various guidelines issued by CBDT and SEBI would be harmonised. SEBI has taken an initiative in this regard. SEBI has set up a high level committee consisting of the key representatives, professionals and successful entrepreneurs from Silicon Valley including Shri Chandrasekar and Shri Saber Bhatia of Hotmail to identify the impediments in the growth of venture capital

> Finance Minister in his budget speech for the financial year 1999-2000 announced that the Government of India will take initiative to boost high technology sectors and to support first generation entrepreneurs through venture capital activity.

activity and to suggest suitable measures to facilitate the growth of venture capital activity in India. Some of the issues have been identified which need to be addressed to pertain to structuring of VCF, investment climate, exit policies and future vision. Some of these are:

1) The popular structure for VCC/VCF in USA is Limited Liability Partnership or Limited Liability Company, which provides for Limited Liability of partners at the same time tax exemption, are also available. In India VCC/VCF could be structured as a company or trust only.

2) Multiplicity of regulations—currently there are three set of guidelines that governs the functioning of VCFs in India i.e. Government of India guidelines for overseas venture capital funds, SEBI Regulations and guidelines issued by CBDT. These need harmonisation and there should be one nodal agency for venture capital

3) Limited exit options available to venture capital funds to liquidate their investment from the venture capital company as there is no market for trading in unlisted securities;

4) Investment restrictions in the form of investment in unlisted equity or equity related securities– the industry demanded that there is a need for allowing investment in structured instrument linked with the performance, debt instruments etc also

5) Tax exemptions offered by the Government of India are not in par with the concessions offered to the mutual funds–even though the venture capital funds take more risk and provide a scarce seed capital to new entrepreneurs. This is a lack of level playing field between the overseas and domestic venture capital funds because of concessional tax structure under the tax treaties provided to the overseas investors;

6) Tax exemptions are provided for investment in specified sectors–the sectoral restriction needs to be relaxed; and

7) Lack of organised source of funds–pension funds and insurance companies are not participating in the venture capital industry.

8) Lack of funds for start-up investments

International Experiences in Venture Capital Financing

In various developed and developing economies Venture Capital activity has played a very significant developmental role. The pace of industrial growth has increased because of Venture Capital activities. Many of the entrepreneurs have given shape to their business ideas into a reality.

In the UK, more than 16500 companies have received venture capital financing since 1983. In a survey carried out by the British Venture Capital Association, on an average, venture backed companies have experienced the following:

a) Sales rose by 34 per cent per annum

b) Exports grew by 29 per cent

c) Investment increased by 29 per cent

In the US, Companies such as Digital Equipment Corporation, Apple, Federal Express, Compaq, Sun Microsystems, Intel, Microsoft and Genentech are famous examples that received venture capital in their early development. In the US, in 1997 venture capitals invested a record, US $11.4bn in nascent companies. According to Venture One, a venture capital fund based at San Francisco, CA: (i) the surge in investments represented a 16% increase over 1996 and (ii) venture capitalists invested in 1848 companies over the year, 162 more than in 1996.

The prosperity of many Australian technology can be directly attributed to venture capitalists. As per the findings of Price Waterhouse Coopers on Companies in the development/expansion stage shows that

a) Employment at an average annual rate of 9.5 per cent between 993 and 1997

b) Sales at an average rate of 12.1 per cent

c) Profits at 34.9 per cent

d) Exports at 15.25

In Taiwan Hsinchu Park and Industrial Research institute illustrate the successful venture capital policy.

a) Hsinchu Park has 3000 expatriates. Facilities include a bilingual school and 2 technical universities.

b) Technology bought from RCA for IC fabrication in 70's by the Industrial Research institute led to the formation of UMC and TSMC, the world's largest IC makers.

c) Legal, regulatory, institutional and tax system mimics US.

Taiwanese capital is now a significant force in Silicon Valley.

In Israel, office of the chief scientist was set up in 1984 to encourage private investment in R&D projects with the risks shared by the government. The salient features are:

a) Funding upto $250,000 with repayment linked to revenue

b) BIRD foundation a U.S.–Israel joint venture finance private joint ventures on a risk-sharing basis, with average investment of $1.2m. Now all the top 10 VC firms in Israel are U.S. owned

c) 26 incubators set up

The concept of incubators plays a vital role in creating an environment for fostering innovation as seen in the example of US, Israel and Taiwan. Ideal incubators allow for beginning entrepreneurs to receive for-profit support from venture capitalists. The support, given in return for an equity stake, would include a productive office environment, expert advice, finance, complementary resources etc. The knowledge

software professionals grew by 14 per cent in 1997 and able at a comparatively low cost. The strength of the qualified English speaking skilled manpower avail- in India. India has the second largest pool of technical- tremendous latent potential of skilled manpower supply Oil, India is to software professional". There is a terms. As has been aptly put ''What Middle East is to cent in rupee terms and 55 per cent in U.S. dollar counted for Rs. 35.1 billion. Exports grew by 67 per counted for Rs. 65.3 billion while domestic market ac- by 58 per cent on a year to year basis. Exports ac- 100 billion mark turnover during 1998. The sector grew (NASSCOM) the Indian software sector crossed Rs. Association of Software and Services Companies tal industry. As per the estimates of National tors, which have tremendous potential for venture capi-

Information technology and software are the sec-

come tomorrows' entrepreneurs.

management experts who have the potential to be- equivalent. All these institutes together produce 40000 more than 400 business schools offering MBA or its graduates of international class. In addition, there are IIMs produce on an average 250 management successful software companies in India and abroad. and computer engineering that helped them to set up Many engineers specialise in information technology period of time convert themselves into entrepreneurs. engineering students graduate. Many of them over a level engineering colleges. Every year a few lakhs of ment of India has also set up many regional and state- and management respectively. In addition the Govern- excellence for education in the fields of engineering stitute of Management (IIMs) are known as centres of Indian Institute of Technology (IITs) and the Indian manpower in the world. Some of the institutes like the The country has the largest scientific and technical

Venture capital industry in India

scale investment funds from abroad.

South Korea, India, Malaysia and Thailand attract large- the country's GDP with similar figures in Singapore and The Venture Capital pool in Hong Kong is 5.5% of

creative ideas are generated.

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is a vast potential in the venture capital industry. entertainment, media and service sectors for which there number of potential professionals in the field of software, within and outside India are well known. There are a Indian technocrats in the field of information technology destinations for investments. The success stories of the biotechnology and service industries are the three major operationalise their activities in the country. Software, presence and there are many intents which would like to Offshore venture capital funds are increasing their capital funds to come forward and set up new funds. phase. India can expect many more domestic venture industry in India undoubtedly leads to a major growth attached by the government to the future, venture capital qualified human resources in the country and the thrust

Considering the vast potential of highly technically

total economic activity of the country. indication of the importance of the industry in the per cent of the total market capitalisation. This is an 1999. Software industry accounts for more than 16 India is approximately Rs 750 billion as on October panies listed and traded on all the stock exchanges in The total market capitalisation of all the software com- industry in all the developed and emerging countries. years. Information technology is the fastest growing 12 to 15 per cent per annum for the next 5 to 7

The global software sector is expected to grow at

years. likely to maintain the momentum for the next 3 to 5 three years growth has picked up commendably and is past, domestic market lagged export growth, in the last per cent of the size of software exports. Though in the fiscal year 1997-98 is also quite large which is about 60 Domestic software market estimated at Rs 35 million in constitute a quarter of India's exports by the year 2005. dustry will employ about 1 million professionals and As per the current estimates, Indian software in-

growth. therefore can continue to have a manpower led meets the global demand. Indian software industry 60,000 software professionals each year, which hardly and beyond. India has the capacity to supply about Japan, USA, Germany, UK and France in the year 2000 estimated 2 million programmers are required by power in the software sector continues to surge. An has touched 160,000. Meanwhile the demand for man-

Government of India has also set up technology parks in few cities of the country. The infrastructure facilities are provided by the government at a specified and earmarked area of a city. Entrepreneurs and researchers are encouraged to set up their enterprises and also experiment with their ideas in these parks. Many progressive states such as Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka have set up software and industrial parks in many of their cities. The state governments provide all the infrastructure facilities to entrepreneurs who can go there and set up their enterprises with minimal investments. Software parks attracted large number of first generation engineer turned entrepreneurs to set up companies. Some of these states encouraged information technologists and reaped benefits.

RBI also set up a working group under the leadership of the State Bank of India with a task of framing fresh guidelines for extending working capital finance to various types of software units. The credit policy of RBI for the year 1999-2000 further emphasised the need for venture capital. The credit policy has relaxed overall ceiling of investment by banks in ordinary shares, convertible debentures of corporate and units of mutual funds etc, which is currently at 5 per cent of their incremental deposits that will stand automatically enhanced to the extent of banks' investments in venture capital. It has also been decided to include investments in venture capital in priority sector lending.

The Government of India has an initial corpus of Rs 1 billion for the purpose of setting up a separate venture capital fund for promoting information technology industry. Small Industries Development Bank of India (SIDBI) has been appointed to manage this fund. Department of Electronics will contribute Rs. 0.30 billion and SIDBI Rs. 0.40 billion and the rest will come from other institutions. It is estimated that information technology industry needs U.S. $500 million over the next 5 years.

The National Association of Software and Service Companies (NASSCOM) is planning to set up a Rs. 0.25 billion venture capital fund exclusively for the engineers of premier institutes such as IITs so that start-up capital will be available for the students of MIT and Stanford in the U.S.A.

SIDBI on its own is setting up a U.S. dollar denominated venture capital fund to finance small information technology companies. The fund is expected to have a corpus of U.S. $10 million. Another notable thing is India's vast population to the tune of around 1 billion, which provides for a vast market for consumables and its retailing.

Summary

Venture capital industry in India is in its growth phase. Large numbers of domestic offshore and private equity funds have been continuously increasing their activity in the venture capital activity. The Government of India and SEBI are seriously making attempts to facilitate more and more venture capital funds to flow into the country. Economic and securities market reforms are ideally placed to attract new venture capitalists within the country and from abroad. The venture capital industry is poised for tremendous growth in the years to come.

Venture capital can play a very important role in the growth of the Indian economy particularly in the sectors where knowledge and ideas can play a catalytic role. If properly backed by timely start-up capital provided by the venture capitalists, these ideas can be turned into creation of wealth and overall economic development of India on an unprecedented scales in the 21st century.

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Venture Capital: Concept, Project Evaluation & the Indian Scenario

Mahim Bisht

Right from the invention of money to development of banks and NBFCs it has been a long chain of evolution. As complexities of economies have grown, new institutions have sprung up to bridge the gap and meet the requirements. The genesis of venture capital is one in the series. A venture capitalist can be described as a 'probability lender'. He lends on ideas, the drive of the entrepreneur and his own assessment of the final product and market. In the USA, where the concept is most developed, 3 out of 10 ventures succeed. But seven fail. Actual Lending by venture capitalists is in different stages at various steps of implementation.

Today, after over a decade of venture capital financing in the country, the stirrings of change are at last beginning to show. From state government initiatives like the one by the Karnataka government, which set up a Rs. 15 crore venture fund to fund for techno-entrepreneurs. Private sector has also come up with funds. Though the whole concept is still on the runway, but it will fly.

Operational Procedure

What do venture capitalists look for. Most venture capitalists will stress on single quality: vision—and the ability to translate that into reality. And since a business does not run on the basis of one person alone, the ability to attract a quality team, who will stay loyal. The venture capitalist tries to first judge whether the money will go to a person of integrity, financial acumen and the energy to build something, to stick it out through thick and thin.

> **The venture capitalist tries to judge first whether the money will go to a person of integrity, financial acumen and the energy to build something, to stick it out through thick and thin.**

Venture capital is a child of the modern era but has its fundamentals in the oldest of drives, the entrepreneurial skill. For decades, new ideas and capital remained on a parallel track. It flummoxed would-be entrepreneurs and killed thousands of potentially great ideas. For every Microsoft, every Nirma that blossomed, a dozen could-have-been-spectacular ventures, died young. For decades, financial institutions insisted on collateral security and surefire guarantees from a would-be-entrepreneur, and the dream of running one's own business was just locked away.

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out through thick and thin. In short, fire in the belly must be all-consuming.

The hard-nosed venture capitalist also knows that a business plan can look ballistic on paper, but it could end up being unviable. In other words, keep your plan flexible. If Plan A fails to materialise, you should have Plan B and possibly Plan C as a back-up. You might never use them, but the flexibility of your planning can inspire confidence in a potential investor. Before you approach a venture capitalist make sure your business plan is a well thought out one. Business plan most often fail because they do not pay attention to fundamentals like an analysis of the market place, or an understanding of the competitive landscape.

Identify the stage of your business that you need the finance for before you pitch your case to an investor. Typically, every start-up business requires funding in four different tranches. Seed-level financing takes care of initial establishment. Second-level or mezzanine funds come next, and then another stage depending on the expansion of the business.

What can you expect from a venture capital company before it invests?

The job of the venture fund manager is to place investments for his clients in business that are, theoretically, riskier than other types of investments. The seeker for ventura funds must have a positive attitude but be prepared for rejection.

Traits venture capitalist looks for

Despite the fact that all four levels of funding can be in the form of equity finance of venture funds, you need to identify the right source for each stage. "Let's face it: there is little or no zero-stage financing in the Indian venture industry at the moment." Investors park their funds more confidently in a company with a record, which gives them a basis to expect a return on their investment. Yet, zero-stage funding is still done by only a handful of dedicated fund managers.

"The trouble in funding fresh projects is that the promoter is more often than not interested in getting his investment back of making money before the project really takes off." This explains why venture funds are particular about 'promoter credibility'.

"Venture capitalists prefer the promoter to hold 10-24 per cent in the initial stages, although it can increase later". The institution also provides interest-free loans if the promoter has a shortfall in funding his equity stake.

The primary focus in intellectual capital: whether the promoter really has an innovative and commercially viable idea, and needs finance till the business becomes self-sustaining.

Where to look and what to expect

Where is all the venture capital people talk about? It's there; just not where most people look. The reason is that most 'venture capital companies' really want to provide capital, often on a secured debt-like basis, to established businesses with profitable operating histories. That is not true venture capital. True 'venture capital' is capital that is used to help launch the products, the ideas and the entrepreneurs of tomorrow.

The risk associated with true venture capital is greater than when providing capital to an established business. Despite the best efforts and inventions, some start-ups will not succeed. In today's market, though, especially if dealing with highly leveraged corporations, we have seen there is substantial risk associated with well established businesses as well as with start-ups.

> **The risk associated with true venture capital is greater than when providing capital to an established business.**

Despite the fact that many fund managers will say that inadequate management is the primary reason for business failure, they will rarely devote time to assist management to help achieve a greater likelihood of success. Consequently, some investments are destined to fail from the start; and many firms use everyone else's failures as a reason for them to avoid start-ups.

Many companies and individuals complain that they have money to invest in "good" projects, but none can be found. First, what is "good" for one person or firm may not be "good" for another. The definition is guided by goals and requirements of the individual investor? An older investor may be looking for income while a younger investor may be looking for appreciation. Often, those goals are unrealistic as applied to venture capital.

What kind of investments do venture capital companies look for?

- 3 to 5 Year Exit Business that have the potential to grow very quickly and to either go public in 3 to 5 years or be sold in that same period. In other words, venture capital companies look for

From the outset, keep in mind that your goals may not be the same as the venture capitalists. Your first and

> **Venture capitals will generally give you the opportunity to succeed without interference until the situation seriously jeopardizes their investment.**

investments they can be out of in 5 years. They may ultimately decide to stay in, but that's something to be considered at a later date. If your goal is a closely-held business for your family and future generations, venture capital may not be appropriate.

• 5X-7X Returns. Within that 3 to 5 years, a venture capital firm wants to have the opportunity to make 5 to 7 times its investment from a combination of profits and appreciation realizable through a public offering or sale. If you have a retail store and you want to expand into the space next door so you can increase your sales by 15-20 per cent, as satisfactory as this may be to you, venture capital may not be appropriate if neither the income nor the realistic potential to go public and generate a 500-700 per cent return in 3 to 5 years are present.

Good management. This may sound obvious, but to a family owned and operated business, or a business operated by its founder, it may be a little unnerving to hear that the venture capital company wants different management. One of the most important and difficult transitions a family operated business can make is to professional management; and whether or not the owners want to make this transition is a key decision that should be made prior to seeking venture capital.

To give up a large share of your business. Some-times demanding as much as 70 per cent of your business, venture capitals will generally give you the opportunity to succeed without interference until the situation seriously jeopardizes their investment. Also, success in achieving the established goals and stand-ards could result in their interest being diminished and your regaining a larger share of the business. Why would you want to give up such a large share of your business? If your business does truly have the potential to yield a 500-700 per cent return to the venture fund in 3 to 5 years, the return to you, even with 30-50 per cent of the business, will be much more than you would have made by keeping 100 per cent and not having the additional capital to grow.

most important decision is to decide whether you can compromise what you want to satisfy them. Since venture capital companies have no shortage of business seeking their money and, as discussed above, do not want to expose themselves to suits for negligence, it is not likely the venture capital firm will compromise what they want.

Indian Scenario

There has been an increase in the pool of funds available for venture capital activity to Rs. 29,884.04 million from Rs. 25,595.17 million 1997. Investments have gone up to Rs. 12,559.85 million in 728 projects from Rs. 10,000.46 million in 691 projects in 1997. Average investment per project has increased to Rs. 17.25 million in 1998 from Rs. 14.47 million 1997. There has been an average increase of almost 20 per cent in the project size from the previous year.

Pool of Venture Capital funds in India

Contributors	1998	
	Rs. Million	%
Foreign Institutional Investors	15,178.05	50.79
All Indian Financial Institutions	7,727.47	25.86
Multilateral Dev. Agencies	2,298.63	7.69
Other Banks	1,709.76	5.72
Other Public	725.32	2.43
Private Sector	623.61	2.09
Public Sector	442.14	1.48
Nationalised Banks	433.67	1.45
State Financial Institutions	365.00	1.22
Non-Resident Indians	313.39	1.05
Insurance Companies	62.50	0.21
Mutual Fund	4.50	0.01
Total	29,884.04	100.00

Investment by Stages of Financing

Rs. 5,146.40 million, which is almost 41 per cent of the total venture capital investment of Rs. 12,559.85 million, has been invested in start-up projects, followed by Rs. 4,478.60 million in later stage projects, Rs. 2,208.39 million in other early stage projects and only Rs. 82.95 million in seed stage projects.

The average amount of investments per project around projects.

make an interesting study. It is Rs. 8.04 million per project in the seed stage, Rs. 9.21 million per project in the turnaround stage Rs. 14.50 million per project in the start-up stage and Rs. 18.72 million per project in the other early stage and Rs. 26.98 million per project in the later stage. This shows that the average investment per project is the maximum in the later stage. This is as expected, since later stage projects generally require larger amounts of finance. Seed stage investments generally require smaller investments per project. These averages also show that not only are the number of investments in turnaround projects minimal, the amounts of investments in such projects are also very little, further supporting the theory that venture capitalists are generally not keen to fund turnaround projects.

Investment by Industry

As in the previous year, the maximum investment has been made in industrial products and machinery followed by investment in computer software and service. There is one interesting change here compared to the previous year. In 1998 the total of the investments in computer software and hardware put together exceeds investments in industrial products and machinery. In the previous year, the total investment in industrial products and machinery exceeded that in the computer industry. This is a clear indication that investment in the IT industry, as a whole in attracting greater attention, compared to other industries. This is in keeping with global trends.

Industry	1998	
	Rs. Million	Number
Industrial Products and Machinery	2,956.67	219
Computer Software Service	2,508.87	100
Consumer Related	1,381.49	52
Medical	817.48	47
Computer Hardware Systems	735.41	30
Food and Food Processing	718.56	50
Tel. and Data Communications	471.89	18
Biotechnology	448.77	27
Other Electronics	426.06	40
Energy Related	229.56	18
Other	1,865.09	127
Total	12,559.85	728

Industry wise Investment

Investment Stages	1998	
	Rs. Million	Number
Start-up Stage	5,146.40	355
Later Stage	4,478.60	166
Other Early Stage	2,208.39	118
Seed Stage	643.51	80
Turnaround Financing	82.95	9
Total	12,559.85	728

Investment by stages of Financing

Venture Capital will, in my perception, become a major source of financing for all greenfield projects. That will be the right way to go. Risk and return will be correlated and a new breed of investors will emerge. □

Issues Facing the Indian Venture
Capital Industry

Shashank Rajurkar

In spite of the fact that Indian venture capital industry is only a decade old, it has nurtured nearly 1000 ventures mostly in SME enterprises. However, full potentialities of VC industry have not yet been realised. In the present paper issues facing Indian VC industry such as fund limitations, lack of incentives, domestic verus overseas competitions on funds anomalies in SEBI and CBDT regulations, sweat equity and ESOP are discussed.

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The Indian venture capital (VC) industry is just about a decade old industry as compared to that in US and Europe. In this short span it has nurtured close to 1000 ventures, mostly in SME segment and has supported budding technocrat/professionals all through. The VC industry, through its investments in high growth companies as well as companies adopting newer technologies backed by first generation entrepreneurs, has made a substantial contribution to economy. In India, however, the potential of venture capital investments is yet to be fully realised. There are around 30 venture capital funds which have garnered over Rs. 5000 crores. The venture capital investments in India at Rs. 1000.05 crore as in 1997, representing 0.1 per cent of GDP as compared to 5.5 per cent in countries such as Hong Kong.

> The VC industry, through its investments in high growth companies as well as companies adopting newer technologies backed by first generation entrepreneurs, has made a substantial contribution to economy.

Issues

The Indian venture capital industry, at present, is at crossroads. Following are the major issues faced by this industry:

Limitations on structuring of Venture Capital Funds (VCFs): VCFs in India are structured in the form of a company or trust and are required to follow a three-tier mechanism — investors, trustee company and AMC. A proper tax-efficient vehicle in the form of 'Limited Liability partnership Act', which is popular in USA, is not made applicable for structuring of VCFs in

India. In this form of structuring, investors liability towards the fund is limited to the extent of his contribution in the fund and also formalities in structuring of fund are simpler.

Problems in raising of funds: In USA primary sources of funds are insurance companies, pension funds, corporate bodies etc.; while in India domestic financial institutions, multilateral agencies, state government undertakings are the main sources of funds for VCFs. Allowing pension funds, insurance companies to invest in the VCFs would enlarge the possibility of setting up of domestic VCF. Further, if mutual funds are allowed to invest upto 5 per cent of their corpus in VCFs by SEBI, it may lead to increased availability of fund for VCFs.

Lack of incentive to investors: Presently, high net worth individuals and corporate are not provided with any investments in VCFs. The problem of raising funds from these sources further gets aggravated with the differential tax treatment applicable to VCFs and mutual funds. While the income of the Mutual Funds is totally tax exempted under Section 10(23D) of the Income Tax Act. Income of the domestic VCFs which provide assistance to small and medium enterprise is not totally exempted from tax. In absence of any incentive, it is extremely difficult for domestic VCFs to raise money from this investor group that has a good potential.

Absence of 'angel investors': In Silicon Valley, which is a nurturing ground for venture fund financed IT companies, initial/seed stage financing is provided by the angel investors till the company becomes eligible for venture funding. Thereafter, Venture capitalist through financial support and value-added inputs enables the company to achieve better growth rate and facilitate its listing on stock exchanges. Private equity investors typically invest at expansion/later stages of growth of the company with large investments. In contrast to this phenomenon, Indian industry is marked by an absence of angel investors.

Limitations on investment instruments: As per the section 10 (23FA) of the Income Tax Act, income from investments only in equity instruments of venture capital undertakings is eligible for tax exemption; whereas SEBI regulations allow investments in the form of equity shares or equity related securities issued by company whose shares are not listed on stock exchange. As VCFs normally structure the investments in venture capital undertakings by way of equity and convertible instruments such as Optionally/Fully Convertible Debentures, Redeemable Preference share etc., they need tax breaks on the income from equity linked instruments.

Harmonisation of SEBI regulations and income tax rules of CBDT would provide much required flexibility to VCFs in structuring the investment instruments and also availing of the tax breaks. Thus investments by VCFs by instruments other than equity can also be qualified for Tax exemptions.

> **Harmonisation of SEBI regulations and Income tax rules of CBDT would provide much required flexibility to VCFs in structuring the investment instruments and also availing of the tax breaks.**

Domestic VCFs vis-à-vis Offshore funds: The domestic VCFs operations the country are governed by the regulations as prescribed by SEBI and investment restrictions as placed by CBDT for availing of the tax benefits. They pay maximum marginal tax (35%) in respect of non exempt income such as interest through Debentures etc., while off-shore Funds which are structured in tax havens such as Mauritius are able to overcome the investment restriction of SEBI and also get exemption from Income Tax under Tax avoidance treaties. This denies a level playing field for the domestic investors for carrying out the similar activity in the country.

Limitations on industry segments: In sharp contrast to other countries where telecom, services and software bag the largest share of venture capital investments, in India other conventional sectors dominate venture finance. Opening up of restrictions, in recent time, on investing in the services sectors such as telecommunication and related services, project consultancy, design and testing services, tourism etc. would increase the domain and growth possibilities of venture capital.

Anomaly between SEBI regulations and CBDT rules: CBDT tax rules recognise investment in financially weak companies only in case of unlisted companies as venture investment whereas SEBI Regulations recognise investment in financially weak companies as venture investment irrespective of their listing status. If investment in financially weak companies offers an attractive opportunity to VCFs, the same may be allowed by CBDT for availing of tax exemptions on capital gains at a later stage. Also SEBI regulations do not restrict size of an investment in a company. However, as per Income tax rules, maximum investment in a company is restricted to less than 20 per cent of the raised corpus of VCF and paid up share capital in case of Venture Capital Company. Further, investment in company is also restricted upto 40 per cent of equity of investee

company. The investment restriction for VCFs may be placed by way of maximum equity stake by VCFs in the company, which could be upto 49 per cent of equity of the investee company.

Limitations on exit mechanism: The VCFs which have invested in various ventures have not been able to exit from their investments due to limited exit routes and also due to unsatisfactory performance of OTCEI. The threshold limit placed by various stock exchanges acts as deterrent for listing of companies with smaller equity base. SEBI can consider lowering of threshold limit for public issue/listing for companies backed by VCFs. Buy-back of equity shares by the company has been permitted for unlisted companies, which would provide exit route to investment of venture capitalists.

Limitation on application of sweat equity and ESOP: in the US, an entrepreneur can declare that he has nothing much to contribute except for 'intellectual' capital and still he finds venture capitalists backing his idea with their money. And when they come together, there is a way to structure the investment deal in such a manner that the entrepreneur still can ensure a controlling stake in the venture. In the US, the concept of par value of shares does not exist that allows the different equity contributors investing at different par value shares. Absence of such mechanism puts limitations in structuring the deals.

Further, as per present Tax structure in India, sweat equity and ESOP issued to entrepreneur and employees gets taxed twice at the time of acquisition and divestment. Tax incidence at two points involving undue hassles to allottees of sweat equity and ESOP. Further, taxing the sweat equity, as a per-quisite in its income, to the extent of 33 per cent defeats the entire purpose of its issue.

Legal framework: Lack of requisite legal framework resulting in inadequate penalties in case of suppression of facts by the promoters – results in low returns even from performing companies. This has bearing on equity investments particularly in unlisted companies.

Conclusions

Notwithstanding these issues faced by the Indian venture capital industry today, the industry is surging ahead. The recent time has seen industry maturing in India with increased focus towards industry specific funds. The industry also saw launch of smaller funds and big equity funds to cater to different segments. The vibrancy of the Indian entrepreneurship, market opportunities for small and medium ventures and encouragement by the Government give rise to optimism on the future of venture capital in the country.

□

Policy & Legal Framework for Venture Capital Industry in India

Rajeev Mukhija

The present paper outlines the policy and legal framework for venture capital industry in India. It examines two such policy instruments viz. 1987 Guidelines and the 1996 SEBI/CBDT compliance rules for the operation of venture funds. Furthermore, the important issues of disinvestments and exit mechanisms are dealt with.

Venture Capital activity started in India during late eighties and the mechanism for its operation issued in 1987 as Guidelines for Venture Capital. The concept of venture capital investments was a logical sequence to seed capital investments offered by public financial institutions for broadening entrepreneurial base in the country by mainly providing finance to technology oriented projects promoted by first generation technocrat promoters. The focus of investment guidelines was on enterprises where the risk element was relatively high due to technology involved being relatively new, untried or very closely held. The venture capital envisaged as small projects costing less than Rs. 10 crores. However, with repealment of Capital Issues (Control) Act, these guidelines were repealed in 1992.

VCF Regulations

The Securities Exchange Regulation Board of India (SEBI) by Act, 1992, SEBI interalia regulated venture capital industry. It issued SEBI (Venture Capital Funds) Regulations, 1996 venture capital industry, which are applicable till date. Govt. also replaced concessional tax treatment for capital gains envisaged under CCI guidelines with tax exemption for VCCs/VCFs on dividend and capital gains income subject to compliance of CBDT rules. The highlights of SEBI regulations and provision of income tax act applicable to Venture Capital Funds are depicted in Table 1 below.

The policy and legal framework for venture capital funds can be summarised as under:

(a) SEBI is the regulating authority for venture capital industry.

(b) Venture Capital Funds can be constituted as Trust Fund or Company. Separate vehicle for constitution and operation of venture funds such as limited liability partnership is yet to be introduced in the country.

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(c) Any company or trust proposing to undertake venture capital investments is required to obtain certificate of Registration from SEBI.

(d) Venture Capital Funds before raising any funds for investment are required to file placement memorandum with SEBI. Private placement memorandum can be issued only after expiry of 21 days from submission to the SEBI.

(e) Venture Funds can raise funds for investment through private placement route. Individual investor is required to invest minimum of Rs. 5 lakhs in venture capital fund. Raising of funds om public is restricted.

(f) Venture capital funds are required to invest 80 per cent of funds raised in equity or equity related securities issued by companies whose securities are not listed or financially weak companies.

Table 1: Venture Capital Funds Regulations

As per SEBI Regulations	As per Provisions of Income Tax Rules	Remarks
Scope and Definitions		
Venture Capital Fund		
Fund established in the form of a company or trust which raises monies through loans, donations, issue of securities or units as the case may be or makes or proposes to make investment as per SEBI regulations.	VCC or VCF operating under trust deed registered under Registration Act, established to raise monies by the trustees for investment mainly by way of acquiring shares of venture capital undertakings in accordance with the prescribed regulations.	Income tax provisions require registration of trust deed.
Venture Capital Undertaking		
Venture Capital undertaking not defined.	It is defined as a domestic company whose shares are not listed on stock exchange in India and which is engaged in manufacture or production of notified articles or things.	For availing income tax exemption, venture funds are required to invest in companies engaged in manufacture or production of notified products/articles. Alternatively venture funds are required to invest in domestic companies.
Investment norms		
VCF barred from investment in any company or institution providing financial services. At least 80% of funds raised by VCF shall be invested in equity shares or equity related securities issued by company whose shares are not listed on recognised stock exchange. In Equity shares or equity related securities of financially weak companies whose securities may or may not be listed on recognised stock exchange.	In case of VCF, 20% of monies raised be invested in the year and when exemption is first sought. 50% of monies raised be invested in succeeding year. 80% of monies raised be invested in next succeeding year. In case of Companies 20%, 50% and 80% of total paid up capital has been referred.	No time frame for achieving investment levels has been prescribed under SEBI regulations. Norms regarding achieving investment levels upto 20% and 50% of the fund were relaxed later.
Minimum investment under VCF		
Not less than Rs. 5 lakhs from any investor.	Not prescribed.	No minimum investment by investor in VCF/VCC is prescribed under CBDT rules.
Minimum holding period for investment		
Not prescribed.	Atleast 3 years. However, minimum holding period of 3 years is not applicable if investee company is listed before completion of 3 years from investment and disinvestment takes place after listing of company.	To claim exemption from income tax, venture funds are required to hold investments for a period of atleast 3 years.
Maximum investment in a company		
Not prescribed.	Not more than 5% of funds raised in case of trust venture fund and of paid share capital in case of venture capital company can be invested in single venture. VCF cannot invest more than 40% of equity of invested venture.	No maximum restriction has been imposed on the size of investment as per SEBI regulations. The prevalent 5% limit has now been increased to 20%.

Disinvestments and exit mechanism in Venture Capital Business

Disinvestments and exit mechanism are among the most important aspects of venture capital industry. The success of venture capital activity largely depends on envisaging efficient exit mechanism from investments and successful implementation of dis-investment. An efficient exit plan enables venture investors to get appropriate returns on investments. The

> **The success of venture capital activity largely depends on envisaging efficient exit mechanism from investments and successful implementation of dis-investment.**

Venture capital funds are barred from investing in company or institutions providing financial services.

(h) Venture capital funds which desire to claim exemption from income tax, are required to follow rules given hereunder:

* Registration with SEBI;

* Claiming income tax exemption in respect of dividend and capital gains income;

* Not more than 40 per cent of equity in a venture;

* 80 per cent of monies raised for investment are required to be invested in equity shares of domestic companies whose shares are not listed on recognised stock exchange;

* Shares of investee companies are required to be held for a period of atleast 3 years. However, these shares can be sold earlier if they are listed on recognised stock exchange in India.

As per recent changes in the provisions of the Income tax Act, Venture Capital investments are required to be restricted to domestic companies engaged in business of (i) software; (ii) Information Technology; (iii) production of basic drugs in pharma sector; (iv) biotechnology; (v) agriculture and allied sectors; (vi) such other sectors as may be notified by the central government in this behalf, or (vii) production or manufacture of any article or substance for which patent has been granted to the National Research Laboratory or any other scientific research institution approved by the Department of Science and Technology.

exit from investment can be envisaged through various routes.

Exit routes

Venture capitalists are supposed to plan exit from venture at the time of investment. The proposed exit plan should have least problems and conform to statutory provisions. Modes by which exit mechanism is generally envisaged, are as under:

(a) *Sale of share on stock exchange after listing share:* Venture capitalists generally invest in ventures at the start-up stage and propose to disinvest their holding after company brings out IPO for raising funds to finance expansion. Consequent listing on stock exchange provide an exit route from investment.

(b) *IPO/Offer for sale:* Venture capitalists may also disinvest their holding through offer for sale to public. This route is often preferred where venture is successful and its internal generations are adequate to meet immediate fund for expansion. Therefore, no IPO is envisaged and instead part of existing equity is offered for sale. In such case, however, investee company should have equity not less than minimum threshold limit for listing and atleast 25 per cent of equity is offered for sale.

(c) *Strategic sales:* At times, venture capitalists disinvest their holding in ventures to strategic investors who may have some kind of synergy of their own business with companies they propose to invest. Arrangement is generally worked out where promoters dis-invest their substantial holding and remain associated with ventures professionals.

(d) *Buy-back of equity by company:* Recently, companies (Amendment) Act, 1999 has allowed companies to buy its own equity shares. Eventhough venture capitalist may not intend to exit through this route, they may consider it as the venture has failed to achieve high growth and the return from the investment is likely to be low/average.

(e) *Promoters buy back:* Promoters buy-back is not generally a preferred route for exit from investment. Venture capitalists consider it as an exit option where promoters are in a position to mobilise funds for buy-back of equity held by venture investors. This option is normally exercised where growth of venture is low/average and returns from investment are also likely to be low/average.

Issues in exercising exit option

In India, venture investors have generally failed to envisage and implement exit from investments successfully due to various reasons. Failure to get exit route from the investment, has often been seen as one of the major hurdles in the growth of venture capital industry, It is in this context, the issue of exit mechanism is being examined.

The problems faced in exit from investment by venture capitalists in India can be cited as under:

(a) *Threshold limit for listing:* Potential for exit has also been affected due to minimum threshold limit of Rs. 5 crores at NSE and Rs. 10 crore of BSE on these stock exchange. At times, companies having small equity base cannot list shares on exchanges. Venture capitalist in such case hardly has an exit option from investment.

(b) *Formalities involved in sale of venture:* Formalities involved in sale/transfer of venture have also restricted smooth exit for venture capitalists. At times, the promoters and venture capitalist join together to groom venture from start up stage to expansion stage with policy of 'Drag along tag along'. However, in such case, they find it difficulty in selling/transferring the venture pending completion of numerous procedural formalities.

(c) *Stock market support:* The movement of Indian stock markets have so far been not rational. The share price movements are generally driven by sentiments and have low fundamental support for the company. Therefore, investors fail to realise the value investments in the former case, while in other cases they could get bounty not supported by the intrinsic worth of investment. Under such scenario, venture capitalists fail to realise the true worth of investment.

(d) *Weak legal framework:* India has weak legal framework which hardly discourages entrepreneurs from committing willful contravention of terms agreed with venture investors. In such cases, venture investors find it difficult to seek legal remedy for exit from investment giving the consideration.

(e) *Under developed market for mergers and acquisitions:* The mergers and acquisitions in India are not very popular due to conservative mindset of promoters to retain control on venture can lack of intent to maximise shareholders wealth. As such, few of the ventures ripe for merger and acquisition don't find favour and

venture capitalists find difficulty in exiting from investment.

Pre-requisite for the efficient exit mechanism

Having examined the exit routes available to venture investors and problems faced in exiting from investment, pre-requisites for efficient exit mechanisms for venture capital investors are as follows:

(a) *Efficient Stock market:* In order to provide a suitable mechanism for exit route to the venture investors, it is desirable that the country has efficient stock markets which have adequate transparency, adequate disclosures and strong systems for expediting transactions/deals. The stock price movements are driven more by the performance and less by the sentiments. The prices become more a function of their intrinsic worth and growth potential of companies and less of euphoria and misplaced sentiments.

> The stock price movements are driven more by the performance and less by the sentiments. The prices become more a function of their intrinsic worth and growth potential of companies...

(b) *Mechanism for listing of equity by companies with low equity base:* While the threshold limit for listing of shares on the recognised stock exchanges is Rs. 5 crores, the mechanism for listing of shares of companies with low equity base is also envisaged. In India, setting up of OTCEI was a step in this direction. However, due to various reasons, activities of OTCEI remained low and it could hardly meet its objectives. Therefore, it is necessary to take adequate steps whereby the functioning of OTCEI can be made operational. This will provide exit route to investors including venture investors in small equity base companies.

(c) *Legal frame work:* In view of weak legal framework in India and hassles in resolving disputes as per terms of investment agreed by promoters, it may be desirable to provide a dedicated legal mechanism for settlement of any disputes arising out of matters relating to investment by private equity/venture investors.

(d) *Facilitate smooth transfer/sale of ventures:* In order to provide exit by way of strategic sales to the venture investors, it is desirable that

sale/transfer of ventures may be facilitated without undergoing numerous procedural formalities so as to ensure that sale or transfer of ventures/holding is expedited at a price which matches its intrinsic networth.

Conclusions

It may be mentioned that the entire spectrum of policy and legal framework for venture capital fund originates SEBI (Venture Capital Fund) Regulations 1996. Further, venture capital funds can claim exemption in respect of dividend and capital gains income as per the provisions of 10 (23) FA of Income tax act and comply with the prescribed guidelines.

The efficient exit mechanism is desirable to ensure that disinvestment by venture investors is carried out at a price matching the real net-worth of the investee company as per exit plan envisaged at the time of investment. This will increase the confidence level of the venture capitalist and other investors giving boost to the venture capital investment in the country and making them an engine for growth of the economy. □

Venture Capital Development in India

I.M. Pandey & Shantanu Dutta

Venture capitalists supply funds to new high risk, not necessarily high-tech ventures and also extend management and marketing supports. Seldom they concentrate on the posteriori development of venture capital firms in India; this is discussed in the present paper. Three case studies of venture capitalists, viz. TDICI, GVFL and Canfina-VCF are presented. Generally they do not like to venture into frontier and high-risk technologies. VCFs are basically equity financing mechanisms. Criteria for selection and performance evaluation of firms receiving venture capital funds are enumerated.

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The concept of venture capital in the sense of risk or start-up capital is quite old in India. This sort of capital has been made available for establishing new business, and financing later developments, by friends, relatives and family members for centuries. The history of modern venture capital in India is not very old, which started in mid '80s. Like many other Asian countries, in India as well, at the government policy level, venture capital is defined in terms of technology financing. For example, in India, tax and other incentives are given to venture capitalists only when finance is provided for high-tech ventures. In practice, most venture capitalists in India, however, follow a flexible and broad approach to venture capital. Venture capitalists supply funds to new, high risk, not necessarily high-tech ventures, and also extend management, marketing and financial skills to the assisted firms. In the Indian context, the concept of venture capital may be defined as investment in the form of equity, quasi-equity and/or conditional loan, made in new, unlisted, high risk or high-tech firms, started by technically or professionally qualified entrepreneurs, where venture capitalists

- expects the enterprise to have a very high growth rate,

- provides management and business skills to the enterprise,

- expects medium to long term gains, and

- does not expect any collateral to cover the capital provided (Pandey and Jang, 1996).

> **Venture capitalists supply funds to new, high risk, not necessarily high-tech ventures, and also extend management, marketing and financial skills to the assisted firms.**

There are number of studies on the investment ac-

tivities of venture capitalists in developed countries (Clarke, 1987; Bygrave and Timmons, 1985 and 1992; Fried and Hisrich, 1988 and 1994; Macmillian *et al*, 1985 and 1987; Tyebjee and Bruno, 1984; Wan, 1991; Wilson, 1993). There are few studies in the context of Asian countries (Ray 1991; Ray and Turpin, 1993; Pandey, 1995), particularly the developing countries. But most of the studies have concentrated on the venture investment process and evaluation criteria. The issue of venture capital development process adopted by venture capital firms (VCFs), which will be discussed in this article, is not addressed in most of these studies.

The discussion comprising in-depth case studies will cover the issues of the initiation of venture capital activity, the sources of venture capital fund, the profile of funds, investment strategy and evaluation and the value addition by VCFs. For the case studies, Technology Development and Information Company of India (TDICI), Gujarat Venture Finance Limited (GVFL) and Canfina-VCF were selected. TDICI, sponsored by all-India financial institution, the industrial Credit and Investment Corporation of India (ICICI), is the largest venture capital company in India GVFL has recently emerged as a significant player in the venture capital industry in India. GVFL located in Gujarat, a fast growing industrial state, and is the only promising venture capital company in this state. Canfina-VCF was started by a commercial bank, Canara Bank, and it is an important player in the southern part of India. The cases are analysed on the basis of the data and information obtained from the company reports, brochures, and extensive interviews with the executives of these VCFs. The paper is divided into five parts. Part one gives introduction and objective of the study. Parts two to four analyse three case studies, and part five provides main conclusions of the study.

> **The discussion comprising in-depth case studies will cover the issues of the initiation of venture capital activity, the sources of venture capital fund, the profile of funds, investment strategy and evaluation and the value addition by VCFs.**

Technology Development and Information

Company of India Limited

In the era of economic liberalisation in Indian industry which started in 1980's, new financial products and services were introduced to support the resulting growth in the industrial sector. Technology Development and Information Company of India Limited (TDICI), the first institutional initiative to deliver venture capital to Indian businesses, was established in this milieu.

Initial Initiatives and Constraints

Around 1983-84, the Industrial Credit and Investment Corporation of India (ICICI)[1] was toying with the idea of setting up a venture capital fund. It did some background work, particularly studying the way in which venture capital operates. The idea took shape only in 1985 when the new government came into power at the centre, and it started taking the initiative to liberalise the economy. ICICI management thought that liberalisation was an essential condition for the success of venture capital. An investor of equity looks for market growth, competition, and information for determining the share prices without which he may not be willing to put up his money. Thus in 1996, a venture capital division was set up within ICICI. The activity started with one or two persons, and the division was headed by Mr. K.S. Nadkarni. It took ICICI quite some time to get off the ground. Because, first of all, the management was looking for small- and medium-size business having an investment of Rs. 1-3 million. ICICI had experience of dealing with medium- to large-size companies. It did not have any experience in the SSI (small scale industries) sector. Thus, management did not have an idea about small-size business. Even to talk to the entrepreneurs of the small- and medium-sized firms was an effort on the part of ICICI's venture capital division. Secondly in India, at the time when ICICI started its venture capital division, the cult of equity did not exist. Loans were available from various sources (State Finance Corporations, Industrial Development Corporation, Commercial Banks, etc.), and equity was therefore, not a widely prevalent and favoured instrument. Thus there was initial resistance to the idea of equity participation. The debt-equity ratios were very high, even 2.5:1. Also ICICI did not know how to get out of the equity investment made in SSEs. There did not exist a secondary market for small companies. In those days listing requirement was Rs. 10 million. There was talk of an OTC exchange. When the idea took shape, the listing requirement was raised to Rs. 30 million. So it became very difficult for ICICI's venture capital division. Thirdly, the pricing of equity shares was controlled by the Controller of Capital Issues (CCI), even in the case of private limited companies. Thus, the environment was hostile to the concept of equity investment. Fourthly, the internal problems of

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1. ICICI is a large development finance company in India. It has government, government-controlled banks and private institutions and individuals as its shareholders. It has grown under a private sector environment.

ICICI created constraints for the operation of venture capital. It clearly had a development banking bias. ICICI was charging interest at 14 per cent on its lending, and in structuring their venture capital deals, this was taken as the basis and added 4-6 per cent more. Thus, the venture capital division's expectation was a return of 18-20 per cent. These projects were taken on an experimental basis with the intention of getting out quickly. The ICICI's venture capital division thus went the whole learning curve.

Because of these problems, particularly the low popularity of equity, the venture capital division of ICICI went for a number of non-equity instruments of venture financing. They devised an instrument which was quite actively used for the first 2-3 years, called a conditional loan. Over a period, management realised that the conditional loan was a bad instrument in terms of return for supporting venture capital. So designing of new instruments, trying to understand the market and products. Further, the entrepreneurs were to be convinced in the initial stages of the development of venture capital activity by ICICI. In fact, it took ICICI quite some time to understand the business of venture capital.

> **Over a period, management realised that the conditional loan was a bad instrument in terms of return for supporting venture capital. So designing of new instruments, trying to understand the market and products.**

Establishment of TDICI

TDICI was promoted by ICICI and The Unit Trust of India (UTI)[2] in 1988. ICICI is among the more prominent development banks in India, with assets in excess of Rs. 183 billion (as on March 31, 1995) and over three thousand corporates in its loan portfolio. ICICI pioneered several innovations in the Indian financial market place such as the first credit rating company, the first screen based stock market and first venture capital company. UTI is the largest mutual fund in the country with an investor base of 38 million and funds under management of over Rs. 517 billion. Through its ingenious savings products and astute funds management, UTI has effectively catalysed the flow of retail home savings into Indian corporate equity. As an asset

2. UTI is a government-owned and one of the largest mutual funds in Asia.

management company, TDICI raises capital from a variety of domestic and international investors, constitutes them into distinct pools and deploys them primarily in unlisted companies that do not have easy access to public sources of debt or equity capital.

Investment Philosophy and Strategy

At the core of TDICI's investment philosophy is the quest for extraordinary value. Investment opportunities are identified at an early stage, supportive with reasonably priced capital which provides for equitable sharing of risk and reward between the investor and the management team, and need-based, situation-specific post financing involvement.

The investment team adopts the following structured approach to discover opportunities:

- Identification of industries in high-growth and profitable sectors which can exploit the comparative advantages of the economy in a global context.

- Taking advantage of the powerful business development network to locate and pursue those companies that are well positioned to emerge as leaders in these industries.

TDICI believes that companies are only as good as the management teams behind them. Accordingly, its business is targeted at teams that possess the managerial bandwidth to compete and excel in the global marketplace. TDICI also recognises that in emerging economies there will be numerous business delivering traditional products and services, that can develop into high-growth business opportunities. TDICI invests in such traditional businesses with a sustainable competitive edge.

> **TDICI recognises that in emerging economies there will be numerous business delivering traditional products and services, that can develop into high-growth business opportunities.**

As a successful early-stage private equity investor, TDICI's primary focus is on small- and medium-sized unlisted companies with exceptional growth and capital appreciation potential. These include start-up companies with one to three years of revenue record that require growth financing and companies close to a public offering.

TDICI also participates selectively in some initial public offerings (IPOs) that have the risk and capital appreciation profile of typical venture capital investments. Such offerings are often due to premature public floatation of stocks by Indian companies, taking advantage of certain regulatory provisions. As a rule investments are largely confined to those companies where TDICI can play the role of a significant financial stakeholder and an influential partner.

TDICI's funds are invested across a wide spectrum of industries and across companies at various stages of growth. Particularly worthy of mention is TDICI's understanding of knowledge-intensive sectors such as information technology, biotechnology and healthcare and appreciation of issues involved in financing of small and medium size companies. TDICI is uniquely positioned to invest in this types of situation because of its expertise.

Investments are primarily structured as subscription to equity share capital. Quite often, especially in the case of start-ups or early stage investments, funding is also structured as convertible preference share or convertible loans. Convertible instruments have been useful in providing sweat equity to management teams through performance based conversion (pricing) contracts.

Change in Investment Focus over Time

TDICI had its initial focus on technological investment and this bias was continued for about 1-2 years (Pandey 1996). In 1988 when the TDICI's then president (Mr. K.S. Nadkarni) visited the USA, the venture capitalists there asked him about TDICI's primary objectives. They said if TDICI's primary objective was merely financing technology or the making of money. TDICI's initial focus on technology financing perhaps helped in financing new technologies, but the investment were not profitable (they did not have significant return potential to the investors of venture capital). To some extent TDICI's commercial approach to investment was secondary to technology. That was the learning curve for the TDICI's management.

Today, TDICI is looking at investments as an investor, and in the process, it has been able to support technologies. Today there is great demand for equity. A lot of restrictions have been removed. Debt-equity ratio norm of financial institutions has come down from 2.5:1 to 1:1 or less. Thus there is a great opportunity for the development of venture capital (Pandey 1996).

TDICI can also make portfolio investment in an existing company which is raising funds in the market. From day one it can get quotation in the press. These are companies owned or started by well-established groups. So TDICI's risk profile could be low. However, TDICI has tried to restrict its investment in such companies to 25 per cent of its total investment. It has identified a niche where there is not much competition today, and it has built up certain levels of skills in the organisation. TDICI could easily get profitable business if it decided to act as a merchant bank but that is not its objective. It's major profits are coming from some of the small ventures, not from the bigger companies. It has been able to make profits from smaller businesses.

Through experience, TDICI learnt how to do business. It has clear focus now, a niche: it shall invest in those small- and medium-sized companies, new or existing, which will be able to raise funds from the financial institutions or go public after some time. What were the reasons for the shifting of TDICI's investment focus? They are:

- There is not much Research and Development taking place in the large organised sector companies in India. Hardly any R&D at the national level is taking place. There is process improvement and upgradation, but no product breakthroughs are coming forth. TDICI initially had discussion with organisations like Indian Space and Research Organisation (ISRO) but unfortunately, it could not support businesses emanating from the technology development of these organisations. There is lack of trust between industry and R&D organisations. Industry does not approach R&D organisations and vice versa. There is no compulsion. In its earlier experience, TDICI found that if it defined its business as technology finance, there were lots of problems. It was not getting enough business because it had narrow focus. For example, it turned down a company which had a good spare business in third-party computer maintenance. It was picked up by another venture capital company and is one of the major player today.

> **There is not much Research and Development taking place in the large organised sector companies in India. Hardly any R&D at the national level is taking place.**

- Another major problem is the risk involvement with a technology based innovative project. After all TDICI has to think of its own

profitability. Hence it is not prepared to take high risk all the time by investing only in technology based (without track record) projects. From the experience, management has found that the success rate of TDICI with its investee companies is only about 15 per cent, in spite of thorough project appraisal before investment.

TDICI is thus targeting itself to unlisted SMEs. As per the venture capital guidelines (released by the Government of India (GOI) on November 25, 1988), at least 75 per cent of investment must be in such companies and 25 per cent could be put into primary issues. But as per the new guidelines, which was released in 1996, VCFs have to invest at least 80 per cent of their resources in the unlisted companies. So far, TDICI has restricted its exposure to the large companies to 25 per cent of the portfolio. There is no focus as regards the sector or technology for such investments.

Investment Criteria and Risk Assessment of the Project

In the recent years, TDICI has been able to generate a large number of deal, because of its good reputation in the market. However, TDICI is very selective in choosing its investment projects. TDICI accepts only 10 per cent of projects which come to it and rejects 90 per cent. Although TDICI's investment process is subjective, investment is considered on the following parameters:

Management: TDICI looks for a sound management team whose members have an excellent track record. The integrity, commitment, and enterprise of the management team are important factors in their decision making. TDICI first evaluates the entrepreneur. At this stage, it does not even look at the proposal. If it does not get satisfactory feedback on the entrepreneur, it drops the proposal at this stage. The first thing TDICI checks with people known to the entrepreneur is his competence. It always has a direct interaction with the entrepreneur when he comes up with a proposal. He should be knowledgeable about the business he is proposing. Another thing which TDICI looks for is his integrity. It goes to any extent to check this through his colleagues, suppliers, customers, bankers, buyers, etc. Next, entrepreneur's long-term vision is important for TDICI since it is going to make its investment for a long period of time.

Market: TDICI generally looks for a large and rapidly growing market opportunity for its investee companies. TDICI is not interested in companies which cannot grow. At least the company has to be a significant player in a niche market or a moderate to significant player in a large market. If the investee company is looking for a niche market, there should be substantial entry barrier. Overall, the main aim is there should be an expected exponential growth.

Technological Focus: TDICI also considers the stages of technology. If it is completely new, they are very cautious. Because this kind of project could not give expected return in earlier period. However they have invested quite successfully in some of the frontier technologies in India. Microland is an example in this regard, which is a value added reseller of Networking Products. If it is a declining stage technology, TDICI investigates its significance in India and other countries with potential markets. For example, in the era of PC technology, terminals for Mini Super Computers and Mainframes are becoming unpopular. But if a single company can tap the world market for this product, it will have a huge potential. Specially if they can set up their production base in a developing country like India where production cost is expected to be low, they can have a significant influence in the world market.

Competitive Advantage: Long-term competitive advantage that would pose entry barriers to competitors.

Profitability: Potential for above-average profitability (TDICI looks for around 30 per cent after tax return from their investments) leading to attractive return over a four to seven year investment horizon.

After a preliminary analysis, TDICI takes up the detailed evaluation. One important aspect of this evaluation is presentation of the proposal by the promoter to the TDICI executives. The group head, president and the person directly concerned go through the presentation. They try to understand his ideas and ask questions. Then they make a techno-economic evaluation. It takes around 2-3 months in evaluating a project proposal.

TDICI mainly invests in the form of subscription to equity share capital of the company. Exit is planned through sale on the stock markets after the company is listed. TDICI looks for a minimum investment of Rs. 5 million and does not normally invest in excess of Rs. 50 million in any one company.

Value Addition

TDICI attaches a lot of importance to managerial support, monitoring and follow-up of assisted projects. At the implementation stage, it monitors and assists in the physical and financial progress of the project as well as market development initiatives.

TDICI takes special care in the market development of the client's products. It provides help in obtaining potential market contacts. TDICI executives provide the basic management support services, both internally by participating in the meetings of the Board of Directors in their capacity as nominees, and externally by establishing associations with various organisations and agencies.

TDICI also helps its assisted firms in identifying key resource persons. For instance, in one venture an entrepreneur was proficient on the technical side, but lacked marketing skills. TDICI nominated a marketing expert as Director in the entrepreneur's firm. Similarly, in another company a financial expert was deputed to advise and guide the promoter on financial matters. IN some other ventures even technical experts have been appointed to catalyse the development activities. TDICI draws resource persons from academia, industry and other sectors and deputers them in the firms with the assent of the entrepreneurs.

TDICI has institutionalised the process of understanding of the problems of entrepreneurs. It periodically meets entrepreneurs to understand their problems through direct feedback. For example, it organises meetings of owners of assisted companies in order to ascertain technical, marketing, managerial or financial problems they face, and to explore ways to improve its interaction with them. Such meetings help to build up mutual confidence, dispel mistrust and generate several valuable suggestions for TDICI.

Gujarat Venture Finance Limited

Gujarat is a fast growing industries state — located in the western part of India. Historically, Gujarat has thrived on the principles of entrepreneurship, individual and collective risk taking. This has helped in developing a large number of small- and medium-sized companies within the state along with other large companies. The State Government and its agencies have also taken positive and pragmatic policies over the years to give a thrust to the industrialisation.

> **Historically, Gujarat has thrived on the principles of entrepreneurship, individual and collective risk taking. This has helped in developing a large number of small- and medium-sized companies within the state along with other large companies.**

Initial Initiatives and Constraints

The World Bank and Government of India decided to select Gujarat Industrial Investment Corporation (GIIC) Limited as one of the first four agencies for developing venture capital in India. The others being Canara Bank, Andhra Pradesh Industrial Development Corporation (APIDC), Technology Development and Information company of India Limited (TDICI).

GIIC incorporated a new asset management company on 2nd July, 1990, viz. Gujarat Venture Finance Limited (GVFL), in association with Gujarat Lease Finance Corporation Ltd., Gujarat Alkalies and Chemicals Ltd. and Gujarat State Fertiliser Corporation Limited. While GIIC holds 40 per cent of the equity capital of GVFL, the rest of the capital has been contributed by the other three organisations. The GVFL is a fund management company and presently acts as a trustee manager of venture funds, namely, Gujarat Venture Capital Fund-1990 and Gujarat Venture Capital Fund-1995. The company started organising the operations and activities with the mission: To provide financial assistance and hands on management support to innovative and technology based projects with inherent high risks and promising returns.

GVFL faced a number of problems in the initial years. In the beginning it was difficult for GVFL to attract entrepreneurs because of its public sector image. Also the company had small capital base which restricted its investment decisions. Developing skilled personnel for the organisation was another problem. It was losing trained executives. Comparatively low salary structure of the company could not attract potential people. GVFL faced problems in raising funds in the initial years as it had to convince its investors without proven track record. In addition, because of its location in Western India, it makes difficult for GVFL to invest in other parts of India.

Objective of GVFL

GVFL started its operations with the following specific objectives:

- Launching of new product/process based on indigenous/imported know-how/technology.

- Technology innovation leading to improvement in profitability, cost reduction, improvement in quality and energy conservation.

- Commercialisation of indigenous material, components, systems, products based on local resources for import substitution.

- To adapt and modify an innovative process/ technology which has been imported.

- Setting up a commercial plant by scaling up process developed at pilot plant.

GVFL did not continue for long in its original objective of patronising frontier technologies. It is now increasingly investing in growth companies to minimise investment risk. The reasons are same as in the case of TDICI's reasons for shifting the investment focus. Modified objectives of GVFL are:

- Nurturing start up companies

- Investing in growth companies

- Supporting new technologies and Innovation

- Supporting first generation entrepreneurs

- Supporting competitive edge of investee company

Investment Strategy

Like TDICI, GVFL's primary focus is on small and medium size unlisted companies with exceptional growth and capital appreciation potential. However, GVFL actively considers investment in innovative business and technology oriented companies which offer scope for high returns. GVFL's funds are invested across a wide spectrum of industries and across companies at various stages of growth.

Investments are primarily structured as subscription to equity share capital. Quite often, especially in the case of start-ups or early stage investments, funding is also structured as convertible preference share or convertible loans. Convertible instruments have been useful in providing equity to management teams through performance based conversion (pricing) contracts. But in Gujarat Venture Capital Fund-95 (GVCF-95), GVFL only invested in equity and quasi equity and it did not grant any loan from this fund. From the past experience GVFL learnt that simultaneous investment in debt and equity of investee company's capital structure reduces a VCF's financial return. The salient features of GVFL's investment strategy are listed below:

- Focus on small and medium size unlisted companies with exceptional growth potential.

- Innovative and technology oriented companies which offer scope for high returns

- Investment in India with focus on Western India. GVFL is based in Ahmedabad—the Western part of India

- Co-investment with other VCFs and institutions in other parts of the country

- Start-up and early stage projects

- Equity and quasi equity investments

- Projects with significant ownership

- Investment ranging between Rs. 5 million to Rs. 30 million

Investment Criteria and Risk Analysis

GVFL's risk analysis process is subjective in nature and it is highly company specific. It considers the following parameters for risk analysis these are illustrated with the case of investee company, Permionics (India) Ltd.

Promoter: GVFL first evaluates the entrepreneur. If it does not get satisfactory feedback on the entrepreneur, it drops the proposal at this stage. GVFL checks the competence of the entrepreneur or promoter. It goes to any extent to check this through his colleagues, suppliers, customers, bankers, buyers, etc. Also GVFL has a direct interaction with the entrepreneur when he comes up with a proposal. He should be knowledgeable about the business he is proposing. GVFL has categorised the risk with promoter in the following manner:

High Risk: First generation entrepreneur or executive turned entrepreneur.

Moderate Risk: Business experience but not in relevant field.

Low Risk: Business experience in relevant field.

Promoter of Permionics was qualified and experienced in related technology. Also he had a good reputation. But he had no experience in consumer marketing. So it can be considered a moderate risk venture in terms of the promoter's risk.

GVFL also looks for a sound management team whose members have an excellent track record. The integrity, commitment and enterprise of the management team are important factors in their decision making.

Market: GVFL generally looks for a large and rapidly growing market opportunity for its investee companies. GVFL is not interested in companies which cannot grow. GVFL has categorised the market risks in the following way:

High Risk: New product; new market to be created.

Moderate Risk: New product to substitute existing product.

Low Risk: Existing product (produced by new technology).

For the product *viz* ultra-filtration membrance for domestic water purifiers of Permionics, concept awareness was already created by its competitors. So market was already there, but there were strong foreign competitors. Hence, the risk was a moderate market risk.

Technology: Like TDICI, GVFL also considers the stages of technology. If it is completely new, they are very cautious. This kind of project could not give expected return in earlier investments. However, GVFL has invested quite successfully in some of the frontier technologies in India. It has categorised the technology risk in the following way:

High Risk: New Technology; developed indigenously at small scale and not yet ready for commercialisation.

Medium Risk: Existing process/technology modified at Bench Scale. There may be problem in high scale production.

Low Risk: Proven technology supplied by collaborators. There may be problem of absorption of technology.

In the case of Permionics the technology was developed by promoters on small scale and the technology is closely held with a few companies worldwide. Hence risk was considered high with respect to technology.

Product Risk: Long-term competitive advantage of the product is important that would pose entry barriers to competitors. Analysis of product risk is highly case specific. The purifier of Permionics had certain distinctive advantages, such as low maintenance, complete purification, price advantage over competitor's product and difficulty to clone. Hence, the product risk was considered low.

Profitability: GVFL investigates project potential for above-average profitability (GVFL looks for an IRR of 35 per cent from its investments) leading to attractive return over a four to seven year investment horizon. It follows the risk-return relationship depicted below:

Overall Investment Risk	Expected Return
Low	25% - 30%
Moderate	30% - 40%
High	> 40%

For Permionics the overall risk of the project was considered moderate. Hence there was an expectation of 35 per cent internal rate of return.

After a preliminary analysis, GVFL takes up the detailed evaluation. One important aspect of this evaluation is presentation of the proposal by the promoter to the GVFL executives. The group head, president and the person directly concerned go through the presentation. They try to understand the promoter's ideas and ask questions. Then they make a techno- economic evaluation. It takes around 2-3 months in evaluating a project proposal.

Value Addition

GVFL has a unique philosophy of "hands on management". Venture finance companies act as complementary to the entrepreneurs or promoters. Venture capitalists, on the basis of their previous experience, advise the promoters on various aspects such as project planning, monitoring, financial management, arrangement for working capital, public issues etc. GVFL follows this philosophy more closely than any other venture finance companies. However, care is taken that it does not result in de factor management of the company.

GVFL takes an active interest in the working of the approved projects and maintains, for this purpose, panels of renowned management and financial experts whose advise is made available to the assisted ventures. Apart from strengthening the managerial functions of these new ventures, GVFL panels will also include eminent technocrats and scientists for providing technical guidance to the entrepreneurs.

GVFL also believes that a good relationship between the entrepreneur and the venture capitalist is a vital element in a successful venture. Therefore understanding this partnership is a necessary first step for the promoter and venture capitalist. While the promoter brings innovative ideas, technology process and personal commitment, the venture capitalist adds financial backing and valuable new business development experience. The entrepreneur and the management team are usually the most critical elements in the relationship.

GVFL adds value in the following areas:

- Formulation of systems and procedures, company law matters

- Dealing with the Government agencies

- Market survey and marketing strategy

- Key personnel recruitment

- Monitoring system for implementation of project

- Accounting manual and budget

- Negotiation for technology transfer and tie up. Preparation of terms of reference. Appointment of technical consultant.

- Marketing tie up. Help in product launching and distributor appointment. Help in establishing networks with buyers, suppliers etc.

- Other inputs whenever needed

GVFL takes up the following actions in the process of value addition:

- Each Investment Officer handles maximum five deals so that he can have a closer look to the project

- Periodic visit by Investment Officer. Frequency of the visit depends on the deal stage

- GVFL forms panel for experts to advise assisted companies, which covers –

    - Company Law

    - Management Consultants

    - Accounting Consultants

    - Labour Law Experts

    - Industrial Engineering Experts

    - Technical Consultants

Guidance at board level by senior GVFL Executives/Experts

Canfina-Venture Capital Fund

Financial institutions like IDBI, ICICI, IFCI were the first to enter the venture capital business. They were followed by the nationalised banks such as the State Bank of India. Canara Bank entered the venture capital business in 1989, through its subsidiary – Can Financial Services Ltd. Canfina-VCF is a relatively smaller player in the venture capital industry as compared to TDICI. How did venture capital evolve at Canfina-VCF? Was the process different from the one experienced by TDICI or GVFL?

Initial Efforts and Context

In 1985, the Chairman of Canara Bank initiated the idea of venture capital. The Bank has been quite active in financing small- and medium-size firms, and it had quite a few technical entrepreneurs in its portfolio. Thus, there existed a context for trying out venture capital and culturally, the bank was geared up to take up this activity.

Mr. Venkatdas was made responsible, as chief executive, for Canara Bank's venture capital business. He is a mechanical engineer and joined the bank with 5-6 years experience as a technical field officer. He has been associated with the credit administration of the small- and medium-size business in the bank (SSIs). He was instrumental in bringing the World Bank's industrial export-credit project to Canara Bank. He presented the scheme on behalf of the Bank to the World Bank. Thus, Can Bank established good rapport with the World Bank. It was at this time that Can Bank came to know about the World Bank's Technological Development fund. In 1988-89, when the World Bank was appraising Can Bank's industrial export-credit project, that the earlier idea of venture financing started taking shape. Canara Bank at the same time floated a subsidiary company, Can Financial Services Ltd. (Canfina), to further the growth and profitability of the bank. The Bank was interacting with the World Bank for a line of credit under their industry-technology development policy (ITP). Canara Bank was able to negotiate a US$ 5.25 million line of credit with them.

The venture capital concept of Canara Bank shaped up according to the World Bank's thinking. Since Canara Bank had Canfina, it was thought that it could manage the fund. It created a trust, and made Canfina the trustee and manager of the Fund under the Indian Trust Act. In October 1989, the Canfina venture capital (Canfina- VCF) was born. It was started with an initial corpus (to be given in several tranches) of Rs. 30 million (approximately US$ 1 million) given by Canara Bank plus Rs. 1 million given by Canfina—the managers of the fund (the World Bank line of credit came later). Then Canara Bank deputed executives from Canfina to the venture fund. The venture capital activity slowly got started. Meanwhile Canara Bank also got US$ 5.25 from the World Bank to be invested in the venture capital activity. In fact, the fund was to flow from the World Bank to the Government to IDBI to Canara Bank, and finally to Canfina-VCF.

Early Phase

The first six ventures were to be evaluated and approved by the World Bank. Through this process, Canfina-VCF started understanding the nuances of venture capital investment evaluation. It started progressing slowly but steadily. Canfina-VCF formulated operating

guidelines for the Fund as well as for the managers, which then became the investment policy aligned to the government guidelines (unlike TDICI which is not bound by these guidelines). Canfina-VCF was required to get permission from the RBI, the Ministry of Finance, the CCI, and the Department of Economic Affairs to enable the fund listed as a venture capital fund (TDICI, for example, cannot change its name; if a venture capital firm wants to be called venture capital fund, it has to be approved by the government). Canfina-VCF's investment policy is directed by the guidelines. Presently, it is investing 25 per cent of funds in non-ventures.

Canfina-VCF now receives ten to fifteen deals each month. Most deals come on their own. When Canfina-VCF was learning the game, its rejection rate was about 60 per cent. Today, the rejection rate has gone up to around 90 per cent. Canfina-VCF has now learnt which project to accept and which to reject.

Canfina-VCF does not want to invest 49 per cent in equity alone. Some companies' equity requirements may be more than 49 per cent because promoters are unable to bring insufficient equity. Canfina-VCF also lends in a "package" but when there are other people ready to lend to the enterprise, it generally takes only the equity position. It has both conditional loans and income notes (IN) as the venture capital finance instruments. Ins are meant typically for second-stage financing. For example, an entrepreneur might have started by using his own capital and may not have a problem in terms of cash flow but he needs to grow faster using some technological upgradation. He would obviously need money. He may have diversification plans as well, but basically through value addition using technological development. Canfina-VCF would give him a loan with an initial low interest rate—may be no interest at all in the first year and 10 per cent p.a. afterwards. He also needs to pay a percentage royalty on sales. Royalty is like a reward for equity. What Canfina-VCF is looking for is a total IRR. This instrument is also helpful in financing an entrepreneur's working capital requirement as he may not be able to obtain funds from a bank. This instrument is better than the conditional loan due to some problems encountered with the latter. For example, the interests accumulates and the entrepreneur can pay only when the cash is generated. Again, whatever the entrepreneur might have accumulated may have to be paid as royalty. Therefore, the entrepreneur is allowed to convert conditional loan into equity if he agrees.

Thus, in the case of Canfina-VCF, it can be concluded that in financing entrepreneurs, it looks at equity or equity-leading routes of financing. It is now shying away completely from conditional loans unless there are equity-convertible. It would like to see that all of its

financing converts to equity which can ultimately become an OTC market product (or profitable). That is the reason why its rejection rate has increased. A project may be viable but may not offer a higher return or be incapable of a higher growth or have a low value addition (nothing may be added to reserves).

Performance Experience

By and large, Canfina-VCF has had mixed experience in its venture capital business so far. Of course, it is too early to say whether or not it has succeeded. It is still is in an investment mode. Although it started in 1989, it considers 1990-91 as the first active year for this new business. Some assisted projects have posed problems which made Canfina-VCF more conscious, especially during 1992-93. Mr. Venkatdas states:

"Our way of looking is that we analyse the whole thing and then if it works and when (we are) convinced, we grant second-round financing. We withdraw when we think there is a problem. For example, there may be a product at (a) purely development stage—this is an early-stage risk. We know that it is impossible to market the product. The entrepreneur also could not show that it could work. During this particular stage, we can decide to write off this investment. So we would not put in more finance in spite of the entrepreneur being technically very competent. The product may not be sold. Let us say the project has succeeded, but there may not exist a market segment for which the product is meant, or may be the price is very high. Sometime the problem may be (of) management rather than (of) the product or the market. We do have problem cases. We have not eaten into our corpus in spite of some trouble cases. We have made some profit on after-tax basis."

Canfina-VCF's minimum level of investment has been Rs. 1 million; but nowadays, it is looking for a minimum investment of Rs. 3-4 million. Processing charges are still unchanged. It has invested in a number of technology-based enterprises. It considers technology as the leading factor for its investment decision.

Canfina-VCF's most successful case is that of a blue chip company where it invested Rs. 0.15 million and provided conditional loan of Rs. 2.5 million. After two bonuses, Canfina-VCF's equity investment (book value) has become Rs. 0.75 million in two years. The company will go public shortly, may be with Rs. 80 share value (8 times increase). Canfina-VCF's investment has increased 56 billion times in three years. It was bargaining for an initial equity of Rs. 0.75 million, but the investee company did not give in since the promoters knew that

it will perform well. Mr. Venkatdas feels that the entrepreneurs know they are going to succeed, and hence do not want to part with the equity and want to hold on.

Tax is a bothersome thing for Canfina-VCF. For example, TDICI does not pay any tax. In fact, Canfina-VCF's chief thinks that in venture capital there is no tax exemption at all. All those funds coming from the Unit Trust of India (UTI) can get tax exemptions but not those which do not have access to UTI funds.

Regional Focus and co-financing

All companies asking to be financed by Canfina-VCF have to have technology. This is not the case with TDICI. Canfina-VCF would like to concentrate on South India. All its investments are in Bangalore, Hyderabad and Chennai. It has started an experiment in co-financing Gujarat Venture Capital Co. Canfina-VCF as the lead financier, has cofinanced one unit in Gujarat. Co-financing needs perfect understanding of each others' culture, thinking, etc. by the two or more parties. Unfortunately, there are differences in the venture capital focus and this stands in the way of co-financing. Some venture capital enterprises have a pre-OTC focus. They like bought out deals. For calling it venture capital, it is necessary to know at what stage the Fund does its financing. It (VCF) should act like an investment company or a mutual fund. The focus must be on technology. Once there is an agreement on the venture capital focus, there can be many possibilities of cofinancing.

Customerisation

There are certain areas where the technology is imported which Canfina-VCF supports, provided there is good potential of customerisation of the product within India. Basically, it supports the financial effort needed to bring the product to the Indian market, adapting it to make it suitable to the Indian context, through the knowledge of the entrepreneurs. Canfina-VCF also assists in creating markets abroad. For example, Electrosonic Instruments, a firm assisted by Canfina-VCF, caters to the domestic market. It is newly developed in the country and has established itself domestically. Canfina-VCF saw its potential in the international market, and gave the company money to go abroad. The firm has tremendous market potential.

Evaluating Entrepreneurs

Canfina-VCF gathers information about the entrepreneurs from various sources. It tries to ascertain the commitment of the entrepreneur through interaction with people known to him. It insists on an effective team.

Canfina-VCF avoids one-man show as well as adamant, rigid, inflexible entrepreneurs. It also avoids those people who show great enthusiasm to go public immediately after venture financing. They may be intending to make quick money from the investors. It checks out long-term commitment of the entrepreneur and his contribution in terms of critical areas of management. Also, it tries to know how the entrepreneurs are going to divide their authority and responsibility later on. They have to identify one of them as the leader.

Technical skills are good, but promoters must have appreciation for management requirements and skills. According to Mr. Venkatdas, if a man is endowed with both Lakshmi (money) and Saraswati (knowledge), he would be successful. He feels that an entrepreneur should be accommodating and have commercial orientation. If he is simply obsessed with technology, without concern for the commercial options. He must be a strategist as well.

A number of entrepreneurs do not know the kind (and extent) of risk they are taking. During appraisal, Canfina-VCF executives know they are able to ascertain what risks the entrepreneurs are taking. Some of entrepreneurs do know the extent of these risks. They know all the situations that may arise but are not able to develop a good business plan. For example, a mechanical engineer approached Canfina-VCF with the concept of an auto-rickshaw. His design was good and comfortable from the user's point of view but he was not aware of the risk he was taking. He did not know anything about marketing, operating conditions, production, etc. He did not know anything about the environment. His product was good but Canfina-VCF could not finance him because he did not his market and business.

> **A number of entrepreneurs do not know the kind (and extent) of risk they are taking.**

Canfina-VCF likes entrepreneurs to be ambitious, but they should also be pragmatic. An ambitious person knows his target but Canfina-VCF makes its own analysis. It tries to avoid ambitious persons.

Canfina-VCF acts quite fast once a proposal is received and if the proposal is to be rejected, the promoter is informed within 15 days. If it has initial interest in the venture, it conducts a detailed analysis. It wants a simple plan but people do come to Canfina-VCF with ideas but without plans. Canfina-VCF executives discuss their ideas with them, and indicate whether they

would be interested. They have learned by experience. Today their executives can pick and choose ventures. Canfina-VCF avoids those ventures which may not have growth potential or are expected to face problems. When it becomes interested in a venture, Canfina- VCF asks for a business plan. A lot of information has to be given in this plan.

Value Addition

Canfina-VCF participates in the management of companies. Its executives attend business committee meetings; they always conduct these meetings as a marketing audit, not merely for finance. The business environment is quite dynamic and so are the strategies; therefore one cannot procrastinate for 10 years and still continue working. Canfina-VCF scans the environment continuously. It looks at the Economic Times or the Financial Express for the fast changing economic and financial scenarios and then makes its assessments about the prospects of the business financed by it. In the meetings, Canfina-VCF executives discuss product-mix options. They also participate in board meetings. In some companies, they are on the board of directors while in others they are just observers. After some time, the executives are able to know which companies in the portfolio will be able to produce good results. The executives optimise their time and efforts in those companies which are expected to grow fast. They have their usual follow up and monitoring, and they talk to the entrepreneurs. They try not to behave like bankers. They act as entrepreneurs themselves. They keep themselves informed of the environmental changes and advise the clients accordingly. The entrepreneurs are not always able to know the rapid changes in the environment. Thus, one of the tasks of Canfina-VCF executives is to keep the entrepreneurs abreast of the environmental changes and discuss the financial implications. They have to condition themselves to ultimately go to the OTC market. For example, there is a company in Canfina-VCF's portfolio which has done extremely well. It has even gone to the export market, and it wants to go public. Even if it offers 20 per cent of its shares to the public, it can get lots of premium money. Canfina-VCF has been educating the company, how it will not lose control even if it goes public. To exist is a real problem in India. If the company has a good book value, the problem is to convert it into market value and still exit. Another problem is the locking period for the venture capital companies. For example, if a VCF has stayed with the company for 3-4 years, nurtured it and brought it to a profitable level, why should it be required to hold on to the investment in the company? In the USA, all biotech companies go the venture capital route when the technology is developed, and when it takes some shape, they go the IPO route and venture capital firms

exit. They do not carry on; they recycle their funds.

Venture capital companies today need to have a different breed of people, feels the chief of Canfina-VCF. According to him, they should be entrepreneurs; they should be given salaries and incentives and groomed properly and should be seen as partners. In the USA, they direct their best efforts to make the enterprises successful. They get management fees and share in the profit. Interest and commitment to the project have to be generated through incentives but since stock options are not allowed in India, employees in VCFs should be given share in the profit. The investment needs nurturing and development over a period of time.

Conclusions

Since venture capital is a relatively new concept in India, it is facing a number of constraints, to mention a few — limit on project cost, guideline for surplus fund deployment, lack of awareness about venture capital, restrictive guidelines, a few tax incentive to the investor or VCFs, anomalous tax structure (UTI funds like TDICI paid no tax, whereas others paid maximum marginal tax), lack of trained manpower, inadequate prospective deal flow, difficulties in resource mobilisation, problem with exit routes etc. In the midst of these constraints venture capital activities in India is still progressing with a reasonable pace.

From the case studies discussed above, it can be seen that the process of venture capital development activity is similar at TDICI, Canfina-VC and GVFL. In these cases, the initiative and the impetus came from the chief executives of the parent organisation. These organisations went through the initial constraints of not knowing the venture capital business well and learnt through trial and error and failures and mistakes. They have problem with fund mobilisation, generating deal flows, retaining experienced employees etc. These organisation put heavy weight on human resource development. GVFL in particular faces difficulties in administering its operation due to lack of management personnel.

In due course of time, TDICI, Canfina-VCF and GVFL have deviated from their original objective of patronising frontier technologies. They are now increasingly investing in growth companies to minimise investment risk. A similar pattern could be witnessed in develop countries like USA (Bygrave and Timmons, 1992). Their primary focus is now on small and medium size unlisted companies with exceptional growth and capital appreciation potential. However, they actively consider investment in innovative business and technol-

ogy oriented companies which offer scope for high returns. Their funds are invested across a wide spectrum of industries and across companies at various stages of growth. But GVFL has more regional bias.

These organisations focused on the loan form of assistance (conditional loan and income notes) in the initial years but very soon they realised that venture capital was basically an equity financing mechanism. Equity financing suits both the entrepreneurs as well as the venture capitalists. Their experience was that it was difficult to administer conditional loan and income note schemes.

In terms of sources of finance or funds there is difference between India and other developed countries. In India majority of funds come from banks and government agencies. It is noticeable that in India, again most of the banks are significantly controlled by government. In developed countries, on the other hand, other sources like insurance companies, pension funds, corporate investors etc. play significant role in the venture capital pool. For example, in USA, pension funds provide more than one-third of the venture capital while the role of government is quite negligible (Bygrave and Timmons, 1992).

> In terms of sources of finance or funds there is difference between India and other developed countries. In India majority of funds come from banks and government agencies.

As regards investment evaluation, TDICI, Canfina-VCF and GVFL, from the very beginning focused on the quality of entrepreneur. They try to collect information about the competence of promoter or entrepreneur from various sources. They also looked at their business plans closely to ascertain the characteristics of market, product and technology. One common feature with regard to the investment evaluation criteria of VCFs in India and other developed countries is that all of them focus their top attention to the entrepreneur's personality and experience (Pandey, 1996). However in terms of the specific traits of the entrepreneurs' personality and experience, the Indian practice differs significantly from that in the USA, Singapore and Japan. For example, amongst the five criteria most frequently rated as essential in the USA, Singapore and Japan, the entrepreneur's characteristics include sustained intense efforts, familiarity with target market and ability to evaluate and handle risk well (Macmillan et al, 1985; Ray, 1991; R. v and Turpin, 1993).

TDICI, Canfina-VCF and GVFL act as complementary to the entrepreneurs or promoters. They, on the basis of their previous experience, advise the promoters on various aspects such as project planning, monitoring, financial management, arrangement for working capital, public issues etc. Also they help their investee companies in finding out resource persons for different purposes.

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Venture Capital: Case Study of Bio-technology Pharmaceutical Company

R.K. Mishra

The present paper deals with the financial viability and performance of a Venture Capital Limited of the pharmaceutical company, M/s Jayaprada Clonetech Private Ltd. in Andhra Pradesh. By virtue of high level of technological competance the firm has been licensed for commenced production of 8000 diagnostic kits of Monoclonal Antibody (Male) for thyroid and pituitary products at the present cost of Rs. 147.00 lakhs with generous funding by IDBI to the tune of Rs. 102.90 lakhs.

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Introduction

M/s Jayaprada Clonetech (P) Ltd., a new company has proposed to set up a unit for manufacturing biotechnology pharmaceutical products i.e., Monocloncal antibody (Mab) based Diagnostic Kits for Thyroid and pituitary hormones and insulin at Uppal Village, Ranga Reddy district, Andhra Pradesh with an installed capacity of 8000 kits per annum. The project was originally appraised by Industrial Development Bank of India-Technology Fund (IDBI-TF) under its Venture Capital Fund (VCF) scheme in September, 1990. The project cost was estimated as Rs. 77.00 lakhs and IDBI sanctioned a VCF term loan on Rs. 65.00 lakhs and APIDC sanctioned an equity assistance of Rs. 1.80 lakhs. During the implementation IDBI felt that though the project progress is satisfactory and is expected to be completed earlier than the originally envisaged time frame, there is expected to be some overrun in the cost of the project. Subsequently in December 1991 IDBI-TF re-appraised the project and re-estimated the project cost as Rs. 147.00 lakhs resulting in a cost overrun of Rs. 70 lakhs. IDBI sanctioned an additional VCF term loan of Rs. 37.90 lakhs totaling its assistance to Rs. 102.90 lakhs.

IDBI increased the promoters (Jayaprada & Associates) contribution from Rs. 12.00 lakhs in the original proposal (15.6% of the project cost) to 44.10 lakhs in the revised proposal (30% of the project cost). APIDC recently sanctioned an additional equity assistance of Rs. 4.80 lakhs to the company. The Promoters are technologically well qualified and first generation entrepreneurs with limited means and therefore approached APIDC-VCL to bridge the gap in equity in view of the sharp increase in project cost for reasons beyond their control.

Background

The Company M/s Jayaprada (P) Ltd. has been incorporated as Private Limited company under Com-

panies Act, 1956 in September 1990 with its registered office in Hyderabad. The authorised share capital of the company is Rs. 10.00 lakhs. It is promoted by team of four technocrats under Dr. (Mrs.) A. Jayaprada (aged 62) an accomplished biotechnologist. She is also its managing direction and assisted by six technical personnel. For developmental work. The company has already succeeded in developing the following MAbs, using certain facilities available with research institutions such as University of Hyderabad & JNTU.

Item	Quantity (mgs)	ELISA Plates (nos.) (32 wells)
T3	15	4500
T4	20	6000
TSH	20	6000
Insulin	10	3000

Dr. Jayaprada, also indicated that the research team has achieved a near breakthrough in developing diagnostic kits for ascertaining pregnancy at a very early stage.

Project Proposal

The company will manufacture diagnostic kits for T3, T4, TSH, LH, Prolactin and Insulin hormones with an installed capacity of 8000 kits per annum.

T3 and T4 hormones are secreted by thyroid gland and their secretion, is controlled by thyroid stimulating hormone (TSH) secreted by pituitary gland. Any change in their concentration in body results in disorders related to overall metabolism of body and heart. Again follicle stimulating hormone (FSH), Leutenising hormone (LH) and prolactin are secreted by pituitary gland and control various functions of reproductive system of the body. Insulin is secreted by specific cells of pancreas gland and controls sugar levels in blood. Hence, measurement of these hormone levels in body would help both in diagnosis as well as monitoring the treatment of disorders related to these hormones.

> T3 and T4 hormones are secreted by thyroid gland and their secretion, is controlled by thyroid stimulating hormone (TSH) secreted by pituitary gland. Any change in their concentration in body results in disorders related to overall metabolism of body and heart.

RIA method involves radioisotopes and needs special facilities as well as greater care in handling and desposing EIA, using monoclonal antibodies, is more specific and sensitive than ETA with polyclonal antibodies.

The company has developed EIA kit based on monoclonal antibodies for FSH, got it tested by some diagnostic centres in Hyderabad and has found it satisfactory. Technology for other hormone kits (which is akin to FSH) i.e. T3, T4, TSH, LH, Prolactin and Insulin is also developed. The kits have been tested at the Medvin Endocrine Diagnostic Centre in Hyderabad. The Diagnostic Centre informed that the trial kits are quite comparable with the imported STG Imuno Assay Kits.

Costs

Estimated cost of the project is Rs. 147.00 lakhs, as per details below (Table 1):

Table 1: Project Costs and Financial Means

(Rs. in lakhs)

	IDBI's Revised Estimate	Expenditure incurred
Land and Site Development	4.56	4.56
Building and Civil Works	27.54	31.89
Plant and Machinery (Imported)	37.19	
Plant and Machinery (indigenous)	17.48	36.35
Erection and Commissioning	0.20	–
Miscellaneous Fixed Assets	14.65	9.33
Operating Expenses (incl. advances)	14.00	17.48
Prelim and Preop Expenses	7.00	8.37
Marketing Expenses	4.00	0.18
Contingencies	2.00	–
Interest during Development Period	8.24	3.12
Margin Money for Working Capital	10.00	–*
Total	146.86	116.52
Say Rs.	147.00	
Finance	Revised Proposal	Money raised
Equity		
Promoters	30.20	28.39
APIDC	6.60	4.80
APIDC-VCL (Proposed)	7.30	–
	44.10	33.19
Loans		
IDBI – VCF Term Loan	102.90	83.00
Total	102.90	83.00

* Cash and bank balance and bank guarantees provided include Rs. 5.24 lakhs.

** Rs. 0.33 lakhs are earned as interest on STDs, which is not included above.

Reasons for Overrun

There is an overrun of Rs. 70 lakhs in the project cost (91% of the original project cost). The major reasons for overrun as given by IDBI are as follows:

(i) Land (+ Rs. 2.06 lakhs) and (ii) Civil Construction (+ Rs. 14.24 lakhs): It was originally envisaged that the factory would have a covered area of 5400 sq. ft. @ Rs. 246/sq.ft. Due to general increase in cost of building materials, the cost of civil construction has gone up to Rs. 278/sq.ft. (by about Rs. 2 lakhs). (iii) The variation in the cost of major items of plant and machinery resulted in an additional burden of Rs. 26.47 lakhs and (iv) miscellaneous fixed asset like elec. generators caused additional Rs. 4.45 lakhs and (v) Operating expenses (+ Rs. 6.4 lakhs) and Preliminary and Preoperative expenses (+Rs. 4.10 lakhs): Based on the expenses incurred upto end-October, 1991, reasonable estimates have been made to cover the expenditure likely to be incurred upto December, 1992 — the tentative period for completion of the venture.

Market Scenario

IDBI has estimated the demand for T3, T4, TSH, LH, Prolactin and Insulin hormones kits is about 5000 kits each per year. All the immuno diagnostic kits are being imported as there are no indigenous producers. The traditional methods for diagnostic of diseases have certain disadvantages like low specificity requirement and costly and sophisticated equipment, etc., on the other monoclonal antibody diagnostic kits developed by the company have the advantageous of high specificity, long shelf life, high sensitivity, simplicity in operation, reproduceable result and cost effectiveness. The cost of the imported kits is around Rs. 6000 per kit as against the selling price of 4500 per kit of the company. The substantial difference in the cost of the kit in addition to the hefty margins offered to the dealers and may push the product in the market without much difficulty. Imported financial indicators are given in Table 2 and expected returns on investment are given in Table 3.

> The traditional methods for diagnostic of diseases have certain disadvantages like low specificity requirement and costly and sophisticated equipment, etc.

In Table 3 disinvestment is assumed in the 7th year by APIDC-VCL. Buy back/disinvestment prices are calculated based on Book value in the year of disinvestment.

Table 2: Important Financial Indicators

Parameters	1994	1995	1996	1997
Installed Capacity (Kits/Annum)	8000	8000	8000	8000
Capacity Utilisation (%)	50	60	75	75
Production (Kits/Annum)	4000	4800	6000	6000
Total Income (Rs. Lakhs)	180	216	270	270
Raw Materials/ Income (%)	25	25	25	25
Interest/Income (%)	15.89	11.48	8.74	7.70
Net Profit/ Income (%)	–2.06	3.94	7.04	6.74
Operating BEP (%)		53.00		
Project IRR (%)		33.00		
EPS (RS)	–0.84	1.88	4.31	4.13
Return on APIDC-VCL Equity (%)		18.80		

Table 3: Expected Returns to APIDC-VCL

Year of Operation	Year	% Dividend	Amount	Book Value (Rs.)	Disinvestment	Total
I	1993-94	0	0	9.16	–	–
II	1994-95	0	0	11.04	–	–
III	1995-96	0	0	15.35	–	–
IV	1996-97	19	1.387	27.57	–	1.387
V	1997-98	19	1.387	19.57	–	1.387
VI	1998-99	19	1.387	21.27	–	1.387
VII	1999-2000	19	0	22.63	16.52	16.520
			4.161		16.52	20.681

The expected returns to APIDC-VCL in such a case is 18.80 per cent.

The actual disinvestment by APIDC-VCL would be made based on a fair price calculated at the time of disinvestment and the first option of buying back the shares would be given to the Promoters.

It can be seen that the expected returns to APIDC-VCL is quite low. This is mainly because the company has to service VCF term loan of Rs. 102.90 lakhs by way of interest @ 18.5 per cent after the commercial produc-

tion and royalty on sales at 5 per cent giving them an over all return of around 33 per cent.

Schedule of Implementation

Civil construction is completed in March 1992 and the majority of the machinery are received and installed. The company has completed the developmental work of the kits in December 1991 and the kits are trial tested till April 1992 and the commercial release of the kits into the market is expected by the end of June 1992.

Conclusions and Recommendations

The project of the company has been originally appraised by IDBI Technology Fund (TF) under its Venture Capital Fund scheme in September 1990. With a project cost estimated as Rs. 77.00 lakhs and IDBI sanctioned an VCF term loan of Rs. 65.00 lakhs and APIDC sanctioned an equity assistance of Rs. 1.80 lakhs. During the implementation IDBI felt that though the project progress is satisfactory and is expected to be completed earlier than the originally envisaged time frame, there is expected to be some overrun in the cost of the project. Subsequently in December 1991 IDBI-TF reappraised the project cost as Rs. 147.00 lakhs resulting in a cost overrun of Rs. 70.00 lakhs. IDBI sanctioned an additional VCF term loan of Rs. 37.90 lakhs totaling its assistance to Rs. 102.90 lakhs. IDBI increased the promoters contribution from Rs. 12.00 lakhs in the original proposal (15.6% of the project cost) to 44.1 lakhs in the revised proposal (30% of the project cost). APIDC recently sanctioned an additional equity assistance of Rs. 4.80 lakhs to the company.

The demand for the product is quite good and the indigenous requirement is being met by imports. The project is ready for commercialisation. The expected returns to APIDC-VCL are around 18.80 per cent which are quite low.

In view of the foregoing, the company's request for Venture Capital assistance of Rs. 7.30 lakhs in the form of direct subscription to equity of the company subject to the standard terms and conditions given in Annexure-I is paced before the Investment Committee for guidance and sanction.

Discussion: In the light of the facts mentioned and information provided, the following issues merit further discussion: (1) Do M/s Jayaprada Clonetech (P) Ltd. qualify for inclusion in the Venture Capital portfolio? Comment on the nature of Terms of Reference laid down by APIDC for extending equity support to APIDC-VCL (2) To what extent is the company's management structure professional? Is family owned management structure ideal to organise a Venture capital company? (3) Is the existing pattern of project appraisal by APIDC-VCL and IDBI appropriate? Should there be multiple evaluations of the same project by the Venture Capital Funds? (4) Is the process of project appraisal suitable to examine the Venture Capital proposals? (5) Is the rate of return estimated for M/s Jayaprada Clonetech (P) Ltd. adequate for it to be accepted by APIDC-VCL and IDBI? (6) Are time and cost overruns in the case of M/s Jayaprada Clonetech (P) Ltd. justified in the existing frame of situation? (7) Is there a need to privatise M/s Jayaprada Clonetech (P) Ltd.? If yes, then work out the modalities for privatisation.

Terms and Conditions for Equity Participation

1. The company shall carry out such alterations to its Memorandum and the Articles of Association in consultation with and to the satisfaction of APIDC-VCL so as to safeguard the interests of APIDC-VCL arising out of its assistance granted to the company.

2. The company/promoters shall enter into a suitable investment agreement with APIDC-VCL to the satisfaction of APIDC-VCL.

3. The company shall produce permission/clearance from the appropriate government agency for setting up the unit.

4. The company shall raise its authorised capital upto Rs. 50.00 lakhs.

5. The subscribed share capital of the company shall be Rs. 44.10 lakhs.

6. The contribution of the private promoters shall not be less than Rs. 30.20 lakhs in the equity share capital of the company. The contribution by the APIDC-VCL shall be made on pro-rata basis with that of the contribution of the promoters and their associates in the equity share capital of the company after obtaining necessary clearances from financial institutions and other government agencies. APIDC-VCL shall release its share of contribution only after the shares subscribed and paid up to the extent of 100 per cent of its promoters' contribution towards equity of the company.

7a. The promoter directors shall give an undertaking to the APIDC-VCL in such form as may be prescribed by the APIDC-VCL that they shall procure for the company such additional finances as may be required to meet the shortfall, if any, in financing the project and/or for working capital. The funds brought in shall not be withdrawn without the prior approval of APIDC-VCL.

7b. The company/promoter directors shall make necessary arrangements to the satisfaction of APIDC-VCL for raising a term loan to the extent of Rs. 102.90 lakhs required for financing the project from Banks/other financial institutions.

8. The company/promoter directors are shall not raise any further term loans/deposits other than the amount of Rs. 102.90 lakhs as mentioned above except with the specific written approval of the APIDC-VCL.

9. It shall be the responsibility of the company to raise short term borrowings from scheduled bank for working capital requirements of the company.

10. The actual expenditure incurred by the promoters for the project shall be subject to the scrutiny an approval of the APIDC-VCL.

11. The company shall not without the proper consent and written approval of the APIDC-VCL pay any commission to its promoter directors or concerns in which directors are interested and for furnishing guarantees for any financial assistance obtained by the company for the purpose of its project.

12. The company shall broadbase the Board and finalise the composition of its Board of Directors to the satisfaction of the APIDC-VCL.

13.a) APIDC-VCL shall have the right to appoint and remove from time to time, director(s), on the Board of Directors of the company; such director(s) is (are) hereinafter referred to as 'Nominee Director (s)', so long as the APIDC-VCL holds shares in the equity, as a result of direct subscription.

b) The number of directors to represent APIDC-VCL on the company Board shall be in promotion to the APIDC-VCL's shareholding in the company with a minimum of one director and the APIDC-VCL's nominees shall not be required to hold any qualification shares.

c) At least one of the nominees of the APIDC-VCL shall be non-rotational director. The articles of association of the company shall contain suitable provisions in this behalf.

If at any time, the Nominee Director is not able to attend a meeting of the Board of Directors or any of its Committees, of which he is a member, APIDC-VCL may depute an Observer to attend the meeting. The expenses incurred by APIDC-VCL in this connection shall be borne by the company.

14. Provided however, APIDC-VCL shall have the liberty and discretion to appoint such directors immediately after the acceptance of the letter of intent by the company, but such appointment shall not be construed as any commitment on the part of the APIDC-VCL to disburse the financial assistance unless the APIDC-VCL is fully satisfied that the company has compiled with all the stipulated terms and conditions precedent to such disbursement.

15. The Managing Director of the company shall be the nominee of the promoter of the company who shall be appointed to the satisfaction of the APIDC-VCL.

16. The APIDC-VCL reserves to itself the right to inspect the factory, properties and assets, documents and records, books and accounts etc. of the company during the period the APIDC-VCL holds shares in the company.

17. The company shall keep the APIDC-VCL informed in such manner and in such form as may be prescribed by the APIDC-VCL from time to time of the progress made in the implementation of the project and of the working of the same and also of any expenditure/diversification thereof, as long as the APIDC-VCL holds any shares in the company. The company shall furnish to the APIDC-VCL all additional information, data, documents and explanations as may be called by the APIDC-VCL in relation to the working and affairs.

18. The company shall furnish to the APIDC-VCL all notices in respect of the Board Meetings, shareholders meetings of the company together with notes and minutes of thereof in addition to the circulation of the same to the nominees of the APIDC-VCL on the Board of the company.

19. The Management of the company vest in the Board of Directors and the day-to-day affairs shall be entrusted to the Managing Director/Committee of Directors.

20. The Promoter directors shall not transfer, dispose off or pledge or in any way encumber their shareholdings in the company without the prior consent and written approval of the APIDC-VCL and the company shall not recognise or register any such transfer of shares without the consent of the APIDC-VCL.

21. The Company shall issue the share certificates to the APIDC-VCL in marketable lots for the subscription made by it towards the equity share capital of the Company.

22. All the matters relating to the affairs of the company and the project such as capital expenditure. raising loans, awarding contracts, placement of orders for goods and services etc. shall be decided by the company in consultation with the representatives of the APIDC-VCL on the Board of Directors of the company or a Committee of Directors consisting of the APIDC-VCL's nominee (s) and the Managing Director of the company and any other directors of the company.

23. Any change in the management of the company and its project shall only be made with the prior consent and written approval of the APIDC-VCL so long as the APIDC-VCL holds any shares.

24. The company shall not embark upon or undertake any new project of expansion/diversification programme without the prior approval in writing of the APIDC-VCL, so long as the APIDC-VCL holds any shares.

25. So long as the APIDC-VCL holds equity shares in the company, the company shall not, without the prior written approval of the APIDC-VCL:

a) Make any inter-corporate investments and/or advance/deposit monies in any other corporate bodies; and

b) Repay the deposits/loans that may be obtained from directors, their relatives and friends etc. for the project.

26. The company shall arrange in consultation with and to the satisfaction of the APIDC-VCL for appointment of suitable technical and managerial personnel and for provision of the necessary training facilities to them and that in matters of recruitment of personnel required to man the project, the company shall give preference to local personnel.

27. APIDC-VCL reserves to itself the right to alter, modify or change all or any of the above terms and conditions and in addition, the APIDC-VCL may impose at its discretion such further conditions as it may deem fit, for the grant/disbursal of

Annexure-II

M/s Jayaprada Clonetech Private Ltd. Cost of Production and Profitability Statement (Year Ending June 30)

(Rs. in Lakhs)

	1994	1995	1996	1997	1998	1999	2000
Installed Capacity (No. of Kits/Yr.)	8000	8000	8000	8000	8000	8000	8000
Capacity Utilisation (%)	40	50	60	70	70	70	70
Production (Kits)	3200	4000	4800	5600	5600	5600	5600
Sales (value)	64.0	80.0	96.0	112.0	112.0	112.0	112.0
Cost of Production							
Raw Material	8.0	10.0	12.0	14.0	14.0	14.0	14.0
Utilities	1.0	1.2	1.4	1.7	1.7	1.7	1.7
Salaries	9.2	10.1	11.1	12.2	13.5	14.8	16.3
Repairs & Maintenance	0.9	1.0	1.1	1.2	1.3	1.4	1.6
Admn. Expenses	1.0	1.1	1.2	1.3	1.4	1.5	1.6
Selling Expenses	19.2	24.0	28.8	33.6	33.6	33.6	33.6
Total	39.3	47.4	55.6	64.0	66.5	67.0	68.8
Profit/Loss	24.7	32.6	40.4	48.0	46.5	45.0	43.2
Interest-VCF-Bank	9.8	9.0	7.5	6.0	4.5	3.0	1.5
Depreciation	7.0	7.0	7.0	7.0	7.0	7.0	7.0
Royalty	3.2	4.0	4.8	5.6	5.6	5.6	5.6
Profit Before Tax	1.3	8.9	16.9	25.2	25.2	25.2	25.2
Tax	0.0	3.6	6.8	10.1	10.1	10.1	10.1
Net Profit	1.3	5.3	10.1	15.1	15.1	15.1	14.9
Dividend (@ 18%)	–	–	2.2	2.2	2.2	2.2	2.2
Cash accruals	8.3	12.3	14.9	19.9	19.9	19.9	19.7

Venture Capital

Vishnu Varshney

Consequent to the government issuing fresh guidelines, there are far reaching implications to venture capital business. In the present paper three vital issues are addressed, that is: venture financing methodology, value addition and disinvestment mechanisms.

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In India Venture Capital (VC) has reached at the cross-roads just, as the Government is about to sign-post changes in the guidelines, which will have far reaching implications for the development of the whole venture capital industry. The rethinking about venture capital guidelines taking place in the Government will be a key to whether venture capital industry will get an impetus or whether it will cease to have any significant role in financing Indian businesses.

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Venture Capital in India began a decade ago, as in-house experiment by two large Indian development banks. In 1988 one of them and the World Bank organised a seminar in India to create an awareness and stimulate interest in venture capital (VC). This was followed by the announcement of VC guidelines in the Parliament in November of the same year. Despite various restrictive covenants these guidelines on VC did create a base for the industry to build-on. Four industry financing institutions started VC activities in India with the support of the World Bank. At the same time, a few venture capital companies in private sector also started with the help of other multilateral institutions, banks and private sectors. At

> **Despite various restrictive covenants these guidelines on VC did create a base for the industry to build-on.**

present there are 33 venture capital companies, 12 domestic venture funds and 31 offshore funds with a total mobilisation of Rs. 4000 Crores.

The present article dwells on three important aspects of venture capital i.e. the different method of venture financing, value addition by the venture capitalist and different divestment mechanism.

Venture Financing

The financing pattern of the deal is the most important element. Venture capitalist carry out substantial financial engineering to provide enough flexibility to meet the requirements of the company. The Venture capitalist typically makes an investment in (i) Equity and (ii) Quasi-Equity.

Equity

The venture capital company invests in the plain vanilla equity of the company either at par or premium. Investment in the form of equity is the most desirable form of venture financing as it does not put any pressure on the cash flow of the company in the initial teething period. Ideally the venture capital assistance should be provided entirely through equity, reflecting an approach of sharing risks and rewards. However in order to retain the day-to-day management and control with the promoter, the normal limit of assistance by way of equity is to be at a level slightly lower than of the promoters equity.

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Quasi-Equity

The quasi-equity instrument are the instruments which are converted into equity at a later date. The convertible instruments are used by the venture capitalist due to the following factors. Such factors may include

(a) Necessity of leverage and

(b) Need to provide incentive to the promoters.

These instruments are normally converted into equity at the book value or at certain multiple of EPS i.e., at

a premium to par value at a later date. The premium automatically rewards the promoter for their initiative and hard work. Since it is performance related, it motivates the promoter to work harder so as to minimize dilution of their control on the company.

The Convertible instruments include convertible debentures and convertible preference shares. The different quasi-equity instruments are as follows:

- Cumulative convertible preference shares
- Non-cumulative convertible preference shares
- Redeemable preferential shares
- Partially convertible debentures
- Fully convertible debentures.

Value Addition

The venture capital firms seek to add value in several ways. The value addition the venture capitalist does comprises:

(i) Assists in evolving marketing strategy including marketing tie ups, product launch, channel distribution and market research;

(ii) Provides multiple round of financing and helps in getting additional capital including working capital requirements;

(iii) Helps in Formulation and strengthening of systems and procedures like Accounting Manual, budgeting and monitoring systems. Assists in secretarial matters;

(iv) Helps in technology evaluation. Assists in negotiations for technology transfer and tie ups with foreign collaborators;

(v) Helps in dealings with government agencies and negotiations with strategic partners;

(vi) Uses network of contacts to enable appointment of nominee directors of eminence on the board;

(vii) Helps in key personnel recruitment and formulating policies for employee retention and

(viii) Provides guidance to investee companies in public listing.

Disinvestment

The most crucial stage in any Venture Capital Investment is the exit. The goal of the Venture Capitalist is

to sell the investment in a period ranging from 3 to 7 years at a considerable gain. The different possible routes for exit from venture investments are: (a) Initial Public Offer; (b) Trade sale; (c) Promoters buy back; (d) Company buy back and (e) Management Buyout.

The most crucial stage in any Venture Capital Investment is the exit.

Initial Public Offer

The most preferred exit route for a venture capitalist is the *Initial Public Offer*. The company can go to the public either through the National Stock Exchanges (NSE), Mumbai Stock Exchange, Regional Stock Exchanges or the OTCEI (Over the Counter Exchange of India). Moreover OTCEI which was expected to play the same role as NASDAQ in USA, Unlisted Securities Market (USM) in UK has been a complete unsuccessful. There are efforts to revive the OTCEI by formation of panel of experts from various field like venture capitalist, Information Technology etc.

Trade sale

In a trade sale the Venture capitalist sells his stake to a strategic buyer which already owns a business similar or complementary or plans to enter into the target industry. This help the strategic buyer to produce a synergistic increase in its value. The promoter may or may not sell his stake to the strategic buyer.

Promoter buy back

In this the promoter buy back the venture capitalist stake at a predetermined price. This is not very popular as the promoter, a first generation entrepreneur is hard pressed for money.

Company buy back

In this the company buys back the venture capitalist stake at a pre-determined price. The company buy back has been recently announced.

Management Buy out

In this the operating management group acquires the business by buying the equity held by the promoters. It usually involves revitalizing an operation, with entrepreneurial management acquiring a significant equity interest.

Conclusion

The abovesaid aspects of VC industry especially financing value addition and disinvestment mechanism may have far reaching implications for the development of the whole venture capital industry. □

Structuring & Launching Venture Capital Funds

Gautam Vashisht

Structuring of venture funds is the process of setting up appropriate bodies for channelising funds from investors into the eligible ventures. Such structuring operations are governed by SEBI guidelines and Central Board of Direct Taxes Rules. The paper indicates how these funds are constituted as Trust Funds with a view to avoid functional shortcomings of the beneficiary. Its advantages are limited life-span, winding up/dissolution on a pre-specified basis. The issue of structuring off-shore funds is also dealt with.

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The process of setting up appropriate investment bodies for channelising funds from investors into the eligible ventures is termed as structuring of funds. The purpose of structuring of investment is to minimise tax outflow, simplify the procedures associated with operations of the Fund, while complying with investment restrictions/Taxation regulation placed by various authorities. Therefore, structuring of funds for venture investments is undertaken keeping in view the following considerations:

(i)   Tax efficiency i.e. additional layer of taxation be avoided.

(ii) Simplicity in operation

(iii) Investors should have limited liability and enjoy maximum tax benefits.

> **The purpose of structuring of invest-ment is to minimise tax outflow, simplify the procedures associated with opera-tions of the Fund, while complying with investment restrictions/Taxation regula-tion placed by various authorities.**

The structuring/Operations of Venture Capital Invest-ments in India is governed by SEBI (Securities Exchange Regulation Board of India) guidelines and Central Board of Direct Taxes Rules. Venture capital investments can be structured on the following lines:

(i) an investment/Venture Capital Company; (ii) A Scheme of Unit Trust of India/division of financial institu-tions; (iii) off-shore entity and (iv) Trust fund.

Investment Company

Following this structure, venture capital organisation

are structured in form of a company. Here, shareholders are investors in the fund. Out of 20 venture capital player only two venture capital organisations are structured in the form of company. Some of the shortcomings of structuring venture investment through this route are:

a) A company is promoted on going concern basis whereas venture capital investors prefers to lock-in their investments for a limited period. Therefore, investment body should be dissolved after a certain period. The winding up of company is complicated and involves considerable procedural formalities.

b) Investors seeks return primarily by way of capital gains, however, if the structuring is in form of a company, return to investors can be provided by way of dividends, which attract dividend tax @ 10 per cent.

c) The share capital of a company can not be redeemed for providing return to the investors as share capital of a company can not be reduced as per the Company Law.

Structuring of venture investments as a Trust fund overcomes some of the shortcoming encountered in a company, as trust has a limited life/time span and can wind up at a pre-determined period. Also the redemptions of the units can be made during the interim period of operation of the Trust fund.

> Structuring of venture investments as a Trust fund overcomes the shortcoming encountered in a company, as trust has a limited life/time span.

Structuring Schemes

Few funds in India are structured as schemes of Unit Trust of India (UTI) wherein corpus of fund is subscribed by UTI and various domestic/foreign investors and fund is managed by a Manager/AMC. As all the schemes of UTI are exempted from tax under Unit Trust of India Act, the venture capital so floated also enjoy tax exemption.

Some of venture funds in India are also set up as division of banks and financial institutions instead of separate legal entity. The profits of these units/divisions are taxed alongwith profit of financial institution or bank.

Structuring of off-shore funds

The VCFs promoted and structured in India are required to comply with SEBI and CBDT regulations. While Private equity funds carrying out venture investments and structured outside India does not fall under the purview of SEBI and CBDT for venture capital investments in India. The off-shore funds are structured in Mauritius to avail of benefit of tax avoidance treaties between Mauritius and India. Typically, a fund is constituted as a non-resident off-shore fund in Mauritius while trustee and protector of fund are constituted as resident companies of Mauritius.

Trust Fund

The Venture Capital funds in India are settled under India Trust Act 1882. Here, pool of funds available for investment from investors are entrusted to Trustee of the Fund. The trustee of the fund can be individuals/company. As there is considerable fiduciary responsibility on individual trustee, a Trustee company for management of funds is a better proposition. The Trust fund can be constituted under a two tier or three-tier structure. In two-tier structure trustee manage the funds on their own, while in three tier structure, trustee entrusts the fund for management to a Asset Management Company (AMC) specifically constituted for the purpose. It specifies contribution/disbursement procedure, induction of new contributors and issue of investment objective, policies and guidelines, investment restrictions commitment period etc.

Operation

The operation of venture fund involves the following:

a) Setting up of trust fund under Indian Trust Act, 1882 by settlor of the Fund, which could be one of main investors in the fund.

b) The trust is required to be registered with Registrar of Trustee prior to commencing its operations.

c) In case fund is created in a three tier structure, trustee and Asset Management companies need to be incorporated. In these two companies, investors should have equity stake on proportionate basis to their contribution in corpus of the fund.

d) The Board of Directors of AMC is subordinated to Directors of Trustee company and reports to Board of Trustee company. The responsibilities of Trustee company and AMC is delineated to

ensure that there is no overlap amongst them. The investment policies are framed keeping in view industry focus of the fund, life of fund, investment stages, instrument, investment restrictions, exit route and portfolio diversification etc.

e) Remuneration to the AMC is normally constituted of two portion. First is the fixed fee which is linked with corpus of the fund and second is the carried interest, which is linked with performance of the unit. Also, net capital appreciation of the fund is shared between investors and AMC in the ratio of 80:20 after providing a nominal rate of return to investors.

f) After registering the fund, incorporating Trustee company and Asset Management Company, entering into FMA. Fund is required to submit application in Form 'A' to SEBI for obtaining certificate of registration. SEBI vets the application, registers the fund and grant certificate of registration.

g) Thereafter fund can file placement memorandum with SEBI which contains details of Trustees/Asset Management company, Details of investment policies, Tax implications, Manner of subscription, Period of maturity, remuneration to AMC, Benefit accruing to the investors, Details of directors of the company etc. SEBI communicates its observations within twenty one days of filing the placement memorandum. On obtaining clearance from SEBI, fund can commence its operations.

Taxation of VCFs

A Venture Capital Fund structured in India needs to follow CBDT regulations for availing of tax exemptions, which are as under:

(i) 80 per cent of money raised under the fund should be invested in equity shares of unlisted companies, within period of three years;

(ii) VCFs are required to hold investment for a minimum period of 3 years;

(iii) VCF can not invest more than 20 per cent of total money raised in a venture and

(iv) VCF can not invest in more than 40 per cent of equity of a venture.

The domestic VCFs/VCCs operating in India are governed by the regulations as prescribed by SEBI and investment restrictions as placed by CBDT for availing of the Tax benefits. They pay maximum marginal tax

(35%) in respect of non exempt income such as interest through Debentures etc., while off-shore funds which are structured in Tax Havens such as Mauritius are able to overcome the investment restriction of SEBI and also get exemption from Income Tax under Tax avoidance treaties. In order to ensure level playing field, it would be necessary to exempt domestic VCFs from tax liabilities.

Alternatively, a tax-efficient vehicle in the form of Limited Liability Partnership Act, which is popular in USA, can be considered for structuring of VCFs in India. This would entail structuring of the Fund in such a manner that investors' liability towards the funds gets limited to their contribution in the fund and also simplify the formalities in structuring of fund.

Limited Liability Partnership

Even though structuring of investments in form of a Trust Fund removes many of shortcomings/problems of a company, limited liability Partnership (LLP) is a more appropriate vehicle for structuring.

In Limited Liability Partnership (LLP) there are two types of partners viz., General Partner and Limited Partner. The general partner are individuals/corporate bodies who decides on investment proposals, disinvestments etc. and invite other investors to become limited partners in the partnership. The liability of limited partner is limited to the extent of their contribution, whereas liability of general partners is unlimited.

The primary advantage of LLP is its tax efficiency. Here the profits under partnership are taxed at partners level only, while in case of fund it is taxed both at fund level and at the investors hand. In case where partner is tax exempt entity, the income becomes completely tax free.

> **The primary advantage of LLP is its tax efficiency. The profits under partnership are taxed at partners level only, while in case of fund it is taxed both at fund level and at the investors hand.**

The main drawback of LLP is that partners are taxed on chargeable gain as investments are disposed of by the fund, even if profits are not distributed. However, its advantages such as tax efficiency and operational matter overweighs its disadvantages and most of VCs in USA and UK are structured on this basis.

Conclusions

Setting up of investment bodies for channelising funds from investor to investee companies constitutes structuring of fund. Though funds in India can be structured in form of a company as Trust Fund. Trust fund offers benefits such as limited life/time span, winding up/dissolution on a pre-specified basis, income distribution etc. over structuring of investment in a company form.

However, a more efficient vehicle for structuring venture capital funds is Limited Liability Partnership (LLP), which is both tax efficient and simple to operate. Enactment of LLP in India would also provide level playing field to domestic VCF vis-á-vis offshore/Private equity funds. ☐

Venture Business in Japan for Economic Revitalization

Fiji Ogawa

The paper analyses the problems of fluctuations of the yen since 1995 in relation to the economic revitalization in Japan. It is true that large business houses have somehow restructured their strategy through global linkages in R&D, technological innovations, marketing, etc. There are problems facing small business firms, especially running through venture capital. Besides restructuring of business enterprises in the competitive scenario and personnel management policies, the paper indicates how the challenges of intense globalization of market economy can be met.

Among Asian countries, only Japan appears to have fallen off the growth trajectory at present. The dynamism of economic development in the NIEs and ASEAN countries is not present in the Japanese economy. Is this lack of economic dynamism is the reflection of a developed country? In April 1995, the value of the yen jumped to ¥79 to the dollar, an all-time high. Many large Japanese industries have accelerated the pace of restructuring and shifted their production bases abroad in order to avoid the effects of currency fluctuations. This is prevalent among electronic and automobile industries that traditionally have a high propensity to export. According to Business Week (10 April 1995), parts and components shipped from Japan to Hitachi's subsidiary in Mexico for the manufacture of TVs were reduced to a meager 30% of the commercial production value. This was due to the continuous efforts made by Hitachi during the past 10 years to improve the operational efficiency of its foreign subsidiaries.

At the macroeconomic level, the sharp appreciation of the yen has had a positive effect as it contributed to reducing the price of imported goods and foreign travel. But this triggered the elimination from the market of firms that have clung to conventional manufacturing and service systems. Japanese industries, be they involved in manufacturing, wholesale, retail, or service stand at a turning point in coping with the rapidly changing business environment. What actions they should take? There are some suggestions in a report prepared by the subcommittee of the government's Industrial Restructuring Council. The report singled out 12 industries that will experience growth up to the year 2010 and suggested that the employment structure should be adjusted to target them. In particular, it selected five growing industries that will contribute to absorbing employment between 1993 and 2000. They are related to: 1) information and communications; 2) quality of life; 3) medicine and welfare; 4) housing; and 5) new manufacturing technology. Among these, industries

relating to information and communications are projected to generate employment for 1.29 million workers.

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Meanwhile, small business should find niche markets by taking advantage of their innate flexibility and agility. The 1994 White Paper on Small Industry also singled out five promising fields for small businesses, related to: 1) social infrastructure; 2) advanced technology; 3) the environment, 4) the aging society; and 5) support for working women.

The economies of the NIEs, which were about 58% of those of developed countries in 1994, will reach almost the same level as those of advanced countries by 2010. The growth trend of the world economy is expected to continue for the next ten years. In particular the economic growth of Asian countries is outstanding. The middle-income population, excluding Japan, was estimated to be 250 million in 1994, but will increase to 750 million in 2010. They will generate huge demands for goods and services. The globalization of small industry is urgently needed to exploit niche markets.

Under such circumstances, business strategy plays a crucial role for small business. Conversely, a small business that excels in corporate strategies, such as creating new ideas, reading future markets, developing new markets, and meeting customer satisfaction, now has golden opportunities to prosper. It is important to grasp the needs of customers. Because they are changeable, this can only be managed by small entrepreneurs whose specific traits are flexibility and agility.

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Strategic Factors for Small Business

Effects of Regional Accumulation

Japanese small business has developed highly competitive power by forming locally dispersed production regions based upon a clear-cut division of labor. Due to the appreciation of the value of the yen vis-à-vis the US dollar from ¥360 to ¥80 over the past 21 years, however, many small businesses such as textiles and ceramics, which have developed highly sophisticated division of labor, have not only lost export competitiveness but also have been hurt by imports. Compared with large business houses, it is not as easy for them to relocate abroad in order to avoid the effects of yen appreciation. So, this is a big blow to small business. But how many small businesses can produce such competitive products and parts? In addition, there is no guarantee that they can maintain competitiveness forever with the changing needs and requirements of markets. The division of labour which Japanese small business has hitherto developed is about to collapse. The textile weaving industry may be treated as a slight exception. It has undertaken new product development and achieved shorter delivery times by forming strategic alliances among small businesses.

The machinery industry has formed the core of the Japanese economy. This is due to the huge number of small businesses that have developed a highly advanced system of division of labor in particular localities. However, these production regions have encountered serious problems since the younger generation is not in a position to take over such activities as foundry, heat treatment, painting, and electroplating. The vacuum thus created in various production processes will adversely affect the development of the machinery industry as a whole. This phenomenon has been accelerated by yen appreciation. It is not an overstatement to say that a number of major machinery production regions scattered across the country are about to collapse. In order to bail out small business, therefore, it is imperative not only to introduce computerization but, more importantly, to secure and develop young successors, engineers, and technicians.

In the light of increasing globalization and computerized information available across national borders, the raison d'être of production regions may appear to lose its validity as localized information, which used to form one competitive advantage of production regions, has given way to global information through computers.

In spite of the age of computerized communications, however, it should be kept in mind that direct,

person-to-person contact has immeasurable merit. Personal dialogue is a seedbed of creativity, and this explains why the exchange of information between entrepreneurs in different lines of business is emphasized.

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Small Business and Technology and shift of manufacturing activities to foreign countries, the quick pace of developing countries in catching up with Japan, the weakening competitive edge in exports, and the flood of imports, large Japanese industries can no longer afford to maintain the conventional linkages with small and medium subcontracting firms since their own survival is at stake.

Technology-related information is also an important strategic factor for small business. Information refers to a "message which is meaningful to the recipient." Information that is not meaningful to the recipient is simply noise. A message that is likely to create meaning in the future is called data. Information is disseminated through machines, written documents, letters, or personal contacts. Information relayed through computers has increased its significance and expanded the activities of small businesses, which have hitherto been limited geographically, to the global scale. Computerized information makes it feasible for small businesses to overcome their inherent disadvantages. Now they are in a position to undertake joint R&D, joint ventures, and business tie-ups in a more active manner across national borders.

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Small Business and the Market

Public infrastructure is available to support small business, but the extent of success of a new business or project is known only when products or services are put on the market. Many small businesses have attempted the commercialization of new products and services but few have succeeded as quite often the market they had in mind was too immature to exploit. The fundamental issues lie in the difficulty of identifying customers who have a strong desire for high-quality goods at lower prices. High value-added products and services that do not meet their needs are no longer wanted. Customer satisfaction is the basic principle for the survival and growth of small business.

More often then not, one of the major causes of failure in developing new products and services is the lack of dialogue with potential customers in the initial, middle, and final stages of technology development. A recent large-scale survey on venture business reported that the majority of successful entrepreneurs have sales and marketing experience. When engineers or scientists start a venture business, therefore, they are advised to develop partnerships with people who are experienced in marketing. The initial secret of the growth of Toyota Motors as a global corporation was the customer-first principle, which was incorporated into the design of the passenger can "Crown" (put on the market in 1955). It was designed based upon the information and suggestions meticulously collected by engineers and dealers from major clients, who were taxi companies at that time.

Reflection of customers' needs in new products and services poses a number of challenges. Technology is the first. CD players were commercialized only through the successful development of the ultra-high precision processing technology. Intrafirm or interfirm R&D makes it difficult to generate a profit unless the production cost is limited to allow a sales price acceptable to customers. The modus operandi of marketing comes next. The extent of rewards depends on whether the firm opts for direct sale, sale via distributors, commissioned sale, mail-order sale, or franchising. In many cases, venture businesses that have achieved new technological development have lost marketing initiatives to other firms and acted as if they were the latter's subcontracting firms. It should be remembered that numerous venture businesses have been successful because of the appropriate choice of marketing method.

The final challenge is when to enter the market. If this timing is wrong, it is difficult to realize the fruits of commercialization. In this case, the reduction of time required for new development becomes a crucial factor. Furthermore, new ventures should always be proactive toward competitive goods and services. The

challenges described above are not easy to overcome, particularly when a new or venture business, which inevitably lacks reputation and credibility, attempts to participate in the market.

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Small Business and Capital

One of the warning signs to Japanese small industry is that the ratio of new businesses opening has become lower than that of those closing. This is due partly to the initial investment required, which has increased over the years. The development of new technology and know-how is indispensable, but it calls for considerable investment. Nevertheless, generating new business is needed to revitalize the Japanese economy. It is necessary to provide public funds, and the government has taken the necessary measures to cope with the capital shortage of new business through the provision of subsidies, loans, tax breaks, credit guarantees, and capital investment.

While city banks and other private financial institutions have been seriously damaged by the after-effects of the bubble economy, the role of governmental financial institutions for small business and the financial functions possessed by local governments have increased. This is particularly relevant when private financial institutions are extremely conservative in financing new business that involves inevitable risks. A new mechanism should be urgently established to provide funds to "new entrepreneurs" who are highly motivated to set up risky businesses.

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> **It is important to keep a balance between the smooth supply of capital and the proper management of venture business. The process from initial R&D to marketing is long, and capital requirements are inflated as the process moves downstream.**

venture business. The process from initial R&D to marketing is long, and capital requirements are inflated as the process moves downstream. Although it is meaningful that the public financial system has been strengthened to support venture business, its operation requires more flexibility.

From the viewpoint of investors, venture business involves a high risk with no guarantee on investment, but the returns can also be highly rewarding. In Japan, financial institutions have traditionally been conservative and given high priority to avoiding risk. Once success has become visible, they storm the entrepreneurs and urge them to take loans for unnecessary expansion of business. This often contributes to the downfall of promising businesses. In order to nurture them, the management and marketing aspects should not be disregarded. This suggests that qualified human resources who can guide new ventures in the right direction are valuable. A combination of capital supply and management guidance leads venture business to success. An era of new entrepreneurship is in the offing. Every effort should be made to foster a social environment that will encourage people to establish new businesses.

Management of Small Business

Qualifications of Entrepreneurs

Given the focus of small business on new project development either by new ventures or by existing small firms, entrepreneurs are the founders of new business. They do not yield to the pressure of the economic recession prevailing in Japan and have a strong conviction of future potential in business. As such, they are unique and valuable to society and should be extended all possible support. What qualifications or traits do such new entrepreneurs possess? First, they are alert to the changes of the times, exposed to international experience, skilled in using computers, and free from the tyranny of precedents and biases. Second, although they have good insight into the changing environment, insight alone is not sufficient unless they can implement new ideas. They are prepared to bear the risks in challenging the unknown. In other words, this is the decision-making capability. A combination of insight and decision making leads to the generation of new products and services. Third, entrepreneurs should possess a sense of speed. What is taking place in the world is relayed instantly through computer networks. Market changes have also gained speed. New business should up as fast as possible. Fourth, the benefits derived from the formation of business alliances or partnerships are significant. Technology fusion and a combination of different resources make it easier to launch a new business quickly. Alliances or partnerships are based upon

mutual trust and confidence among the people involved in the new business. Fifth, entrepreneurs should possess a good knowledge of marketing.

If the above five qualifications are broadly taken as valid, what are the personal characteristics of entrepreneurs? First, they are optimistic so that they can always paint a rosy scenario for tomorrow. Second, they are action oriented. Third, as their actions should be accepted by other people, they are sociable and easily earn the trust of others. Fourth, they maintain a challenging spirit toward new business and do not give up. Fifth, they have accumulated basic knowledge, technology, and know-how relating to new business. The average age of successful entrepreneurs in venture business is around 35 years. This suggests that they have already spent some time acquiring a sense of marketing after completing their education. Professor Karl H. Vesper in his book New Venture Strategies (1980) singled out several prerequisites for launching a new venture. The most important factor is the generation of an "idea," followed by the receipt of "orders from customers," and the availability of "capital." In addition, "personal connections" and "technological know-how" should not be ignored. No venture business is viable in the absence of idea generation.

Launching New Business

It is difficult to identify the starting point of business. Professor Vesper suggested the following:

(1) Some people have an original idea to launch a new business when they are in school or after spending some time in business.

(2) When they have a new idea for business, some people consider it for many years to determine whether it can be commercialized.

(3) Some decide to launch a new business when they leave their current job.

(4) Others decide to launch a new business when they make an initial contact with partners or consultants, offer an official proposal to them, or apply for bank loans.

(5) Some consider the starting point occurs when they begin formal procedures of registering a new firm, remit capital funds to the bank, the firm is ready to accept orders from customers, the firm logo is made public, the firm receives its first order, the firm delivers its first product or provides the first services to customers, profit and loss start to balance or the firm starts to earn a surplus at the end of the fiscal year.

The process of launching a new business is turning point in life and entrepreneurs must take many actions promptly. Considerable expenses are incurred in the initial stage of operation, for which government subsides an low-interest bank loans are helpful. Losses tend to be accumulated initially while profits are generated much later. Under such circumstances, incubation centers play an important role by providing not only a workplace for operations at relatively low cost but also consultancy services relating to technology, capital mobilization, and management. In Japan the Kanagawa Science Park (KSP) has earned a reputation as an incubation center. In Europe, the Berlin Innovation Center (BIG) serves similar functions. These institutes support promising, high-tech businesses, and many developed countries have shown keen interest in establishing similar organisations. Of course the Sources of idea generation are multifarious. Existing small firms may get ideas from their clients. Entrepreneurs may develop ideas that were not adopted by their former firms. However, it is useful to find a source of ideas in a more organized manner, such as brainstorming with other people, the purchase of patents, ideas collected from colleagues, customers' needs, the analysis of products and services developed by competitors at home and abroad, study of the trends of science and technology, idea contests open to the public, and study of the source of success of highly profitable firms. Firms should aggressively tap all available sources as they may yield new ideas. Once new products have been made on a trial basis, samples and catalogues can be taken to potential customers. It is more effective if samples are offered to public institutes, large firms, and influential persons to obtain guarantees. Quality standards certified by public technical institutes are also instrumental in augmenting the credibility of the product. The firm needs to install the machinery and equipment to manufacture a certain volume of products. Once the process reaches this stage, it is important to prepare for packaging, advertising, marketing, and price setting.

> **Incubation centers play an important role by providing not only a workplace for operations at relatively low cost but also consultancy services relating to technology, capital mobilization, and management.**

Operating New Business

Launching a new business is one thing and operating it is another. The real capability of entrepreneurs is at

stake when they launch business operations. They must excel in achieving efficiency through the following measures:

(1) The setting of long-term objectives in line with the entrepreneurs's business philosophy will motivate workers. The set objectives will dictate specific corporate strategies as well as tactics and action plans. More desirably, the design of detailed tactics and actions plans should be left to workers in the workplace.

(2) Communication and dialogue with partners, workers, and advisors is one of the most important factors in running a new business successfully. Entrepreneurs should maintain constant dialogues with them so as to develop mutual confidence from the initial stage of operations.

(3) Close teamwork and high morale among workers are instrumental in earning support from customers, affiliated firms, banks, and public administrators. Senior staff should play a major role in this regard, but the behavior and actions of individual workers vis-à-vis those outsiders also affect their confidence level.

(4) Teamwork is a source of a firm's vitality and competitiveness. Good teamwork can be developed and maintained under good leadership. Leadership capability and the creation of a favorable work environment for higher motivation depends upon the extent of education and training given. Kaizen in the Workplace for improving technology and know-how, upgrading quality, reducing costs, and shortening delivery times is implemented through the joint efforts of team members who share the objectives of satisfying customer needs.

(5) Good teams tend to dissociate from other teams in the same organisation. Therefore coordination and linkages between teams improve the productivity of the entire organisation. Close linkages should be extended to affiliated firms that are involved in production, marketing, and distribution. Thus it is important to spread the concept of equal partnership between functional teams and between different organisations.

(6) Hard work through continuous *kaizen* by workers will increase the revenues of the firm. Top management should always keep in mind an equal sharing of achievements and due promotion, without which worker motivation for higher productivity can scarcely be expected.

Continuous Learning and Challenges

Continuous learning and challenges have been more significant than today for small and venture business. In the age of rapid progress in science and technology, deepening of information and communications, and changing markets, entrepreneurs are required to make continuous efforts for self-renovation and improvement. Today's new business can be obsolete by tomorrow. The dynamic changes in Japan's industrial structure offer a golden opportunity to new entrepreneurs in entering the market and to existing small businesses to adopt a more aggressive strategy. Firms should be resilient in the face of changes, and continuous learning and challenges are the keys to changing entrepreneurs and organisations. A special issue of Fortune (28 November 1994) covered the "management of change." It highlighted that the management of change is the management of paradox. First, all workers should participate in causing changes but those who voice skeptical views should not be tolerated. Second, a step-by-step approach should be taken for organisational changes, although long-term perspectives should always be kept in view. Third, changes take place at great risk. Leadership should be so exercised as to allay fears among workers and other concerned parties. In a nutshell, changes progress between fear and comfort.

Professor Robert H. House of the Business School of Pennsylvania University has emphasized several qualifications required by entrepreneurs who cause changes. First, they have a vision of a rosy future, or "innate optimists" in the words of that author. Second, they are convictionists who do not hesitate to sacrifice absolute confidence in their staff. Fourth, they are less motivated by finance reward or power-grabbing than by the development of a new organisation and capable staff and the achievements they make.

Continuous learning and challenges should be applied to daily *kaizen* for the improvement of production processes, products, and management. The Toyota Production System was introduced when the first "Crown" was made in 1955, which was a steppingstone for Toyota to become a world leader in the automobile industry. When Toyota's growth is analyzed from the viewpoint of the management of change, it is found that the evolution started with product renovation and then moved on to process renovation – *kaizen* – process renovation – product renovation. It should be noted that *kaizen*, process renovation, and product renovation are mutually lined. When this analysis is applied to new business, it starts with the commencement of the project and moves to process installation, *kaizen*,

process renovation, and product renovation. Once there is a sign of decline, the firm should repeat the cycle starting with the generation of new ideas. Not a few small businesses have maintained their corporate life longer than the automobile industry, but most of them have successfully converted from one business to another in response to the changing market.

Conclusions

The basic management of small business lies in the coexistence of firm-specific identity and linkages. The firm-specific identity constitutes the core of competitive power. This may be replaced by the word "appeal". Products and services should appeal to customers.

The first principle is "psychological linkages" between the concerned parties. In other words, a sense of partnership should be formed on the basis of mutual trust, efforts, and cooperation. They should share the concept of kyosei, or symbiosis, as a common understanding. The second principle is "technological linkages" that refer not only to unified product and protocol standards between firms but also to coordinated operations in processing, assembly, and distribution.

These linkages play their respective roles, but what is most important is how to establish harmony among them. This is orchestral management, which will facilitate the generation and development of new business. No vertical hierarchy is desirable in the promotion of orchestral management in that the vision of management should be shared on an equal footing.

Recently, Japanese researchers have paid attention to the secret of revitalization of production regions by small businesses in Italy.

The reason why small business can be the origin of revitalization may be the personal linkages between entrepreneurs and workers. Family-oriented management is practiced whereby equal partnership is emphasized and hierarchical authority is rejected. This work environment should be expanded to influence outside organisations such as affiliated firms and customers.

In the USA, the virtual corporation is considered the ideal form of new business in the future. In order to make this a reality, excellent technologies, the existence of market opportunities, cooperation across national borders, and mutual trust between business partners are indispensable. It should be repeated that no business can be viable in the absence of mutual trust and confidence between people. In an age when Japanese industries have lost their previous dynamism, business horizons should be opened with limitless potentials for

> **In order to make this a reality, excellent technologies, the existence of market opportunities, cooperation across national borders, and mutual trust between business partners are indispensable.**

growth. There is no reason for small entrepreneurs not to take advantage of these potentials. While large industry is obsessed with restructuring for its survival, Japan's economic vitality rests on the shoulders of venture business and small entrepreneurs. The creation of new business should be promoted as a national movement. It will also attract the younger generation whose unemployment rate has become a serious social problem in Japan.

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Japanese Government Policies for the Development and Promotion of Small Business

Hajimu Hori

The author has reviewed the evolution of Japanese small scale industry since post war (early 50s) till to present age of globalization. The time period of four decades have been divided into three stages of growth. It is true that Japanese Govt. policies have helped immensely the growth of small firms under the nose of stiff competition by giants and multinationals, but still there are several handicaps. The authors have outlined several policy measures.

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Introduction

Presently a third venture boom has now arrived in Japan. During the first and second booms, there was a fervor among small entrepreneurs not to miss the bandwagon. Due to negative economic growth after the oil crisis, the first boom did not last long, while the second boom was also ephemeral because of the recession caused by the yen appreciation. Consequently it is argued whether the third boom will also end as a short-lived phenomenon or become a long-lasting dynamic event. Venture business is an attractive but at the same time difficult business. Why does Japan require venture business today? What are the basic prerequisites to make venture business viable? Is venture business relevant to the Japanese socio-economic environment? Answers to these questions may be found in the historical development of the Japanese economy after the war and the lessons derived from history.

> **Venture business is an attractive but at the same time difficult business.**

Post-war Economy Development

The first stage of development was from 1945 to 1955 when major efforts were directed towards economic recovery from the war. As a huge number of ex-soldiers returning from neighbouring countries were not able to find employment, many of them started to open small businesses which spread like wild fire across the country. The dissolution of the financial cliques (zaibatsu) under the order of the US Occupation Force also helped develop a favourable business environment for small entrepreneurs. However, large industry

continued to play a major role in the economic rehabilitation because of their resources. Further government policies were also in favour of large industry, as it adopted the slide production system emphasizing the skewed allocation of resources to such major industries as steel and energy. Policies for the development of small industry began to form gradually, and consultancy services were offered to strengthen technological skills and upgrade the managerial know-how of small entrepreneurs. It was during this stage when government approved the establishment of cooperative associations among small firms.

During the latter part of the first stage between 1950 and 1955, an economic boom had arrived and large industries needed to outsource parts and components in order to expand their production capabilities. Vertical linkages between large and small businesses were formed at this time. The government set two priority policies: employment generation and the strengthening of the overall production capacity of industry to attain future growth. The former was addressed to small business, while the latter was reserved for large business. The Small and Medium Enterprise Agency under MITI worked out policy measures to prevent small business from bankruptcy as it could lead to unemployment.

The second stage of development was from 1955 to 1973 when Japan achieved high economic growth. Japan was still a developing country in the early period of this stage. Under rapid economic development, the unemployment problem almost disappeared; on the contrary, labour shortages became a serious issue. Problems arising from the dual structure of the economy started to emerge around this time. A glaring dichotomy was observed between large and small businesses in terms of wage levels, working conditions, and the arrangements for bank loans. How to eliminate this dual structure was the challenge for government. During the latter part of the second stage, wage differences narrowed due to labour shortages while the productivity gap remained wide. In 1964, the OECD recognized Japan as a developed country and accepted her membership which obliged her to implement a series of measures to liberalize trade and investment control. While the labour shortage still remained a big issue,

> **A glaring dichotomy was observed between large and small businesses in terms of wage levels, working conditions, and the arrangements for bank loans.**

policy emphasis for small business shifted to its modernization and rationalization to strengthen market competitiveness and achieve higher productivity.

The third stage was from 1973 to 1985 when stable growth was the mainstay of the national economy. The economy shifted its emphasis from growth-by-all-means to environmentally friendly economic growth. In this era, Japan was influenced by a wave of exogenous changes such as the introduction of the floating foreign exchange system and the two oil crises. Changes were also observed in Japanese society and the economy such as the globalization of business corporations, emphasis on a better quality of life rather than monetary rewards, and recognition of the importance of soft managerial resources such as information, know-how, and HRD. In the meantime, small business lagged behind in its response to the changing environment partly because it lacked soft managerial resources relating to, among others, new marketing information after the oil crises. Differences in productivity which were narrowed during the previous phase expanded once again. Hence government policies for small business centred on the strengthening of soft managerial resources.

Globalization

The latest stage is from 1986 until the present during which the Japanese economy has undergone a dramatic metamorphosis towards globalization and deregulation. Before the Plaza Accord in 1985, one US dollar was ¥240. After the Plaza Accord, its value appreciated very rapidly to the level of ¥160 in 1986. Changes were not limited to the currency issue only. The dynamic growth of newly industrializing economies (NIEs) gained momentum and products made by them flooded the Japanese market. Many Japanese firms increased their volume of foreign direct investment in NIEs and ASEAN countries to counter their competitive power. Either by design or by accident, the harmonious symbiosis between large and small businesses, which has long been considered a secret of Japan's high economic growth, started to be diluted in its significance, if not to disappear. Many large businesses implemented radical restructuring and reengineering for their own survival under the most serious economic recession ever experienced since the end of the war.

Hitherto many large manufacturing firms used to provide small subcontracting businesses the necessary resources in technology, managerial skills, and others for their manufacture of particular parts and components. The large firms however found that this arrangement was too costly to maintain. An alternative strategy has been to discontinue production of particular goods and offer

the relevant technologies to small businesses who continue to produce them through OEM arrangements under the brandname of the large firms. Gradually large businesses have handed over a whole range of manufacturing activities to small businesses, so that the former could concentrate their resources in such areas as planning, R&D, and design. As a result of this technology transfer, an increasing number of small businesses have acquired highly advanced technology and skills, and large businesses could no longer assemble final products without supplies of parts and components from such small businesses. Now they stand on an equal footing with large businesses in negotiating business transactions. In some cases, they can dictate their own terms and conditions. On the other hand, there still are many small businesses that have neither advanced nor firm-specific technologies which are competitive in markets. Thus a new dual structure has emerged between small industries.

> An alternative strategy has been to discontinue production of particular goods and offer the relevant technologies to small businesses who continue to produce them through OEM arrangements under the brandname of the large firms.

Large businesses have now developed a variety of networks in purchasing the necessary parts and components subject to cost, quality and delivery terms. One noticeable feature is that many small businesses in neighbouring Asia have upgraded their technological capabilities to the level which satisfies large firms in Japan. Hence they have advantages both in cost and in quality. Small businesses in Japan are finding it very difficult to compete with them unless their technologies are highly firm-specific. By now the conventional, vertical integration "keiretsu" — the purchase and supply of parts and components on long-term and stable terms by limiting the number of participants in the market — has gradually been taken over by a new form of networks not only in the domestic market but also across national borders. For example, in the past, if a small subcontracting business wanted to sell its products to firms to which it was not affiliated, it had to seek approval from its parent firm. If it did not do so, the parent firm would very likely cut the linkages immediately. Now the situation is different. The parent firm has encouraged its affiliated small businesses to sell products to non-affiliated firms as it can no longer support the latter through the provision of resources. Thus, the form of the "keiretsu" has been transformed to one of ordinary business transactions. Some argue that the keiret-

su system has completely disappeared. This is not necessarily correct as the keiretsu still remains in the form of a looser network, rather than a pyramid structure. During this stage government policy for small businesses has pointed in the direction of encouraging them to change the line of business and to acquiring capabilities in soft managerial resources.

> One noticeable feature is that many small businesses in neighbouring Asia have upgraded their technological capabilities to the level which satisfies large firms in Japan.

Emergence of Venture Business

In response to the dynamic changes in the Japanese economy, small business has also changed its characteristics. It may surprise the reader that Sony, Matsushita, and Honda that are known as global corporations started as technology-oriented, small venture businesses. Their history is much longer than those which started to appear during the venture boom. There are two types of venture businesses in Japan. Sony and Honda fall under the first type which started in a very small scale and grew large. Whereas Toyota and Fujitsu belong to the second type that were established by large firms as their affiliates and now are much larger than their parent firms. Until 1995 government policies for small business were designed across the board; venture business was qualified to apply for government assistance, but no specific policies were prepared for the development and promotion of venture business.

Some argue that the 1990s is a new economic era which is epitomized by mega-competition, while others contend that it is still a continuation of the previous period of stable growth. Either way, it appears that the Japanese economy is on the way to recovery from the long recession. According to the theory of business cycles, small business is expected to recover from recession faster than large business. But this does not seem to pertain to the recession Japan has experienced in the 1990s. Its impact on small business was greater than economic theory predicted. The appreciation of the yen and the rapid growth of Asian economies are major factors in explaining the significant change in the economic structure. In fact this impact can be observed in the statistics relating to the establishment and closure of small businesses. Since 1986 the establishment ratio has followed a downward trend and the closure ratio has been higher than the opening ratio. In one sense, this may suggest that the Japanese economy, in which

small business plays a core role, has lost its vitality for future growth. In order to revitalize industrial dynamism, the promotion of venture business may offer one solution. Being free from the conventional mindset and approach in forming corporate strategy, venture and new businesses appear to be in a better position to take advantage of technology and human resources – the only two production factors Japanese industry is though to possess – for the development of unique products and services. In this regard the demise of the lifetime employment system has generated an immeasurable impact upon the labour market. These days the entry and exit to the labour market has begun to take over lifetime commitment to one single firm from the graduation from school to retirement age. This is a blessing in disguise for small businesses as skilled workers and qualified staff from large business have become redundant and are willing to join small business to find new job opportunities. Moreover many young workers select small businesses to start their job careers.

The age of globalization, information, deregulation, and competitive markets offers new business opportunities to venture businesses. At the macro economic level, savings in Japan have been much higher than investment, and this means that there is a need to create more investment opportunities. At present savings re moved abroad in search of attractive investment opportunities. If they are made available to the domestic market there are positive consequences for the national economy. In this context, the emergence of venture business is important as it offers lucrative investment opportunities. It is no overstatement to say that the traits of venture businesses such as flexibility in meeting market needs, speediness in decision-making, and lack of bureaucracy will lead to successful investment in a competitive market. It is often said that large business tends to lack these characteristics, and this explains why many large businesses have now emphasized flat organisational hierarchies which devolve decision-making authority to a number of small groups within their own organisations.

In spite of a seemingly favourable environment for venture business in Japan, there still are many problems. Compared with the USA, the fundamental prerequisites in promoting venture business are weak. First, there is a lack of assessors who are qualified to take stock of the extent of the risks involved in new venture business. This weakness has induced large capital investment into large businesses as they are relatively free from investment risk and further can offer sufficient collateral. Second, while venture business is less constrained by technological development itself, there is a dearth of supporting services for expediting the processes of commercialization by venture busi-

ness. For example there is a lack of R&D, legal, management, and marketing consultancies. In addition, there are traditionally few "angels" in Japan who can sponsor venture business. Third, there is a lack of opportunities for training and education in the development of entrepreneurship.

In order to overcome these constraints, government has just started to offer two kinds of support systems. First, support for strengthening managerial, financial, legal, and technical resources is to be offered to venture businesses. At this juncture, mention may first be made of the financial mechanisms available in Japan. In Japan, just as in other countries given the same conditions, banks are more willing to give loans to large firms rather than to small firms. There are two financial mechanisms available in Japan. First, there are government financial institutions specifically reserved for small businesses such as the Small Business Finance Corporation. Second, locally-based small financial institutions are available that provide loans to small businesses located in the same locality. As the linkages between them are close both personally and officially, loans are given based upon mutual trust and confidence. Of course, this does not mean that loans are made by totally ignoring the risks involved. Third, there is an institutional mechanism in each prefecture which functions to reduce or dissipate the business risk of small firms. The credit guarantee association is a case in point which acts as a guarantor form small businesses when they obtain loans from financial institutions. Small businesses pay commission to obtain the guarantee and financial institutions obtain insurance from the association. Second, as the market for venture businesses is still immature, the government is going to organise a "venture plaza" which is something like a market where efforts are made to match-make venture businesses with venture capital. As to the first support, a new law concerning the promotion of creative activities by small industry was enacted in April 1995 with a view to promoting high-tech venture businesses and R&D intensive new business. This law attempts to induse small businesses into the area of venture business so that they will undertake high-tech R&D and commercialization (see Annexure). The response by small business to this new law was more than originally anticipated and more than 500 firms have been accepted as qualified to receive support. This shows that the spirit of entrepreneurship in search of R&D-oriented new business has remained ubiquitous throughout the country. New technological developments are likely to take place one after another with cooperation among venture businesses, R&D institutes, and universities. And this further indicates that small venture business will lead economic vitality into the next century.

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The Global Operations of A Venture Business

Motoo Matsuura

The paper presents an historical survey of the prolific growth of the Japanese firm Juken Koggo Co. Ltd. Since its humble origins during 1965, it manufactures a wide range of miniature plastic parts vital for sophisticated appliances in semiconductors, IT, etc. Not only the firm has taken a lead over several other companies in Japan, but has become globally competitive.

In 1965 when Japan was in the middle of rapid growth the Juken Kogyo Co., Ltd., was established. It manufactures a wide range of miniature plastic parts which have a highly advanced and sophisticated technology and which are supplied to large firms. This may give an impression that Juken is a small subcontracting firm under the strong and sometimes undue pressure from large firms. In reality this is not so. More often than not it is Juken which gives pressure to the large firms. This is because Juken concentrates on manufacturing activities which large firms cannot undertake. In this context, it is also not true that Juken covers a niche market because it does compete with other firms in the same market. Unlike other firms which expanded their economies of scale in particular during the period of high economic growth in the 1960s and 1970s, Juken opted for limiting the number of workers to a bare minimum.

It appears that the computer network and the internet have gained an increasing momentum in Japan, but, in the perception of Juken, they have not been so popular as claimed by the mass media. In Juken, a personal computer network was introduced three years ago and at present all workers in Japan have their own computers and communication network, in addition a large number of laptops and mini computers are available in the firm.

> It appears that the computer network and the internet have gained an increasing momentum in Japan, but, not been so popular as claimed by the mass media.

Historical Survey

Traditionally women workers have played an impor-

tant role in the company and nowadays four section chiefs out of seven are women. In fact Juken was surprised to see the enactment of the law concerning equal employment opportunities between men and women several years ago as this practice has long been prevalent in the firm.

It is interesting to note that the Japanese economy has met a turning point every ten years. Firms that have been successful in tiding over each turning point have grown and stayed in the market. The 1960s was the era of expanding economies of scale under the aggressive high growth policies of the government. A number of large-scale mergers took place during this period in the steel, banking, and automobile industries. At this time, Asian countries had become important trade partners with Japan as the suppliers of oil and the recipients of goods from Japan.

> It is interesting to note that the Japanese economy has met a turning point every ten years.

The 1970s was the era when Japan suffered from a wave of external shocks. One took place in 1971 which terminated the gold-conversion system in the United States, thus introducing the floating exchange rate. Second, the first oil crisis occurred in 1973. The prime minister at that time was the major architect of the abortive Japanese Archipelago Remodeling Plan. As he failed to control hyper-inflation, subsequently aggregate demand restraint policy was adopted with a view to driving out the rampant inflation. Naturally this was a big blow to, among others, small firms as banks hardly made loans available to them. Even if loans were made available, few small firms could afford to borrow as the interest rate was much higher than they could absorb. The 1970s was also the era when the post-war industrial revolution took place. Profits derived from these improvements were invested in new technological developments such as energy-saving and pollution control technologies. Transistor television sets and energy-saving compact cars established competitive edges in global markets.

> Profits derived from these improvements were invested in new technological developments such as energy-saving and pollution control.

Although at that time few Japanese firms recognized the significance of foreign exchange which was floating every day, Juken was prepared to cope with such changes as it was a crucial factor in undertaking joint ventures abroad. In the mid part of the 1970s the president predicted the following future economic scenario: the yen was likely to be around ¥100 to one US dollar in 10 to 15 years time. Consequently many electric and electronic appliances makers that were Juken's important customers would shift more than 50 per cent of their production facilities abroad. The scale of the domestic economy would be reduced by half. Based upon this scenario, Juken accelerated the pace of foreign direct investment so that it could avoid the influence of the volatile foreign exchange rate. By so doing, the firm could also respond to the needs of long-time customers who would go abroad.

Strategies

Juken soon established four corporate strategies. First, that it should develop a core or key technology based upon the integration of relevant production technologies. In particular, priority was given to the development of manufacturing technologies relating to die-making and injection molding machines. Second, that it should develop a data base for numerical control (NC) machine operations. Third, that it should make the factory more systematic for the production of energy-saving molding machines. These are still the main machines used in Juken's domestic and foreign factories and they have also been sold to other customers. Fourth, that in anticipation of the shortage of energy in the future, it should develop ultra small parts such as plastic gears and cogs weighing 1/1000g for watches. This technology was successfully developed and Juken has produced 10 million parts for watch-making firms. At present it is now challenging to develop parts weighing 5/10000g.

At a time when Juken was used to relying upon statistical quality control methods, it received a very large order from an automobile firm for one million parts on the condition that not a single reject would be tolerated. Although it was indeed a very tall order, the president decided to accept it. He thought that statistical quality control was far from sufficient to warrant the quality of one million parts. He bought all the available textbooks on QC and studied them for one week preparing a simple manual of QC operations for workers. The assignment was successful achieved without generating a single defect. The interest rate was around 7.5 to 8.5 per cent. It was just after the second oil crisis in 1978 and the displacement effects were observed in relation to wages and land prices. Even after

inflation was subdued, wage and land prices did not decrease. The annual salary of an average worker at the age of 22 was ¥ 560,000.

The 1980s was the era when Japanese industry demonstrated its dynamic power and competitiveness while US industries suffered from the after-effects of a bubble economy. From their affluent cash position, Japanese firms acquired lands and real estate in the USA. It was claimed that Japan was invincible. While Japanese industry was at the height of its power, the US counterpart was working hard to assimilate Japanese management systems and practices and successfully implemented corporate restructuring and reengineering. This became the basis for US industry to regain competitiveness in the 1990s. For example, both General Motors and Ford have been reinvigorated based upon the elaborate analysis and assimilation of Toyota's production system and human relations. Now it was the turn of the US firms to claim that there was nothing else they could learn from Japan.

Policy Initiatives

In the 1990s when the bubble economy started to burst, those finance-oriented entrepreneurs were in deep trouble as many of them had to settle warrant bonds which they had issued in anticipation of the increase of their value. The bonds which had been considered as huge assets now turned into huge debts. In the meanwhile, the second type of entrepreneur suffered less as they were not required to settle external financing and loans. In the eyes of the president, even equity financing should also be considered as a kind of loan to the extent that firms are obliged to account to shareholders. So as to avoid interference by shareholders, Juken had no intention to expand the scale of the firm through external financing. The president was the only shareholder and hence neither dividends nor bonus has been paid. The retention of profits is the only source to strengthen the firm's financial position.

> In the 1990s finance-oriented entrepreneurs were in deep trouble as many of them had to settle warrant bonds which they had issued in anticipation of the increase of their value.

The Plaza Accord in 1985 which triggered the sharp appreciation of the yen gave a warning to Juken that a fully-fledged globalization of the economy would be in the offing in the 1990s. The firm started to prepare for this new paradigm. First, the technological development achieved during the 1970s and 1980s was further upgraded. The efficient transfer of technology has been achieved through the reinforcement of databases regarding techno-managerial information. The pace of new technological development has accelerated in preparation for the next economic recession. Second, as the value of the yen was predicted to become stronger in the 1990s, Juken started to establish foreign subsidiaries from around the mid 1980s. The globalization of Juken is still in progress and its nature has become more sophisticated in that strategic alliances have been made between Juken's subsidiaries abroad. These have combined to make new investments in third countries. Third, it is extremely important to give an orientation to young workers about the war in Asia and the ugly acts conducted by the Japanese military forces. The sharing of understanding about the past history will form the basis to develop harmonious linkages between Japan and neighbouring Asia. In fact it is no overstatement to say that Juken has given higher priority to education on the pre-war Japanese history rather than to techno-engineering education.

The year 1998 was taken as a watershed year for the firm. In anticipation of the significance of digital technology, it has already started to withdraw from the production of analogue-based parts and shifted the emphasis to digital-based parts which are used for computers, CD-ROMs, and telecommunication equipment. The progress of globalization is likely to accelerate during the 1990s, together with an increasing value of the yen. Juken has adopted a number of corporate strategies in order to cope with such business environments. First, it has already started to construct the most up-to-date molding factory. The firm can be immune from recession only through the synergistic efforts of lower cost, higher quality, and quicker delivery (QCD). Orders for goods never fail to materialize as long as it follows the principle of QCD both in substance and in spirit. Second, it has also started to produce the most up-to-date compact injection molding machines. They have been delivered to affiliated firms abroad so that Juken can stay competitive in the global market on the basis of a powerful cooperative network. Third, a plan is underway to complete an ultra-miniature mold manufacturing technology.

As to the relationships with foreign subsidiaries, Juken has already passed the initial period in technology transfer and training where the vertical flow — namely from Juken's headquarters in Japan to its foreign subsidiaries in Asia — of technology and experience prevailed. Nowadays, both parties have established close linkages on an equal footing. On the one hand, the parent firm in Japan has been playing a core role in supplying advanced technology to foreign affiliates,

while on the other, it has benefited from the marketing capability possessed by the latter.

The spirit of equal footing is also shown by the plan that newly-recruited Japanese workers will be sent to the affiliated firm in Singapore to receive training. And Singaporean fresh workers are to be sent to Japan for receiving on-the-job training. As the Singapore affiliate has already acquired the ISO 9000 certification, the parent firm is planning to acquire it under the guidance of the Singapore affiliate. The chairman of the Taiwan affiliate, who used to be a member of top management of a famous bank in Taipei, has provided accounting and management advice to the parent firm on a regular basis. The parent firm has not asked its affiliates to pay licensing fees or royalties. This is not because the level of technology developed by Juken is not up to the satisfactory level. On the contrary, the level of technology is extremely high and it has been sold to many firms in Japan at an extremely high licensing fee. Rather technology has been provided to subsidiaries on a cost basis in the light of the spirit of equal footing. Juken believes that the sharing of resources including technology will contribute to the strengthening of the position of firms like Juken in the global market. Equal footing leads to mutual trust and hence no contract papers have so far been prepared within the group in concluding business dealings. According to Juken's experience, asian people honor an oral commitment to the fullest extent, and not a single misunderstanding or problem has occurred in the past 20 years as far as oral commitments are concerned.

Current Scenario

What is the current position of Juken? At present it has 80 workers in Japan whose average age is 30.1 years old. The annual salary of a worker aged 24 was ¥4 million in 1995 (no wage difference between sexes). This salary level was higher than that of large firms and hence the firm needs to undertake management rationalization to every extent possible so as to retain young and qualified workers at the high salary level. The annual working hours were 1,890 hours and holidays were 129 days except the annual leave. The interest rate at present is very low at 2 per cent or less. The annual domestic sales turnover was ¥3 billion.

The change of the times points to the change in the business environment. Every time a new change occurs, small entrepreneurs have to acquire new knowledge and take new actions. As their resources are limited compared with large firms, they have to be more careful to observe and analyze the changes and take quick action. They will lose to market competition once they fail to take timely action.

The 1960s was the era of the scale of economies. The 1970s was the era of quality and production control. The 1980s was the era of financial management. The 1990s was the era of globalization and business is no more bound by national borders. And the 21st century will be the era of the advanced information society. All these changes took place and will take place in accordance with the needs and requirements of the times. Juken has a strong conviction that its prosperity can be derived only from mutual cooperation and assistance among its affiliated firms in Asia and Europe. Its strong linkages have made it possible to remain competitive in domestic and foreign markets. In future, quality control and production management will not be sufficient to make firms competitive. They need to develop and acquire advanced information-related manufacturing technologies. As for Juken, it has already renovated the production system in such a manner as to cope with such high technological areas. Take for example, the manufacturing of the plastic mold. Under normal circumstances it requires 100 to 200 hours to make it, but Juken has been able to make it within one hour although this is still at an experimental stage. Once its commercialization is realized which is coming shortly, it will be offered to affiliates in Asia. Juken has not asked affiliates to provide dividends and instead advises them to strengthen their internal reserves. Should, however, the patent firm go under in future, it is their duty to rescue it. As presidents of Asian affiliates are all in their thirties, the time will soon come when the parent firm is led by one of them. Moreover it is in the natural course of events that the top management of Asian affiliates will join the board of directors of the parent firm. These strategies have been developed not because the higher positions offered are due rewards to them but because they have accumulated experience and know-how

> The 1960s was the era of the scale of economies. The 1970s was the era of quality and production control. The 1980s was the era of financial management. The 1990s was the era of globalization and business is no more bound by national borders.

which will strengthen corporate management both at home and abroad. All information – managerial, accounting, and technology – is open to affiliates as they can have instant access through the computer network. Only small firms that can taken advantage of information technology will be able to survive in the 21st century. □

Globalization & Ecological Responsibility

Udo E. Simonis

Consequent on globalization of economic development since mid 90s, ecological responsibility has assumed major technological importance under the banner 'Sustained Development'. There is an extensive debate on the deteriorating conditions of the global ecology and the necessary globalization of environmental policy. Over-exploitation of natural resources and the destruction of global eco-systems are the rising issues. The author of the paper being connected with the UN agency for environmental policy suggests several vital measures to ensure these palliatives under severe competition among industrial nations.

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The term and concept of globalization comprises a description and a prescription: it describes in the dominant economic understanding, a widening and deepening of international flows of commodities, finance and information into a single, integrated global market while it prescribes in the prevent political comprehension, that national and international markets are to liberalize further, because only unregulated flows lead to the best possible results for economic growth and social welfare. Globalization in the context of liberalization is also a powerful ideological instrument in the current struggles on distribution both within and between nations. But this hardly cares for the role of ecology nor acknowledges this as a global ecological problem. This is because national economic policies also do not value ecology very much. Nevertheless or probably exactly because of that, it's necessary to think about the possible conflicts over resource-use and environmental degradation that go along with further globalization of the economy, and about the resulting need for a globalization of policy in general and environmental policy in particular. And in this context, the responsibility of entrepreneurs has to be addressed.

> **Globalization in the context of liberalization is also a powerful ideological instrument in the current struggles on distribution both within and between nations.**

Economic-ecological Interrelations

There is a very extensive and lively debate on the bad and worsening conditions of the global ecology and the necessary globalization of environmental policy. In particular, over-exploitation of natural resources and the destruction of global ecosystems are well-known. On the question of formulating and implementing a globally oriented environmental policy, remarkable progress, particularly regarding climate

and biodiversity issues has been made.

The beginning of this policy-process can be dated back to the first UN-Conference on Human Environment in Stockholm, 1972; its first highlight was the 1987 report of the World Commission on Environment and Development, which introduced the term sustainable development (Fig. 1) as a strategic concept: The old question of economic growth is still on the agenda but a second problem — viz. that of a devastating use of nature could no longer be ignored. And in addition to the traditional question of social justice that of intergenerational justice, of solidarity with the future, came to the fore.
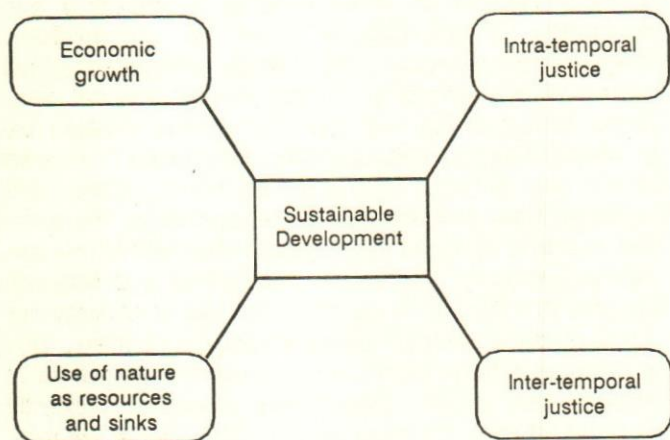

Fig. 1. Aspects of Sustainable Development

While translating the concept of sustainable development into common language and down to earth action, the first (intended or unintended) misinterpretations occurred: Some mistook it for permanent economic growth, others for a biocentric dictate. The necessary differentiation between the economic, social and ecological dimensions of sustainability was not undertaken or sustainability was emptied of all meaning to ignore any possible conflicts. However, as empirical studies show, differentiations are made by society: In Germany, for instance, there still is a group of growthmen (approximately 20 per cent) — fewer than in the past; but there are also post-materialists — approximately of the same size as the first group. Apart from these two groups there is a majority of citizens (about 55 per cent) which is split into the semi-sensibilised affluent, on the one hand, and the disadvantaged, on the other hand.

Industrial society is heavily focused on efficiency, but sufficiency is no taboo and consistency no foreign word any longer. Consistency, when applied to ecological questions, requires the environmentally sound composition of material and energy flows as well as a throughput management of the production systems.

> **Industrial society is heavily focused on efficiency, but sufficiency is no taboo and consistency no foreign word any longer.**

Materials and Energy throughput

For an industrial society in general and of specific regions in particular, materials and energy throughput is still much too high. Regarding most of the relevant material and energy resources there are two aspects: First, the situation is still on an expansion path through a change of trends has not yet taken place. Secondly behind this growth syndrome, understood in material and energy terms, lies a big distribution problem. The consequence of this will be that those use used to stand at the bottom end, namely the developing countries, the poor regions and the poor social strata, will in future strengthen their demands for equity concerning the use of resources and the environment.

The ratio between material throughput caused by men and material throughput caused by nature also requires further differentiation: there are bigger and smaller problems. As far as non-renewable resources and concerned chrome is one of the better cases: here, anthropogenic material throughput amounts to only about double the throughput activated by nature (Fig. 2). The worst case is represented by lead: here, anthropogenic material throughput is 333 times larger than natural throughput.

> **The ratio between material throughput caused by men and material throughput caused by nature also requires further differentiation: there are bigger and smaller problems.**

And what about renewable resources? Consider freshwater as an example. According to a recent estimation by the United Nations the number of countries suffering from absolute water scarcity might double within a generation (Table 1). All these and many other examples show that besides efficiency it is sufficiency and consistency that is required if ecological responsibility would be defined for a globalizing economy.
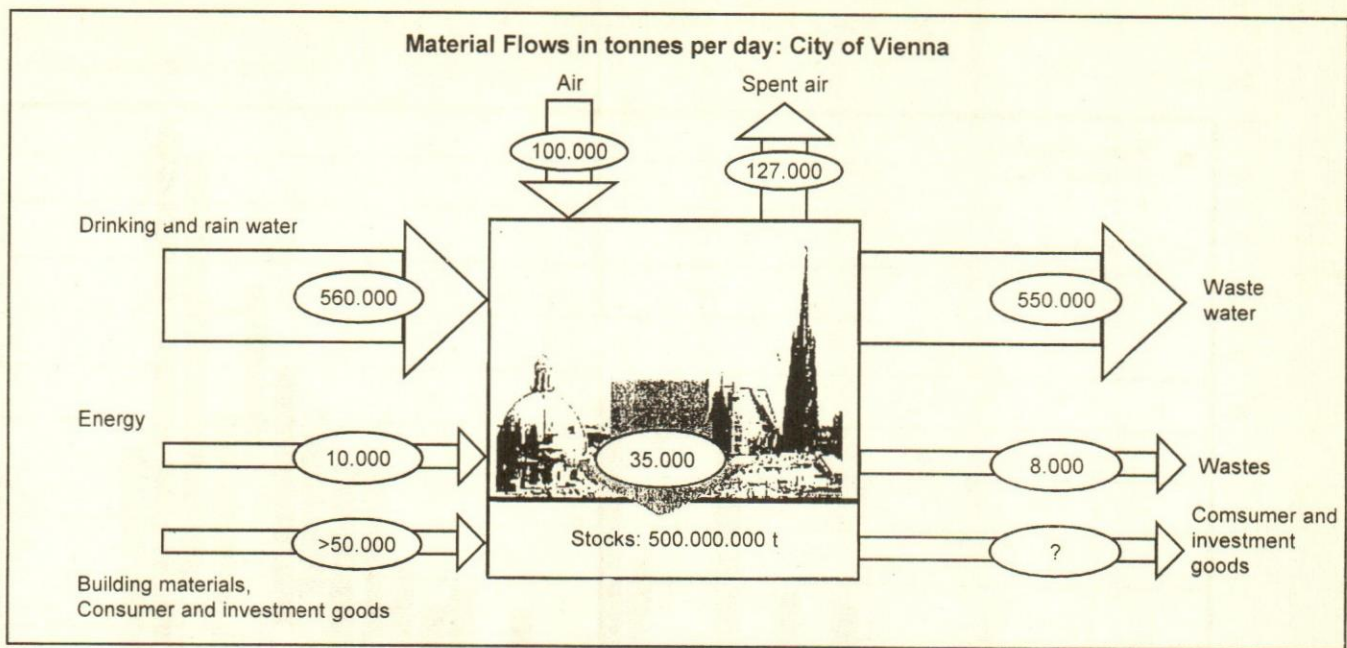
Material Flows in tonnes per day: City of Vienna

Fig. 2. Material Throughput of Vienna

Table 1: Water Availability in selected countries, in m³ per capita and year

Countries according to regions	1992 actual	2010 estimated	Changes in %
Africa			
Egypt	30	20	−33
Algeria	730	500	−32
Kenya	560	330	−41
Libya	160	100	−38
Mauritania	190	110	−42
Morocco	1.150	830	−28
Niger	1.690	930	−45
Rwanda	820	440	−46
Somalia	1.390	830	−40
Sudan	1.130	710	−37
South Africa	1.200	760	−37
Tunisia	450	330	−27
Middle East			
Israel	330	250	−24
Jordan	190	110	−42
Lebanon	1.410	980	−30
Saudi Arabia	140	70	−50
Syria	550	300	−45
Others			
Netherlands	660	600	−9
Singapore	210	190	−10

In the present context only a few of the probable effects of these energetic and material driving forces can be enumerated (Ayres and Simonis, 1994).

One of the possibly dramatic effects resulting from on-going global warming is the rise of the sea level. Estimates are that a global temperature rise of 2 degrees Celsius would lead within the next century (medium IPCC scenario) to an average rise of the sea level by 50 cm. This would affect many people as about 40 per cent of the world's population live in coastal areas.

> **One of the possibly dramatic effects resulting from on-going global warming is the rise of the sea level.**

There are other frightening scenarios of possible future developments. But one need not even look to the future, also recent natural catastrophes are frightening (Fig. 3). This is evident for instance from the data compiled by Münchener Rück-Versicherung, an international insurance company.

The dilemma of rapid economic growth could be illustrated as: Modern man carries a large, 'ecologic rucksack', which still gets heavier, and he marks the world with a big 'ecologic footprint'. And the dilemma of
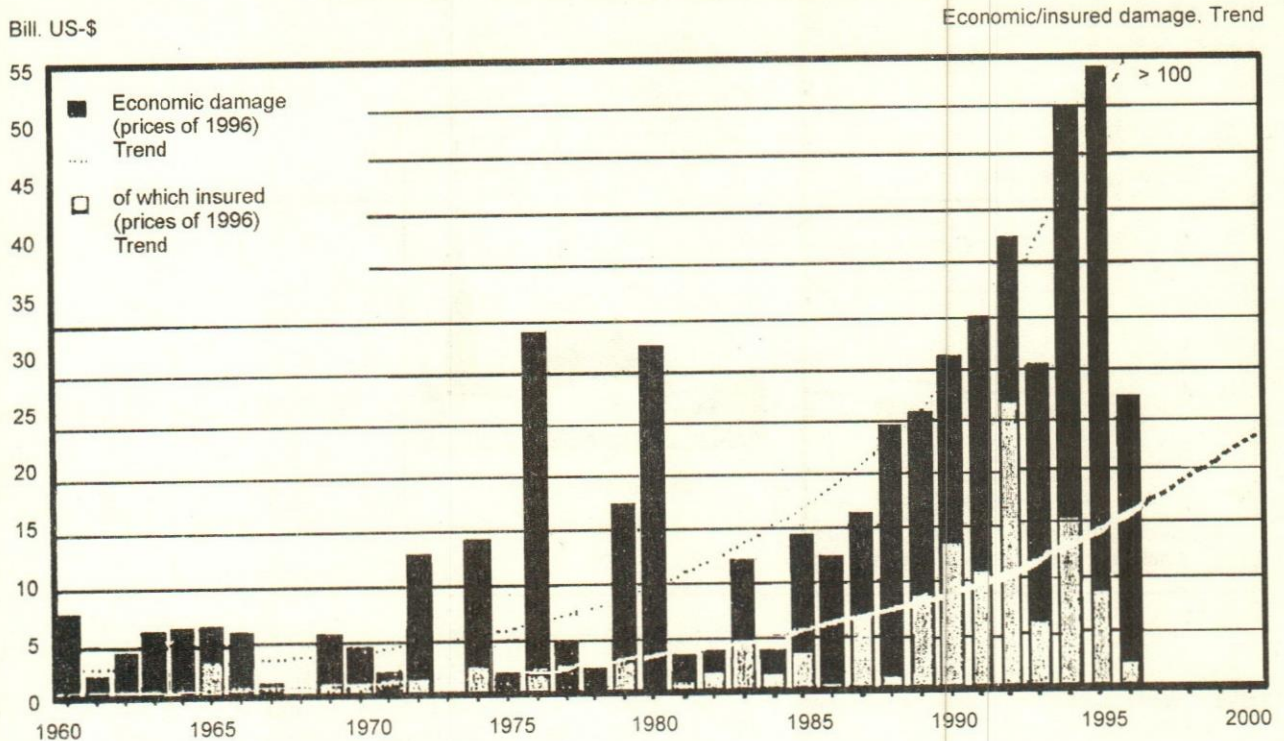
Fig. 3. Great Natural Catastrophes, 1960-1996

Source: Münchner Rück 1997

industrial society could be described in the language of strategic management as disrespect for or total neglect of the "golden rules of ecological management".

> **The dilemma of industrial society could be described in the language of strategic management as disrespect for or total neglect of the "golden rules of ecological management".**

Specific Examples

According to data recently published by "Nature" oil supplies will only last for another 36 years if the present rate of consumption continues. One of the three golden rules, however, says that consumption of non-renewable resources should be balanced by new supplies of renewable resources — for example by a respective increase in solar energy. Continued over-exploitation of renewable resources, as now happens in the case of fish and freshwater means a violation of the second golden rule according to which the regeneration capacity of renewable resources should be preserved.

Furthermore, a rapid increase in the world's population has to be taken into account; even if the population should "only" double, the world will become considerably more "crowded". The present state of "crowdedness" has been impressively illustrated by Herman E. Daly: Taking global Net Primary Production (NPP) as an indicator, the present world population uses already 40 per cent of the terrestrial NPP. This percentage will rise to 80 per cent when the population doubles; and so there will be only little room left for quantitative economic growth.

There can be no doubt about the fact that the state of the world has changed from "empty" to rather "full" (Fig. 4). The question however is, whether growthman will acknowledge this in good time or whether nature will have been irrevocably ruined by the time they come to their senses. On the other hand, in a steadily filling world the question whether things can't be managed differently will certainly be voiced by a steadily growing number of people.

Ecological Changes

Three decades of study established two different trends in industrial countries: There is a group of countries
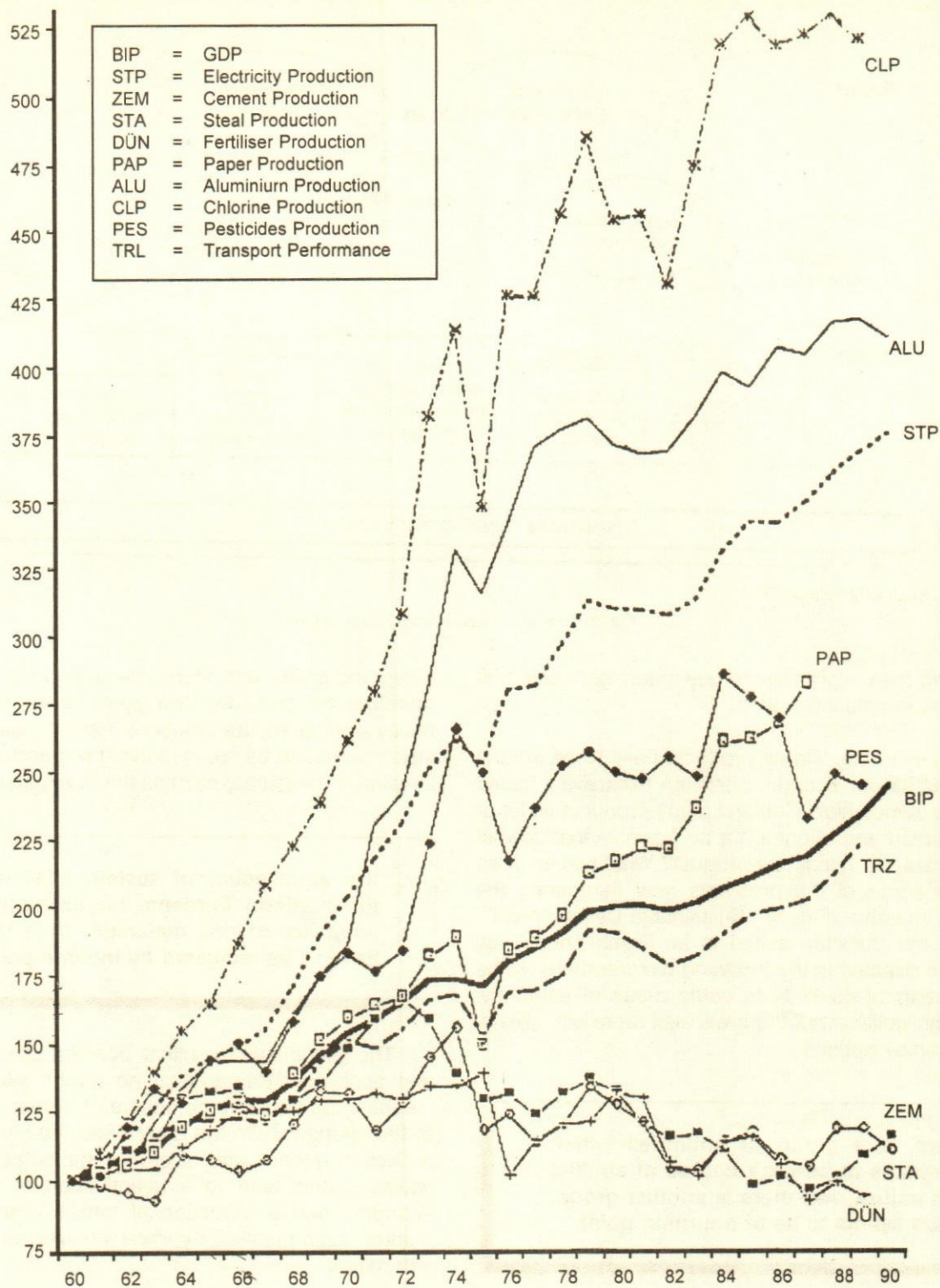
Fig. 4. Structural Economic Change in Germany

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which continues to be on a course of conflict with nature, and there is another group, which seems to be at a turning point; in some countries even a clear de-coupling of economic growth from a further burdening of the environment has taken place At first glance this seems to support the position of those who fully rely on "technical innovation" – and who consider this the most important task of modern entrepreneurs. A different conclusion, however, can also be drawn: Technical innovation is a necessary but insufficient precondition for a sustainable
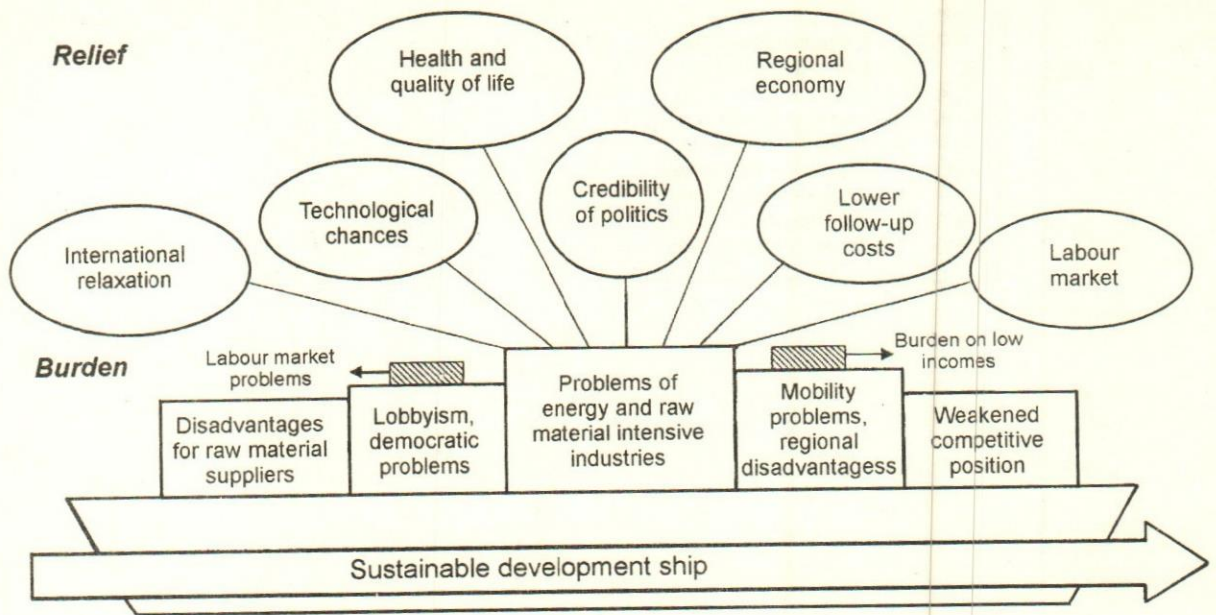
Fig. 5. The Ship "Sustainable Development"

society. We then might have to pay much more attention to socio-economic innovation.

As an example, 'Do all products have to be sold in the market, is our economic system exclusively based on private ownership?' Couldn't many products be let or leased instead and might it not be possible that several people share the use of one product? What can be done to relieve some of the problems now hampering the course of the ship (Fig. 5) "Sustainable Development". This was the question asked in an Delphi-enquiry by Austrian; it resulted in the following picture: there will be a sharpening of conflicts in some areas of economy, society and politics, but there will also be reliefs, alleviations, and new options.

> **There is a group of countries which continues to be on a course of conflict with nature, and there is another group, which seems to be at a turning point.**

If a strict policy of sustainability leads to shortterm burdens, for example for suppliers of raw materials, then these have to be mitigated by income policy. When lobbying intensifies because one has to step out of the use of coal in the medium term then the answer might have to be found in a pro-active policy of introducing renewables. Industries with high consumption of energy and materials will probably strongly resist an active climate policy and adequate solutions have to be found. But also care has to be taken to avoid regressive impacts of innovative measures, such as the ecologic tax reform.

> **If a strict policy of sustainability leads to shortterm burdens, for example for suppliers of raw materials, then these have to be mitigated by income policy.**

The mitigation of conflicts over the use of resources and ecological degradation no doubt will become of central importance in the course of further globalization of the economy. On the other hand the globalization of politics in general and of environmental politics in particular, should lead to a re-activation of the regional economy and a reduction of tensions on the labour market, accompanied by lower ensuing costs for man and nature.

Ecological Management

The people of the world are united by the vision, without frontiers and prejudice, without hunger and fear of destruction. Though one knows that this vision cannot be realised today or tomorrow, yet one must strive

step by step to approach this goal established by Willy Brandt's Declaration in 1986 is the basic tenet of the Foundation for Development and Peace (SEF).

Conclusions

Entrepreneurs must learn to see themselves as global citizens and base their actions on global responsibility. To an increasing degree, this responsibility means ecological responsibility. The demands on natural resources (the "ecological footprint") by modern globalizing economy are too strong and the emissions of pollutants and waste (the "ecological rucksack") are too large and so are destroying the ecologic systems. The footprints have to become smaller, the rucksacks lighter—this should be an easily understandable message for a sustainable society.

This request not only challenges entrepreneurs, but also consumers and politicians. And it should not be left to the future but accepted as a vital task of the present—because, as the SEF founding declaration continues: "The future of mankind depends on whether

> Entrepreneurs must learn to see themselves as global citizens and base their actions on global responsibility. To an increasing degree, this responsibility means ecological responsibility.

we are able to see ourselves as global citizens, ready to base our actions on global (and this means ecological! U.E.S.) responsibility".

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Adoption of Energy-Efficient Lamps in Keralam

N. Vijayamohanam Pillai

The present case study analyzes the results of a household sample survey conducted in Thiruvananthapuram, the capital city of Keralam, to assess the extent of energy conservation, in the backdrop of the severe power crisis in the state. This is feasible by adoption of energy-efficient lighting devices such as conventional, slim and compact fluorescent lamps and electronic ballasts. In the present paper the state of adoption is examined in relation to the theoretically identified determinants using chi-square tests; a multiple regression approach to interpreting chi-square analysis throws more light on the sub-category-wise relationship between adoption and its determinants.

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Keralam has been passing through a very severe power crisis for a long time. It has literally plunged into the darkness of load-shedding and power cuts since the turn of the eighties that brought in recurring draught. The sole dependence on hydro-power has left the system at the mercy of the natural vagaries; coupled with this has been the sluggish growth in installed capacity. During the last 20 years since 1976-77, Keralam has added just 497 mega watts (mw) to its installed generating capacity and during the last 10 years a meagre 32 Mw only! Based on the 14th Power Survey, it is reported that the deficit between the power requirement and the availability in the State would be as high as 1142 Mw by 2000.

> **The sole dependence on hydro-power has left the system at the mercy of the natural vagaries; coupled with this has been the sluggish growth in installed capacity.**

Energy conservation assumes added significance in such a pathetic situation of crisis (Govt. of India, 1986). The rural energy crisis, identified with firewood crisis for cooking (Ravindra Nath and Shailaja, 1986), has led to the development of the fuel-efficient, smokeless and time-saving cooking stone in India, the diffusion of which is facilitated under the National Programme on Improved Chulha (NPIC). Fluorescent lamps (FLs) and compact fluorescent lamps (CFLs) have already made the electric lighting more efficient. While an ordinary bulb (incandescent lamp, IL) has an efficiency of only 22 lum em/watt, a fluorescent tube light (40 watts) has 64 lumen/watt and a slim tub light (36 watts) has 70 lumen/ watt efficiency (Deo, Modak and Shukla, 1991). Thus the FLs not only yields more light, but also saves power, a slim tube light, compared with an IL (60 watts), saves more than 40 units

of electricity a year, assuming the lamp is used for 5 hours a day. CFL is much more efficient, an 11 watts CFL, which consumes only 13 watts of electric power, is much more luminous than a 60 watts IL, saving at the same time 47 watts of power per lamp. Thus using a CFL results in a saving of about 86 units of electricity a year, assuming a lighting period of 5 hours a day. If a household has 4 or 5 lamps, this then implies an immense saving of electricity in, say, Keralam as a whole with about 35 lakhs electrified households. As one unit electricity saved is equivalent to one unit generated, this in turn implies huge savings in additional capacity costs and working expenses. Moreover, CFL has a life expectancy of some 8 times that of IL; but is costlier.

Using electronic ballast instead of conventional choke with FL also has a number of benefits in addition to energy saving, such as flicker-free light, instantaneous start even at low voltage, etc. While an ordinary FL choke consumes 10-15 watts of power, electronic choke takes in only 2-3 watts power. Thus substitution of electronic choke (EC) for conventional one with a FL results in a saving of about 22 units of electricity a year, assuming a 5-hour lighting period a day.

> **Using electronic ballast instead of conventional choke with Fluorescent lamp has a benefit in addition to energy saving, such as flicker-free light, instantaneous start even at low voltage.**

In Keralam, the Agency for Non-Conventional Energy and Rural Technology (ANERT), established by the State Government in 1986, functions as a nodal agency engaged in the process of spreading the message of renewable sources of energy and energy conservation among the various sections of the society. A number of other institutions and voluntary organisations are also there in the field involved in the dissemination of energy-efficient technologies (EETs) through awareness programmes, distribution of energy-saving devices at subsidized rates, etc. During 1992-97, ANERT distributed, besides other devices, 34000 electronic chokes and 22000 CFLs as part of implementation of diffusion of energy-saving devices under the Integrated Rural Energy Programme (IREP), and conducted 123 energy conservation exhibitions, 841 user education programmes and 425 awareness campaigns (Govt. of Keralam, 1997, p. 67).

Determinants of the Adoption of Technology

Energy efficiency improvement has been widely recognized as a major option for the developing countries (DCs) in their quest for environmentally sound and sustainable energy development; as such measures have the advantage of encouraging reductions in energy requirements and the associated polluting emissions. Price and institutional reforms are in general expected to provide strong incentives to the adoption of such strategies (World Bank, 1992, p. 118).

> **Energy efficiency improvement has been widely recognized as a major option for the developing countries in their quest for environmentally sound and sustainable energy development.**

The factors that determine the diffusion of EETs are generally analyzed in a broad framework of analogy to the rate of acceptance of technological innovation in industry and in agriculture. Most of the earlier studies on the diffusion of technology in industry have shared the view that the observed changes, both spatial and chronological, in the distribution of particular innovations, are determined by economic variables (Rosenberg, 1971, p. 209), and not only by ignorance Mansfield (1968, Ch. 7).

Another aspect of the diffusion process studied concerns the types of firms that are quick to adopt new technology. Mansfield (1968, Ch. 8) suggests that size of firm is the main determinant, given the profitability of the innovation; larger firms are more efficient. Carter and Williams (1958) have earlier suggested that managerial attitudes are also a determinant of the willingness to adopt new technologies quickly (Mansfield, 1969; Globerman, 1975; Metcalfe, 1970 and Romeo, 1977).

The variables thus recognized as determining the diffusion of industrial innovation, along with other socio-demographic variables, have been explored for their roles in the efficient-technology adoption in agriculture and recently in energy use. The important variables singled out at the end-use level in general are discussed below:

Information

Information on energy prices and costs of the EELT devices (FL, CFL and EC) is an important prerequisite for rational investment decision on them by a consumer (Sutherland, 1991; Howarth and Anderson, 1993; Sanstad and Howarth, 1994; Jaffe and Stavins, 1994; Levine et al, 1995). Better information in the form of energy efficiency labeling or advisory services to help consumers make more informed decisions is required,

as the consumers are often ignorant of the energy performance of the appliances they buy and their decisions are usually based on financial and aesthetic grounds (World Bank, 1992, p. 117; Hill, O'keefe and Snape, 1995, p. 80). The households' state of information is usually represented by the level of their knowledge of average electricity tariff (energy prices), costs of the EELT devices and technical knowledge of energy efficiency (energy savings) of these devices. The level of this technical knowledge is assessed through a questionnaire distributed to the households. A technical knowledge score is developed from the answers to these questions by assigning '1' for the correct answer and '0' otherwise and taking the sum of the correct answers to represent the scope (Shrestha and Karmacharya, 1998; Herdt and Mandac, 1981).

Cognitive Skills

The mere presentation of factual information or advisory service need not induce individuals to act rationally. Rational decision making presupposes cognitive processes also (Simon, 1967; Howarth and Anderson, 1993; Sanstad and Howarth, 1994; Levine et al, 1995). Formal schooling is generally hypothesized to go a long way towards determining and developing an individual's cognitive processes (Schultz, 1975; Jamison and Lau, 1982; Rahm and Huffman, 1984).

> **The mere presentation of factual information or advisory service need not induce individuals to act rationally. Rational decision making presupposes cognitive processes also.**

Occupancy Hypothesis

In the rental housing market, there is a split between the property developer (owner) and the user (tenant), and their interests often diverge. Property owners often decide upon investment in energy-conserving options only upon occupancy factor (Train, 1985; Sutherland, 1990). On the other hand, the tenant, who is always in mobility, may not have the incentive to finance the investments, unless he is assured that he can take away the EELT devices he has installed once he terminates the tenancy (Maillet, 1986; Clerc, 1986; Fisher and Rothkopf, 1989; Howarth and Anderson, 1993; Jaffe and Stavins, 1994; Sanstad and Howarth, 1994; Levine et al, 1995; Haugland, 1996). Occupancy status (owner or tenant) of the household is taken in most of the studies to represent the significance of this hypothesis.

Risk and Uncertainty

The risk and uncertainty of profitability in the case of an unfamiliar technology is another important determinant to be considered (Feder, Just and Zilberman, 1985), as the investors are in general risk-averse. The diffusion of a new technology is largely facilitated by the spread of information on its availability, profitability and other efficiency characteristics as well as by the demonstration effects (Grilliches, 1957; Thirtle and Ruttan, 1987). Further, heavily advertised consumer products are found to have faster diffusion process (Lekvall and Wahlbin, 1973; Ozga, 1960). That is, the potential adopters' exposure to different aspects of EETs through various formal communication channels and informal sources tends to reduce their subjective uncertainty (Harriss, 1972; Grilliches, 1980).

> **The risk and uncertainty of profitability in the case of an unfamiliar technology is an important determinant to be considered.**

An exposure score is developed by assigning '1' for each source of information (four formal and three informal, as given above) from which the decision-maker has come to know about the technology, and by taking the sum as the total exposure score for him (Shrestha and Karmacharya, 1998).

Capital Market Accessibility

Installation of EELT devices, as compared with the conventional ones, involves higher initial costs, which for many households are often beyond their reasonable reach. This necessitates having recourse to the capital market. However, the capital market being imperfect in most of the DCs, the poor have relatively limited access to credit (Basu, 1997) and often have to pay substantial premium on borrowings. Such situations force the poor, to require much higher rates of return on the installation of EELT devices (World Bank, 1992; Sanstad and Howarth, 1994; Levine et al, 1995), or rather, a very small time of recovery' for the investment (Maillet, 1986).

Methodology

This array of determinants, identified by the theoretical analyses to hypothesize various consumer-level barriers to the adoption of EELTs, has been studied in terms of their proxies in a number of empirical papers. While some studies are devoted to testing the statistical

validity or the hypothesized barriers (Sutherland, 1990, 1991; Ingham, Maw and Ulph, 1991; Shrestha and Karmacharya, 1998), others (especially in the DCs) limit the scope of the analysis to a ranking of the barriers (Parikh, Reddy, Banerjee and Koundinya, 1996; Reddy and Shresths, 1998; Latif and Shrestha, 1997). Generally, the use of chi-square test in such studies should be subject to some important caveats in that, it is not a measure of the degree of relationship, but is only a test of whether or not a null hypothesis of no association should be rejected (Best, 1981, p. 287; Thompson, 1994). However, as the chi-square distribution, upon reaching $\nu = 30$ degree of freedom (df), becomes basically symmetrical and approximates the normal distribution, an obvious relationship between chi-square and commonly used parametric tests can be found to exist.

In multiple linear regression, the proportion of variance shared between the dependent variable and the predictors is reported as the coefficient of determination, R^2. A similar proportion-of- shared-variance interpretation is possible in contingency chi- square applications when all variables are categorical. Thus the interpretation of R^2 in the general linear model may be carried over to the analysis of contingency tables (Leitner, 1979). That is, the omnibus chi-square value calculated from a contingency table can be converted into a proportion of shared variance by dividing it by the total sample size, N, i.e., $R^2 = \chi^2/N$. As the omnibus chi-square value is the sum of all the individual cell chi-square values, for each cell we can estimate the corresponding R^2 value (by dividing the cell chi-square value by N).

The omnibus chi-square value does not specify which combination of categories contributes more or less to statistical significance, a standardized residual (SR) for each cell can be used to determine which discrepancies between the observed and the expected values are larger or smaller than might be expected by chance (Haberman, 1978; Marascuilo and McSweeney, 1977; Reynolds, 1984; Siegel and Castellan, 1988). It is equal to the square root of the cell chi-square values, with the sign (positive or negative) of the difference between the observed and the expected values. As a rule of thumb, if a SR is greater than 2 in absolute value, it can be concluded that the residual contributes to the overall significance of the chi-square value (Haberman, 1973).

However, the results based on the analysis of standardized residual discrimination and interpretability; that is, it provides no insight into the relative and absolute contributions of the individual cells. The relative contribution, i.e., the percentage contribution of each cell to the overall test statistic, is estimated by dividing each cell chi-square value by the omnibus chi-square value. An absolute contribution to the proportion of variance shared by the two factors of a contingency table is obtained from the respective cell R^2 value (the cell chi-square value divided by N) as a percentage.

> The results based on the analysis of standardized residual discrimination and interpretability; that is, it provides no insight into the relative and absolute contributions of the individual cells.

Thus what distinguishes the present paper from the earlier studies is such a regression approach to interpreting chi-square contingency table analysis, that adds, to a test of null hypothesis of no-association, further meaning by finding significant relationship between the sub-categories.

Results

Using the above methodology a sample survey on the state and determinants of the adoption of energy-efficient lighting devices (conventional and slim FLs, CFLs, and ECs) by households in the capital city of Keralam (Thiruvananthapuram) has been conducted. In all, 450 households were surveyed at random in different localities of the city, using a structured questionnaire, during the four months of June-September in 1998.

The state of adoption of EELTs is taken as a dichotomous qualitative variable, and, accordingly the respondents using at least one energy-efficient lamp (EEL) are categorized as 'adopters' and others as 'non-adopters', (note that the use of EC presupposes the adoption of EEL). Table 1 presents the basic characteristics of the households surveyed.

Adoption of FL has been found to be very common among the city households; as many as 91 per cent of the surveyed households are in this category and only 42 have remained as all-IL-households. However, the proportion of adopters falls progressively in the case of other more efficient lamps (generally below 15%). Out of the 450 sample respondents, about 14 per cent have professional and technical education, 36 per cent, Master and above, 31 per cent, Bachelor and the remaining 19 per cent, Pre-Degree and below.

The adopters of CFL and EC have been found to be better informed about the major parameters that help assess the cost effectiveness of the EELTs than others

Table 1: Characteristics of the Sample Households

	Conventional FL		Con. FL with EC		Slim FL		Slim FL with EC		CFL		CFL with EC	
	Adopters	Non-Adopters	Adopters	Non-Adopters	Adopters	Non-Adopters	Adopters	Non-Adopters	Adopters	Non-Adopters	Adopters	Non-Adopters
No. of households	408	42	69	381	139	311	53	397	62	388	44	406
Average No. of EELs	6	7	4	6	6	6	5	6	4	5	3	6
Average age (years)	38	49	36	43	36	46	33	43	31	40	30	42
Proportion of respondents providing correct information on:												
(a) Electricity tariff (%)	26.5	19.1	63.8	25.2	34.5	25.7	67.9	23.2	77.4	20.6	77.3	23.2
(b) Costs of EEL devices (%)	34.6	26.2	72.5	26.8	39.6	31.2	75.5	28.2	80.6	26.3	80.0	28.8
Average technical knowledge score	2.0	1.9	2.7	1.9	2.4	1.8	2.7	1.9	2.8	1.9	3.0	1.9
Education												
Pre-Degree/+2 & below (%)	18.1	26.2	14.5	19.7	15.8	20.3	13.2	19.7	11.3	20.0	15.9	19.2
Bachelor (%)	29.9	38.1	29.0	31.0	28.8	31.5	32.1	30.5	45.2	28.4	29.5	30.8
Master & above (%)	37.0	26.2	36.2	36.0	38.1	35.0	17.0	38.5	12.9	39.7	15.9	38.2
Professional & Technical (%)	15.0	9.5	20.3	13.3	17.3	13.2	37.7	11.3	30.6	11.9	38.7	11.8
Occupancy status												
Owner (%)	83.6	45.2	92.8	77.7	89.2	75.9	92.5	78.3	93.5	77.8	93.2	78.6
Tenant (%)	16.4	54.8	7.2	22.3	10.8	24.1	7.5	21.7	6.5	22.2	6.8	21.4
Average exposure score	3.7	1.1	3.9	1.8	4.4	2.6	4.9	3.0	5.8	3.2	6.1	3.3
Average implicit discount rate (%)	19.3	22.4	19.9	23.1	20.0	23.3	21.4	25.0	22.0	26.8	22.1	26.6

Notes: FL = fluorescent lamp CFL = compact fluorescent lamp Con. FL = conventional FL
CFL = compact fluorescent lamp EC = electronic choke

including the adopters of FL, as illustrated by the level of knowledge they have about the electricity tariffs and the cost of the EEL devices. Only about 28m per cent of the total respondents have had correct information on the average energy rates they pay and about 34 per cent, on the costs of the EEL devices. The average electricity tariffs are Rs. 0.70, 0.90, 1.10, 1.60 and 2.10 per unit respectively for the households in Keralam that consume up to 100, 101 to 150, 151 to 200, 201 to 300 and above 300 units per month.

The higher exposure score of the adopter-households points towards the significance of the communication channels, that tend to guide the prospective adopters in their safer decision-making. Out of the 450 respondents, about 23 per cent, through other formal sources (leaflets, supply agents, advisory services and billboards), whereas about 26 per cent, through the in-formal channels of friends/relatives and only nearly 3 per cent, through neighbours.

Most of the respondents were initially unaware of the scarcity premium of capital shortage. However, they responded well to a little bit of effort at educating them on this matter and the implicit discount rate they have then required ranges from 15-32 per cent. While 26 per cent of the total respondents have required discount rates of 14-17 per cent in line with the bank rates, 36 per cent have required usurious rates in the range of 18-25 per cent, and the remaining 38 per cent, above that. Evidently, adoption or non-adoption of costlier EEL devices involves higher discount rates for the sample respondents.

Table 2 presents the results of the chi-square tests on various hypotheses, as discussed above, on the

determinants of the adoption of EEL devices. The null hypotheses to be tested are that there is no association between adoption of EEL devices and (a) the household decision maker's state of information (proxied in terms of knowledge about electricity tariff, costs of the EEL devices and their energy efficiencies), (b) the decision maker's cognitive skills (in terms of education), (c) the occupancy hypothesis (in terms of the occupancy status of the household), (d) risk and uncertainty (in terms of the decision maker's exposure to different communication channels), and (e) capital accessibility (in terms of the implicit discount rate).

The association of adoption with the occupancy status and with the exposure to communication sources (i.e., risk and uncertainty) also is established in all the cases. However, adoption seems to be independent of capital accessibility (discount rate) in the cases of both conventional and slim FL, though they are associated in the other cases of costlier devices.

Now when one turns to further interpretation of these results in terms of regression approach. In Table 2, R^2 values corresponding to the estimated chi-square values are also reported. Thus, for example, the household decision-maker's state of knowledge of the average electricity tariff has significant bearing on his adoption of conventional FL with EC, and that knowledge accounts for 9.4 per cent of the variance in adoption. In general, the knowledge of energy rates significantly explains 0.7-11.9 per cent of variance in the adoption of EEL devices, and the knowledge of the cost of these devices, 0.7-10.3 per cent. Similarly, the relationship between the decision maker's technical knowledge and his adoption of EEL devices significantly accounts for 4.1-15.2 per cent of shared variance. In general, only the owner-occupied households invest significantly in EEL devices (corroborating the occupancy hypothesis), and this occupancy status explains 1.2-8.5 per cent of variance in adoption of different devices. Risk and uncertainty also is a major factor accounting for 2.8-4.5 per cent of variance in adoption of EEL devices. The relationship between capital accessibility and adoption of costlier EEL devices accounts for 2.6-5.0 per cent shared variance.

The next question is: which category cells contribute the most to the statistically significant relationship? This is explained using standardized residuals and relative and absolute contribution, reported in Table 3. Only the significant results are reproduced; we use the rule of thumb of greater-than-two-in-absolute-value to test the significance of the SRs.

In the case of the respondents' state of knowledge about energy rates and cost of EEL devices, the SRs are significant only for the costlier devices. Thus, the SR of the contingency cell relating the adoption of conventional FL with EC to the correct knowledge of electricity tariff is 5.4 and to incorrect knowledge, −3.43. This means that the respondents having such correct knowledge have adopted conventional FL with EC significantly more than expected and those having incorrect knowledge, significantly less than expected. These two cells have contributed about 78 per cent and 28 per cent respectively to the statistically significant omnibus chi-square value. The very insignificant relative contributions of the other two cells (non-adoption vis-á-vis correct and incorrect knowledge) add further meaning to interpreting the results. In terms of absolute contribution, the finding that the respondents having correct knowledge of energy rates are significantly more likely than expected to adopt conventional FL with EC has accounted for 6.4 per cent of the variance shared between the respondents' state of knowledge of energy rates and state of adoption of FL with EC; and the finding that those having incorrect knowledge are significantly less likely than expected to adopt has explained 2.6 per cent of the shared variance. The same qualitative interpretation follows for other cases of costlier EEL devices also, as well as for the results regarding knowledge of the cost of EEL devices. Thus, in general, the adoption of costlier EEL devices by the households having correct knowledge about electricity rates and the appliance costs has been found to be significantly more than expected and by those with incorrect knowledge, significantly less than expected.

> The adoption of costlier EEL devices by the households having correct knowledge about electricity rates and the appliance costs has been found to be significantly more than expected and by those with incorrect knowledge.

In the case of conventional FL, the statistical significance of the omnibus chi-square value that confirms the association between the decision-maker's state of technical knowledge on energy efficiency of the different EEL devices and his state of adoption of conventional FL is largely contributed to by the association between low technical scores and the consequent non-adoption.

As already mentioned, cognitive skills nurtured by education seems to have some effect only on the adoption of the costlier EEL devices. Even in these cases, significant contributions to the higher omnibus chi-square values have come from only two categories of

Table 2: Results of the Chi-Square Test and Inferences

Determinants (Proxies in brackets)	Conventional FL			Conventional FL with EC			Slim FL		
	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.
1. Information (Knowledge of (a) electricity tariff	1.16 (0.003)	1	accepted	42.42 (0.094)	1	rejected	3.26 (0.007)	1	rejected +
(b) costs of EEL devices	1.06 (0.002)	1	accepted	22.23 (0.049)	1	rejected	2.98 (0.007)	1	rejected +
(c) efficiency rating)	18.6 (0.041)	3	rejected	41.7 (0.093)	3	rejected	31.6 (0.070)	3	rejected
2. Cognitive skills (Education)	4.18 (0.009)	3	accepted	2.76 (0.006)	3	accepted	2.61 (0.006)	3	accepted
3. Occupancy hypothesis (Occupancy status)	38.18 (0.085)	1	rejected	8.28 (0.018)	1	rejected#	10.66 (0.024)	1	rejected#
4. Risk & uncertainty (Exposure to communication)	20.15 (0.045)	3	rejected	12.5 (0.028)	3	rejected*	17 (0.039)	3	rejected
5. Capital accessibility (Implicit discount rate)	0.6 (0.001)	2	accepted	22.55 (0.050)	2	rejected	2.93 (0.007)	2	accepted

(Table 2 Contd.)

Determinants (Proxies in brackets)	Slim FL with EC			CFL			CFL with EC		
	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.	Calculated chi-square value (R-square in brackets)	df	Statistical inference on Ho.
1. Information (Knowledge of (a) electricity tariff	46.46 (0.103)	1	rejected	36.39 (0.081)	1	rejected	53.5 (0.119)	1	rejected
(b) costs of EEL devices	46.17 (0.103)	1	rejected	30.16 (0.067)	1	rejected	44.89 (0.10)	1	rejected
(c) efficiency rating)	55.66 (0.124)	3	rejected	52.46 (0.117)	3	rejected	68.24 (0.152)	3	rejected
2. Cognitive skills (Education)	27.58 (0.061)	3	rejected	30.58 (0.068)	3	rejected	28.05 (0.062)	3	rejected
3. Occupancy hypothesis (Occupancy status)	8.82 (0.020)	1	rejected ^	8.25 (0.018)	1	rejected#	5.3 (0.012)	1	rejected ^
4. Risk & uncertainty (Exposure to communication)	13.26 (0.029)	3	rejected*	15.66 (0.035)	3	rejected#	13.89 (0.031)	3	rejected#
5. Capital accessibility (Implicit discount rate)	12.2 (0.027)	2	rejected#	15.57 (0.035)	2	rejected#	11.56 (0.026)	2	rejected*

Notes: = Ho is rejected at 10% significance level
others are rejected at less than 0.1% level
rejected ^ = rejected at 2.5% level
df = degrees of freedom

rejected* = rejected at 1% level
Ho = null hypothesis of no association
rejected# = rejected at 0.5% level

Table 3: Statistically significant standardized residuals and relative and absolute contributions of the cells of the contingency tables

	Conventional FL			Con. FL with EC			Slim FL			Slim FL with EC			CFL			CFL with EC		
	SR	RC	AC	SR	RC	AC	SR	RC	AC	SR	RC	AC	SR	RC	AC	SR	RC	AC
1. Information																		
Adoption×correct knowledge																		
(a) electricity tariff				5.37	67.90	6.40				5.42	63.28	6.53	4.71	61.07	4.94	5.82	63.41	7.54
(b) cost of EEL devices				3.54	56.51	2.79				5.19	58.24	5.98	4.15	57.01	3.82	5.16	59.41	5.93
Adoption× incorrect knowledge																		
(a) electricity tariff				-3.43	27.71	2.61				-3.41	24.98	2.58	-3.02	24.98	2.02	-3.77	26.59	3.16
(b) cost of EEL devices				-2.51	28.26	1.40				-3.72	29.95	3.07	-2.97	29.20	1.96	-3.71	30.73	3.07
Adoption× technical knowledge																		
Score 2				-2.45	14.35	1.33	-2.47	19.27	1.35									
Score 3				3.66	32.08	2.97	2.67	22.52	1.58	4.48	36.06	4.46	4.11	32.15	3.75	4.89	34.99	5.31
Score 4				3.86	35.71	3.31	2.93	27.20	1.91	5.01	45.01	5.57	4.38	36.53	4.26	5.31	41.32	6.27
Non-adoption× tech. knowledge																		
Score 1	2.71	39.59	1.64															
Score 2	-2.80	42.20	1.74															
2. Cognitive skills																		
Adoption×education																		
Master & above										-2.29	19.08	1.17	-2.98	29.14	1.98	-2.25	18.05	1.13
Professional & technical										3.24	38.07	2.33	3.33	36.34	2.47	3.87	53.51	3.34
3. Occupancy hypothesis																		
Adoption×occupancy status																		
Tenant				-2.37	67.73	1.25	-2.14	42.86	1.02	-2.03	46.58	0.91	-2.17	56.86	1.04	-1.96	72.18	0.85
Non-adoption × occup. status																		
Owner	-2.57	17.33	1.47															
Tenant	4.90	62.9	5.34															
4. Risk & uncertainty																		
Adoption×exposure to communication																		
Leaflets etc.				2.14	36.63	1.02	2.24	28.46	1.11	2.01	30.42	0.90	2.33	34.64	1.21	2.29	37.81	1.17
Friends/relatives				-2.09	34.82	0.97				-2.35	41.67	1.23	-2.50	39.91	1.39	-2.47	43.91	1.35
Non-adoption× exposure																		
Leaflets etc.	-2.98	44.12	1.98															
Friends/relatives	-2.19	23.82	1.07															
5. Capital accessibility																		
Adoption× discount rate																		
Bank rate				3.67	59.74	3.00				2.37	46.04	1.25	2.62	44.00	1.52	2.43	50.92	1.31
Above usurious rate				-2.19	21.23	1.06				-2.25	41.00	1.13	-2.52	40.70	1.41	-2.13	39.19	1.01

Notes: SR = standardized residuals; RC = relative contribution (%); AC = absolute contribution (%)

educational level – Master's Degree and above, and professional and technical Degrees.

The survey results have supported the occupancy hypothesis that justifies investment in cost-effective EEL devices in the owner-occupied buildings, but not in the tenant-occupied ones. The significance of this relationship in the case of conventional FL is largely contributed to by its non-adoption by the respondents in accordance with their occupancy status.

> **The survey results have supported the occupancy hypothesis that justifies investment in cost-effective EEL devices in the owner-occupied buildings, but not in the tenant-occupied ones.**

The respondents' exposures to the formal communication channels of leaflets/supply agents/advisory services/billboards and to the informal sources of friends/relatives also have been the major contributor to the statistical significance of the relationship of the state of adoption to the risk and uncertainty involved in it. The adoption of all the EEL devices except the conventional FL has been largely influenced by these two sources of information.

The less-than-expected adoption of most of the EEL devices by the respondents who came to know of these devices from their friends/relatives and the very insignificant role of the other informal communication source (neighbours) are enough indicators of the anomic social setting into which the life of the typical urban Keralite has of late shrunk. Warren and Clifford (1975) have shown that there are major differences in energy conservation behaviour by type of social setting/neighbourhood. Sources of information used have varied by neighbourhood type, with the integral setting conducive to the use of all information sources from mass media to interpersonal discussion, and the anomic setting, at the other extreme, making little use of any information resource.

Larger contributions to the statistical significance of the association between capital accessibility (in terms of implicit discount rate) and state of adoption of the costlier EEL devices have come from the adopter-households requiring discount rates in the range of the formal bank rates as well as above the usurious rates only. While the households satisfied with the former rates have adopted the costlier EEL devices significantly more than expected, those requiring above-usurious rates have adopted significantly less than expected.

Conclusions

The paper presents some of the results of a sample survey carried out to assess the extent of the adoption of EEL devices by the households in the capital city of Keralam. The major determinants of such adoption have been theoretically identified at the consumer level and tested for statistical significance using proxy variables. One of the major results of interest has been regarding the inefficacy of the cognitive skills (proxied through education) in determining the adoption of some of the common EEL devices; even in the case of the costlier devices, non-technical education of higher levels appears to have failed to induce adoption to the expected extent. Another surprising result exposes the I-don't-care-who-lives-next-door syndrome of the urban Keralites: neighbours have contributed very negligibly to the communication sources open to the adopters and for those respondents guided by friends/relatives, adoption has been significantly less than expected. The occupancy hypothesis stands valid as the tenants' adoption rate remains significantly less than expected. The occupancy hypothesis stands valid as the tenants' adoption rate remains significantly less than expected. While those households requiring moderate discount rates have adopted the costlier devices significantly more than expected, those requiring exorbitantly usurious rates have made investments in these devices much less than expected.

Besides these variables generally considered, other factors such as price, income, etc., also affect the adoption decisions considerably. While there would be strong pressures for more effective use of energy, if its prices were to account for external costs and scarcity (Hill, O'keefe and Snape, 1995, pp. 80-81), higher costs of the EETs tend to dampen the spirit of conservation, the prospective adopters thus requiring much higher rates of return. This has led many countries to introduce subsidies for new types of energy-saving investments by electricity customers (World Bank, 1992, p. 117).

Though the regression approach to interpreting the contingency table analysis used in this study has yielded significant insight into the behaviour of the sub-categories of the determinants in relation to the state of adoption, more information can still be elicited by a formal quantification of the relationship in the framework of qualitative choice models, e.g., probit and logit models.

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Impact of Information Technology on Organisational Effectiveness

D.K. Banwet, Vinayshil Gautam & Rakesh Shalia

As the information technology expenditures of enterprises are now recognised as a significant balance sheet item it becomes important to analyse the strategic role of IT. In the present study involving 18 large organisations having successful information systems, the impact of Information Technology on organisational effectiveness has been examined. The results indicate that the information technology has a strong impact on organisational effectiveness, which was measured by organisation's goal attainment function, human resource function, adaptive and integrative function. It is seen from the findings of the study that the impact of IT on organisational effectiveness is instrumental to the successful implementation and usage of such systems in the organisation.

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It has always been difficult to assess the benefits and the impact of information Technology investments (Chernavy and Dickson, 1974). Measuring the effectiveness of IT has consistently ranked as one of the top ten issues in major surveys of Information Technology Management (Haris and Ball, 1982, Dickson *et al*, 1984, Brancheau and Wetherbe, 1987). Although IT evaluation measures have been developed in the past (King and Epstern, 1983, Srinivasan 1985), a new requirement has emerged in Indian industries where IT is slowly acquiring a significant place and IT expenditures are now recognised as an important balance sheet item. There is a need to assess the strategic role of technology and the impact of IT on organisational effectiveness. In the Indian context the impact of IT on organisation has been meager. Very little systematic effort has been carried out which can be considered adequate in terms of coverage, comprehensiveness and validity of conclusions.

> In the Indian context the impact of IT on organisation has been meager. Very little systematic effort has been carried out in terms of coverage, comprehensiveness and validity of conclusions.

In this paper to assess the impact of IT on organisational effectiveness, the problem of effectiveness measurement and different studies carried out on organisational effectiveness have been incorporated.

Organisational Effectiveness

There have been many attempts to define and measure the effectiveness of organisations, most within last 20 to 25 years. For instance, the "Survey of Organisations" is a diagnostic instrument designed to measure "certain critical dimensions of organisational

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                    INFORMATION TECHNOLOGY

                 ORGANISATIONAL EFFECTIVENESS
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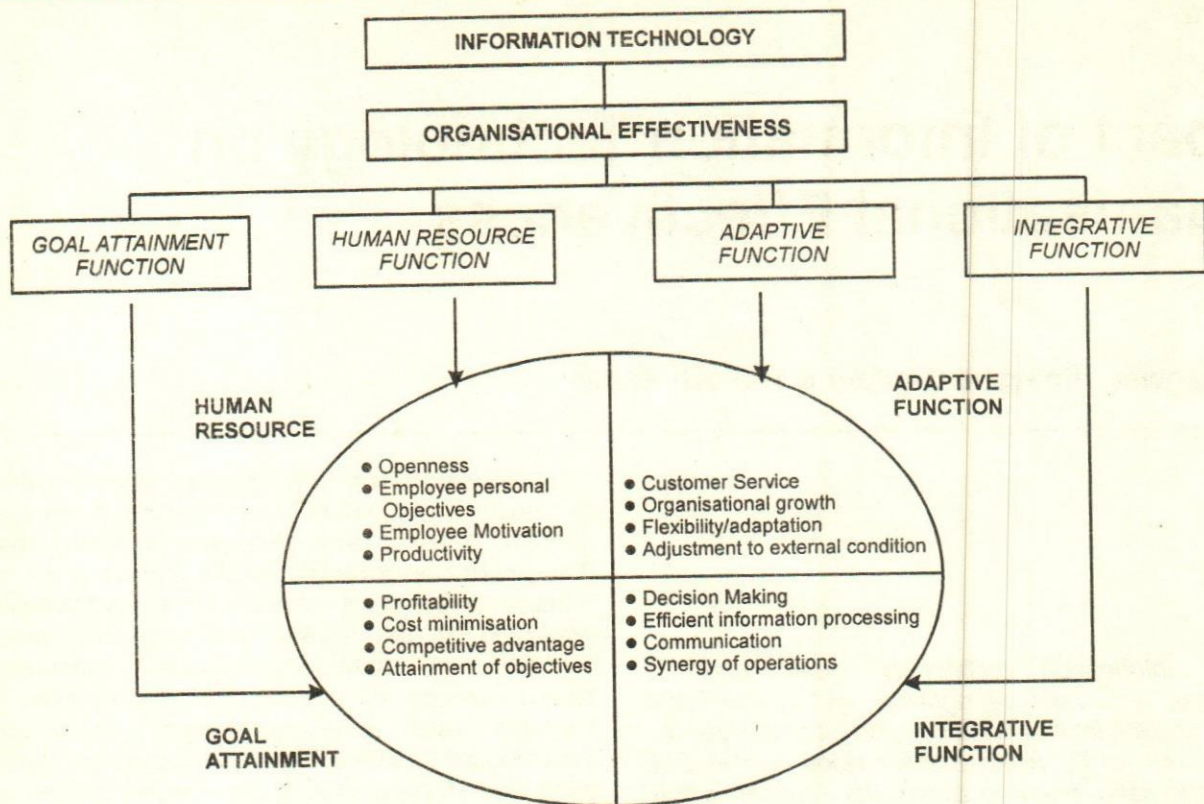
Fig. 1. Conceptual Model

climate, managerial leadership, peer behaviour, group processes and satisfaction" (Taylor and Bowers 1972). Steers (1975) reviewed 17 organisational studies, and summarized the 14 evaluation criteria mentioned in two or more cases. Of these, 'adaptability/flexibility' was mentioned in over half of the studies reviewed, and 'productivity' and 'job satisfaction' in about a third. All other criteria were mentioned in less than a quarter of the studies reviewed.

Campbell (1977) reviewed the organisational effectiveness literature, suggesting "how criterion measures of organisational effectiveness should be developed so that they can be used to compare organisations, evaluate the effects of organisational development efforts, and determine what characteristics of organisations are significantly associated with organisational effectiveness as a basic construct."

Miles (1980), commenting on the "Organisational effectiveness jungle", identified five major schools of organisational effectiveness though: scientific management, human relations, socio- technical, organisational development, and the classical theory of the firm. Miles (as did Campbell, earlier) sorted these schools of thought into two general classifications — goal attainment models and systems models. Van de Ven and Ferry (1980) advanced another view of organisational

effectiveness, highlighting the question of "organisational effectiveness from whose perspective." The work presents their efforts to design, apply, and improve a framework for conducting continuing assessment within complex organisations, offering a process model for others to adapt and/or follow.

Scott (1977) suggested integrating the various effectiveness criterion into a system containing three basic models: a rational system model, with a mechanistic, instrumental focus: a natural system model with a organic, system-maintaining focus; and an open system model, with a system-elaborating as well as a system-maintaining focus. Cameron (1980) proposed a four-model framework, consisting of goal, system resource, internal processes and participant satisfaction models.

Quinn and Rohrbaugh (1983) set out to illustrate the idea that organisational effectiveness is "a socially constructed, abstract notion carried about in the heads of organisational theorists and researchers." Working with the Campbell's list of effectiveness criteria, Quinn and Rohrbaugh asked a group of organisational theorists to consider 30 criteria listed, to eliminate overlaps, and to evaluate the similarity of all possible pairings of the remaining items. The result was a reduced list of 17 effectiveness criteria yielding

136 paired comparisons. The resulting similarities judgement were subjected to multidimensional scaling to identify basic underlying dimensions of organisational effectiveness.

In order to carry out the impact study of information technology on organisational effectiveness, the effectiveness criteria were mapped from different studies done by Campbell (1977), Scott (1977), Seashore (1979), Cameron (1980) and Quinn and Rohrbaugh (1983). These organisational effectiveness criteria were mapped into four broad functions of organisation viz.

- Goal-Attainment Function
- Human Resource Function
- Adaptive Function
- Integrative Function

Hypotheses

Based on existing literature and the conceptual assessment of the nature and extent of impact of IT on organisational effectiveness, the following hypotheses were constructed:

Impact of IT on Goal attainment function of the organisation

M1a: Increases the profitability of the organisation

M1b: Helps in reducing costs at various levels

M1c: Provides competitive advantage to the organisation

M1d: Helps in attainment of organisational objectives.

Impact of IT on Human Resource Function of the Organisation

M2a: Promotes openness amongst and between different levels of the organisation.

M2b: Helps the employees to meet their personal objectives.

M2c: Helps in improving the employee motivation in the organisation.

M2d: Helps to increase the productivity of the employees.

Impact of IT on Adaptive Function of the Organisation

M3a: Use helps in improving customer service

M3b: Helps in overall organisational growth

M3c: Use of IT makes organisation more flexible and adaptive

M3d: Helps the organisation to adjust easily to the external environment.

Impact of IT on Integrative function

M4a: Improves the quality of decision making at all the levels of the organisation

M4b: Use improves the information processing capabilities of the organisation

M4c: Improves the intra-organisation and inter-organisation communication.

M4d: Helps in creating positive synergy between the various departments.

Research Methodology

A quantitative questionnaire survey was conducted to test the hypotheses. A perpetual study was carried out in order to assess the impact of IT on different parameters of organisational effectiveness by seeking the perceptions of selected respondents from different levels.

The target population was comprised of organisations from manufacturing, service and consultancy sectors that satisfied the following criteria inclusively:

- Strategically independent
- Profit seeking
- Large size — more than 500 employees.
- Successful in-house information systems.
- Open to investigations.

A questionnaire was used to collect the relevant data and information. The responses were scored on a five-point scale. For example, one of the items asked IT managers, 'To what extent does the information technology use in your organisation has improved quality of decision making at the top management level'. Possible responses ranged from 5 (to a very high extent), 4 (to a substantial extent), 3 (to fair degree of extent), 2 (to some extent), and 1 (to no extent). The selection of respondent was done very meticulously to ensure that they represent various functional areas and various levels in organisation's hierarchy. Also it was ensured that the respondents had been working with the company for atleast 2 years, so as to have adequate knowledge and experience of IT applications.

Table 1: Impact of IT on Goal Attainment Function

Degree of Impact	Value	Profitability			Cost Minimisation			Attainment of Orgn. Obj.			Competitive advantage		
		Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %
To a very great extent	5	25	27.78	27.8	34	37.8	37.8	13	14.44	14.4	11	12.3	12.3
To a great extent	4	20	22.22	50	29	32.2	70.0	31	34.44	48.8	33	36.7	49
To a Fair extent	3	16	17.78	67.8	20	22.2	92.2	34	37.78	86.6	31	34.4	83.4
To some extent	2	16	17.78	85.6	6	6.7	98.9	12	13.33	100	10	11.1	94.5
To no extent	1	13	14.44	100	1	1.1	100.0	0	0	100	5	5.5	100
Total		90	100		90	100.0		90	100		90	100	

Table 2: Impact of IT on Human Resource Function

Degree of Impact	Value	Openness			Employee Personal Obj.			Employee Motivation			Productivity through people		
		Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %
To a very great extent	5	28	31.11	31.11	22	24.4	24.4	12	13.33	13.3	22	24.4	24.4
To a great extent	4	22	55.6	55.6	18	20	44.4	13	14.44	27.7	32	35.6	60
To a Fair extent	3	20	77.8	77.8	15	16.7	61.1	18	20	47.7	20	22.2	82.2
To some extent	2	15	94.4	94.4	29	32.2	93.3	21	23.33	71	9	10	92.2
To no extent	1	5	100	100	6	6.67	100	26	28.89	100	7	7.78	100
Total		90			90	100.0		90	100		90	100	

Table 3: Impact of IT on Adaptive Function

Degree of Impact	Value	Customer Service			Flexibility/Adaptation			Organisational Growth			Adjustment to external Conditions		
		Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %
To a very great extent	5	37	41.11	41.1	31	34.4	34.4	18	20	20	10	11.1	11.1
To a great extent	4	32	35.56	76.7	26	28.9	63.3	25	27.78	47.8	28	31.1	42.2
To a Fair extent	3	13	14.44	91.1	18	20	83.3	23	25.56	73.4	22	24.4	66.6
To some extent	2	5	5.556	96.7	12	13.3	96.6	15	16.67	90	18	20	86.6
To no extent	1	3	3.333	100	3	3.33	100	9	10	100	12	13.3	100
Total		90	100		90	100		90	100		90	100	

Table 4: Impact of IT on Integrative Function

Degree of Impact	Value	Decision Making			Efficient Information Processing			Communication			Synergy of Operations		
		Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %	Fre-quency	%	Cumu-lative %
To a very great extent	5	12	13.33	13.3	20	22.2	22.2	9	10	10	5	5.56	5.56
To a great extent	4	29	32.22	45.5	32	35.6	57.8	32	35.56	45.6	30	33.3	38.9
To a Fair extent	3	30	33.33	78.8	25	27.8	85.6	30	33.33	78.9	29	32.2	71
To some extent	2	13	14.44	93.2	9	10	95.6	16	17.78	96.7	16	17.8	89
To no extent	1	6	6.667	100	4	4.44	100	3	3.333	100	10	11.1	100
Total		90	100		90	100		90	100		90	100	

Limitations

(a) The methodology does not permit identification of cause and effect relationships amongst various organisational function variables

(b) The methodology does not take into consideration the perceptions of other stale holders, such as, customers of the Organisation concerned.

Data Analysis

Statistical analysis was carried out using SPSS. This analysis pertained to the responses received from the questionnaire.

For all valid responses received from respondents a frequency analysis was carried out (Tables 1-4) in order to have distribution of responses on the impact of IT, various organisational effectiveness parameters. In order to compare the degree of impact weighted average of the impact was calculated. In particular, the validity of hypotheses that IT has a positive impact on each organisational effectiveness variables, Z-test of proportions was conducted.

Thus from 112 Questionnaire forwarded to 18 different organisations 96 responses were received back. 90 were found appropriate for carrying out statistical analysis. SPSS a statistical analysis package has been used for analysis. The frequency analysis, which was carried out to study the degree of impact of IT on each Organisational effectiveness parameter, is presented in Table 5.

Impact of IT on Goal Attainment Function

As can be interpreted from the data analysis 67.8 per cent of the respondents gave a rating between Fair, to a very great extent of impact of IT on Profitability measure. The Weighted average rating came to 3.28, which is greater than the degree of impact. The Z value was 1.54, which is positive and within the acceptable limit of validation of the null hypothesis. It can therefore, be concluded that IT has a fair impact on profitability of the organisation.

On Cost Minimisation, 92.2 per cent respondents gave a rating between fair to a very great extent. Further, the weighted average was 3.8 and Z value was 4.51, which is positive and within the acceptance limit of the null hypothesis. Thus it can be stated that IT helps in Cost Minimisation to a great extent.

On analysing the responses for impact of IT on competitive advantage it can be seen that 83.4 per cent

gave from fair to a very great extent. Further, the weighted average was 3.4 and Z value was 5.61 which also being positive, is within the acceptance limit. Thus it can be inferred that IT helps organisations to achieve competitive advantage.

The responses on impact of IT on Attainment of Organisational objectives were positive as 86.6 per cent of respondents favoured the hypothesis. The weighted average was 3.5 and Z value 4.51.

Table 5: Overall impact of IT on Organisational Effectiveness

Effectiveness Variables	Cumulative % of Response for Fair Great and very very High Degree of Impact	Weighted Avg.	Z Value
Goal Attainment			
Profitability	67.80%	3.28	1.54
Cost Minimisation	92.20%	3.8	4.50
Competitive Advantage	83.40%	3.4	5.61
Attainment of Orgn. Objectives	86.60%	3.5	4.51
Average	82.50%	3.5	
Human Resource			
Openness	77.80%	3.6	3.44
Employees Personal Objectives	6.10%	3.2	0.21
Employees Motivation	47.70%	1.84	−2.3
Productivity through People	82.20%	3.6	4.3
Average	75.50%	3.06	
Adaptive Function			
Customer Service	91.10%	4	6
Flexibility/Adaptation	83.30%	3.8	4.51
Adjustment to External Conditions	66.60%	3.3	2.58
Organisational Growth	73.40%	3.1	1.29
Average	78.60%	3.55	
Integrative Function			
Decision making	78.80%	3.3	3.65
Efficient Information Processing	85.60%	3.6	4.95
Communication	78.90%	3.3	3.66
Synergy of Operations	71%	3	2.15
Average	78.60%	3.3	

Impact of IT on Human Resource Function

As can be inferred from the analysis 77.8 per cent respondents gave a rating from Fair to a very great extent of impact of IT on Openness. The Weighted

average rating came to 3.6, which is greater than fair degree of impact. The Z value was 3.44, which is positive and within acceptable limits.

61.1 per cent felt that IT has either fair or great or very great impact on employee's personal objectives. The weighted average of 3.2 indicates it to be a fair degree of impact. The Z value of 0.21 supports the hypothesis.

47.7 per cent respondents suggested that IT help in increasing employee motivation. The weighted average of 1.84 suggests that impact is very low. 82.2 per cent suggested that IT use improves productivity through people. Both these hypotheses could be validated as Z values were within acceptable limits.

The impact of IT on the parameters, adaptive function and integrative function (Table 5) were quite similar to the impact of parameters discussed above.

Conclusions

This study is an initial attempt to conceptualise and empirically understand the impact of IT on organisational effectiveness. The findings of the study provide theoretical and practical insights into the complex realm of Organisational effectiveness and impact of IT on the effectiveness parameters. These findings are preliminary and exploratory, but they do suggest some directions for future research that may both enhance our understanding of organisational effectiveness and impact of IT on the effectiveness.

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Optimization of Blast Furnace Productivity of Integrated Steel Plant

Satyanarayana Dash & M.V. Chary

In the present paper a multiple linear regression model for establishing the relation of various identified independent parameters on the production of hot metal from the blast furnaces of an integrated steel plant has been developed. The model was an IBM package, 'Application Systems' in the systems department of Visakhapatnam Steel Plant. The regression equation obtained has been tested with the actual production of hot metal and various operating parameters. The estimated production levels of the hot metal are very close to the actual production data. Based on the impact of various parameters on the production of hot metal from the blast furnaces, the optimal operating ranges of the parameters for the blast furnaces of Visakhapatnam Steel Plant have been suggested. The model can be used for achieving higher production and productivity levels from the blast furnaces in the integrated steel plants.

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The history of modern steel industry in India can be traced back to the first decade of twentieth century. However, the growth of the Steel Industry has been quite slow till Independence, inspite of the fact that there was strong market from 1950 onwards as well as ideological pressure for not only expanding the capacity of existing units but also building up new plants in the public sector. Three integrated steel plants were set up in the early 1960s, signifying an achievement which could be considered unique for any developing or even developed nation at that point of time. Subsequently, Bokaro Steel Plant started rolling steel only in 1974-75. In the early 1980s, the capacity of the public sector steel plants at Bhilai and Bokaro was increased to 4 million tonne per annum (mtpa). In August, 1992, a public sector integrated steel plant with a capacity of 3 mtpa of liquid steel was commissioned Visakhapatnam.

> Three integrated steel plants were set up in the early 1960s, signifying an achievement which could be considered unique for any developing or even developed nation at that point of time.

From a modest presence in 1947, the steel sector in India has acquired a significant place in the economy, 50 years down the line. India is currently ranked as the 10th largest steel producer in the world. The supply of finished steel in India has increased from a level of less than 1 Million tonnes in 1948 to around 23 Million tonnes in 1997-98.

India is richly endowed with major raw material sources for iron and steel making. It has the basic infrastructure, though somewhat inadequate; it has skilled manpower; it has the basic manufacturing base; it has

strength in Research and Development; it has a pool of engineering and metallurgical talent; it has enormous potential for consumption; its dependence on imports is very limited, unlike many other countries. So, it is hardly surprising that India occupied a pre-eminent position in steel at one point of time. What is surprising, however, is that inspite of these resources, India has slipped down and the Indian Steel Industry has become internationally uncompetitive during few decades prior to 1991. Other countries has overtaken us through a process of careful, methodical planning and nurturing the Industry at every stage. However, with the liberalisation of Indian Economy, the Steel Industry is once again on the path of reviving its past glory.

The economic reforms introduced since 1991 have totally transformed the environment under which the steel had operated. Steel was removed from the list of industries reserved for the public sector. Pricing and distribution controls were disbanded in 1992. In the liberalised environment, the domestic steel sector has been able to withstand the competition from imports despite a steep reduction in customs duty. A number of fresh capacities are likely to be commissioned in the coming years. In order to remain in the present competitive environment, the important issues like, Technology Selection, Productivity — Capital and Labour, Infrastructure, Energy and Environmental, Product Quality, Customer Satisfaction and Market Development have to be given more attention.

> **In the present competitive environment, Technology Selection, Productivity — Capital and Labour, Infrastructure, Energy and Environmental, Product Quality, Customer Satisfaction and Market Development have to be given more attention.**

Integrated Steel Plants

The Steel Industries resorting to production of steel from ores is called an integrated steel plant. The operations in an Integrated Steel Plant are quite complex. The main production departments in an Integrated Steel Plant are Coke Making Unit, Sintering Plant, Blast Furnace, Steel Melt Shop & Rolling Mills. Out of these major units, Blast Furnace is the most important Production Unit and can be called as heart of the Steel Plant.

Working of Blast Furnaces

The production of Liquid Iron from the Blast Fur-

nace ranks foremost amongst all the iron making processes (The liquid iron produced from the Blast Furnaces is called as Hot Metal). This is not only because of the very high production rate but also because of the great degree of heat utilisation that can be obtained in such furnaces. Modern high capacity furnaces are producing as much as 12000 tons of hot metal (thm) per day. The Chemical equation for the process of conversion of Iron Ore into Hot Metal are given below:

$$3\ Fe_2O_3 + CO = 2\ Fe_3O_4 + CO_2$$
$$Fe_3O_4 + CO = 3\ FeO + CO_2$$
$$FeO + CO = Fe + CO_2$$
$$FeO + C = Fe + CO$$
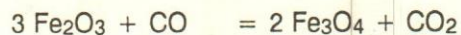
The production of Hot Metal from Blast Furnaces depends on various parameters, which are both internal and external.

Blast Furnaces at Visakhapatnam Steel Plant

The iron making facilities at Visakhapatnam comprise of two blast furnaces named Godavari and Krishna each of 3,200 m³ volume. The annual production capacity of hot metal from the Blast Furnaces is 3.4 million tonnes. The Blast Furnace burden comprises of about 80 per cent sinter and 20 per cent sized ore.

Blast Furnace Productivity

It is a measure, which indicates the efficiency of operation of the Blast Furnaces. This productivity is indicated in terms of production of Hot Metal per day in tonnes per cubic meter of the Furnace Volume. The productivity of the Blast Furnaces in India varies from 0.46 to 1.54 t/m³/day as against the international levels of 2.2 to 2.8 obtaining in most of the developed countries. Obviously, higher the production from a particular Blast furnace, higher will be the productivity.

The gap in Blast Furnace Productivity leaves very good scope for improving the productivity of the blast furnaces operating in India. In the recent past, by resorting to various productivity improvement measures, Bokaro Steel Plant (BSL), a unit of Steel Authority of India has declared one out of the operating five Blast Furnaces, as surplus and stopped using the Blast Furnace. BSL is planning to dispose off the surplus Blast Furnace.

In case, the levels achieved in the developed countries are achieved in India, it would be possible to

almost double the production of liquid iron from the existing facilities in the country with out adding any new facilities. This is possible by paying close attention of factors like raw material blending and preparation, stamp charging, increasing the coke strength, controlling the alkali loading into the Blast Furnace Burden, reducing slag volumes, increasing the proportion of sinter, improving the quality of sinter, paying attention to the raw material distribution inside the Furnace etc. In fact in India, where the cost of equipment and the capital are bound to be very high, the steel industry will have to concentrate more on productivity/technological improvements to compete with its international counterparts.

Parameters of Production

The important input and operating parameters, which have been found to have direct impact on the production of the Blast Furnaces have been identified. On analysis of the production performance of Steel Plants, it is generally observed that, the production during Summer and Monsoon months is lower compared to the other months. Taking cue from this, it was felt desirable to analyse the reasons for this trend. Keeping this in view, it was decided to consider the atmospheric parameters like maximum temperature, rain fall, relative humidity during the day alongwith the other technical parameters and find out the impact of these parameters on the daily production of Hot Metal from Blast Furnaces.

In order to establish the relationship between the production of Hot Metal and other parameters as identified above, it was decided to run Regression Analysis, taking production as Dependent Variable and other Parameters as Independent Variables. It is felt desirable to discuss the type of impact (positive or negative) of various identified variables on the Production of Hot Metal, before using the Regression Analysis. In the current study/analysis, the daily production of Hot Metal has been considered as the dependent variable and the identified 13 parameters have been considered as independent variables. The details of the independent variables with their short names as used in the Programme are given below:

1. Coke Quantity (CKQTY)
2. Sinter Quantity (SNTQTY)
3. Iron Ore (I/O) Quantity (OREQTY)
4. Differential Pressure in the Furnace (DIFFPR)
5. Blast Volume (BLVOL)
6. Blast Temperature (BLTEMP)
7. Ash Percentage in Coke (ASHPCT)
8. Off Blast Hours (OFFBLHR)
9. Off Blast Frequency (OFFBLFREQ)
10. Sinter Basicity (SNTBAS)
11. Steam Injection in the furnace (STMINJ)
12. Maximum Temperature during the day (MAXTEMP)
13. Relative Humidity during the day (RHUM)

Iron Ore, Sinter and Coke Quantities and Ash

These three are the major input materials in the Blast Furnace and form the Burden for charging in the Furnace. Sinter and Iron Ore are the Iron bearing materials and these are charged in some proportion and Coke is the reducing agent.

The blended Coal is crushed into coal dust and the same is heated in the Coke Oven Batteries in the absence of air. After a specified period of heating, Blast Furnace Coke is produced. The Ash content in the BF Coke varies from 15 per cent to 17 per cent. Lesser the ash content in the Coke, the Quality of Coke would be better with higher quantity of fixed carbon.

Blast Volume, Differential Pressure in the Furnace and Blast Temperature

Air Blast is sent into the Blast Furnace from Tuyere level. The air is preheated in the Stoves prior to sending inside the Blast Furnace. The temperature and pressure at which the air blast is sent into the Blast Furnace are called as Blast Temperature and Blast Pressure respectively. The pressure of the top gas is called as Top Gas Pressure, which is maintained at a certain level. The difference between the Blast Pressure and the Top Gas Pressure is termed as Differential Pressure. It is required to maintain the Differential Pressure within a specified range. In case the Differential Pressure is more than the upper level or less than the lower level of the specified range, the production would be adversely affected.

Off Blast hours and Off Blast frequency

In case of emergencies, like problems in the Furnace, poor off take of Hot Metal, the Furnace would be put under Off Blast. During this period, the Furnace would be under heating condition. Off Blast time and frequency have a direct impact on production.

Sinter Basicity and Steam injection in the furnace

Sinter Basicity is an Index of Sinter Quality. It is the ratio of the Oxides of Calcium and Silicon. The desirable Basicity should be in the range of 1.60 to 1.70. Steam is injected into the Blast furnace mainly for (i) controlling Flame temperature inside the Furnace, (ii) maintaining good permeability and (iii) maintaining good movement of material in the Furnace.

Climatological Parameters

During summer the atmospheric temperature is normally high, due to higher ambient temperature, the efficiency of the workforce gets affected. Lower the atmospheric temperature upto a certain level, the working condition would be better. Similarly, the relative humidity in the atmosphere is also a factor, which will have a bearing on the working of employees. This is particularly so, since Visakhapatnam Steel Plant is a shore based Plant. The rain fall during the day also adversely affects the production of Hot Metal.

Regression Analysis

In order to express the relationship between two variables, if it exists, the method of correlation and regression is resorted to for indicating the relation. Two variables are said to be correlated, if an increase in one variable, on an average, results in an increase or decrease of the other and vice versa. Simply, it may be stated that, correlation is said to exist when the two groups of series of items vary together directly or inversely. In case the higher value of one variable are associated with higher values of the other variables i.e. when the movement of two variables are in the same direction, it is said to be positive or direct correlation. If, on the other hand, the higher values of one are associated with lower values of the other i.e. when the movements of two variables are in the opposite direction, the correlation is said to be negative or inverse. Between two observed phenomena, the relationship may range all the way from no relationship at all to a relationship so close that one is inclined to think that one phenomenon is the function of the other. Correlation will be perfectly negative, if an increase in one variable is accompanied by a decrease, in a perfectly definite ratio in the other variable.

There may be some cases, where correlation exists only to a limited extent that is when a change in one variable brings about a change in the other variable, but the change in the latter bears on definite ratio to the change in the former. Thus, correlation may be (i) perfect positive, (ii) limited degree of positive, (iii) no cor-

relation at all, (iv) limited degree of negative and (v) perfect negative. When, perfect positive relationship is found to be existing between two variables, it is designated as (+)1; perfect (-)ve relationship is designated as (–)1 and no relationship as "0". Thus, the observed result of correlation is generally in between (+)1 and (–)1.

The impact of the above independent variables on the Production of Hot Metal has been assessed through Multiple Linear Regression. The Application Systems package of IBM available in the Main Frame Computer of the Systems Department in Visakhapatnam Steel Plant has been utilised for running the Regression Analysis. The results obtained from the output have been analysed. With a view to establish prima-facie relationship of the Technological/Operational Parameters and Atmospheric conditions on Production of Hot Metal in Blast Furnaces, initially a sample daily data for a period of 64 days from the years 1995-96 and 1996-97 was collected and Regression Analysis was carried out with the help of the Computer package. The period selected for sample study was the second half of May and December of both the years. Keeping in view the substantial change in the weather condition during May and December, the data for the sample study was selected. The results obtained from the sample study confirmed the relations. The sample study enhanced the confidence level for further proceeding with the Project.

The daily data pertaining to 1995-96 (365 days) was considered for running the Regression Analysis. It has been felt that the data of one full year would be a good representative sample, as all the weather conditions during the year and various input conditions would be reasonably covered in this period. With a view to establish the dependence of various variables, four alternative sets of Programmes were run. In the Alternative-I, all the identified independent variables were considered. This Alternative gives the actual/real operating regime. However, in order to establish the actual type of relationship of each of the variable/group of variables, three more Alternatives were considered. The results of the Alternative-I are finally considered for arriving at the recommended operating regime. The results of the other Alternatives have helped in analysis and hence not elaborated in this paper. The details of the Alternatives considered are given below:

Alternative - I

Dependent variable : Production

Independent variables: All 13 variables (Both Environ-

mental and Technological/Operational Parameters): Max. Temp., Rel. Hum, Rain Fall, Blast Temp., Ash percentage, Blast Valume, Coke Quantity, Sinter Quantity, Ore Quantity, Off Blast Hours, Sinter Basicity, Steam Injection, Differential Pressure.

Alternative - II

Dependent variable : Production.

Independent variables: Only Technological/Operational Parameters : Blast Temp, Ash percentage, Blast Volume, Coke Quantity, Sinter Quantity, Ore Quantity, Off Blast Hours, Sinter Basicity, Steam Injection, Differential Pressure.

Alternative - III

Dependent variable : Production

Independent variables: Only Environmental Parameters : Max. Temp, Rel. Hum, Rain Fall

Alternative - IV

Dependent variable : Production

Independent variables: Individual Parameter (all the 13 Parameters were considered independently)

Conclusions

The results obtained from the Multiple Linear Regression are as follows :

Alternative - I

The results are given at Annexure-I. The Regression Equation is given below:

"PRODN'N = 1.99* "MAXTEMP" N – 3.46* "RHUM" N + 3.34* "RFAL" N + 1.61* "BLTEMP" N –K 54.65* "ASHPCT" N + 0.166* "BLVOL" N + 0.180 "CKQTY" N + 0.467* "SNTQTY" N + 0.601* "OREQTY" N – 27.63* "OFFBLHR" N + 61.53* "SNTBAS" N – 36.46* "STMINJ" N – 523.95* "DIFFPR" N + 731.86

Algebraically, the Regression Equation can be written as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \varepsilon$$

Regression Coefficient	Independent Variable
Where	
$\beta_1 = 1.99$	X_1 = MAXTEMP
$\beta_2 = (-) 3.46$	X_2 = RHUM
$\beta_3 = 3.34$	X_3 = RFAL
$\beta_4 = 1.61$	X_4 = BLTEMP
$\beta_5 = (-) 54.65$	X_5 = ASHPCT
$\beta_6 = 0.166$	X_6 = BLVOL
$\beta_7 = 0.180$	X_7 = CKQTY
$\beta_8 = 0.467$	X_8 = SNTQTY
$\beta_9 = 0.601$	X_9 = OREQTY
$\beta_{10} = (-) 27.63$	X_{10} = OFFBLHR
$\beta_{11} = 61.53$	X_{11} = SNTBAS
$\beta_{12} = (-) 36.46$	X_{12} = STMINJ
$\beta_{13} = (-) 523.95$	X_{13} = DIFFPR
β_0 = Constant 731.86	

ε = Random Variable, and Y = PRODN

From the Regression Equation, it may be seen that, the increase/decrease in one unit of each of the Independent variable would result in increase/decrease of Production of Hot Metal equivalent to the quantity of Regression Coefficient. For example, if the Blast temperature in increased by 1 degree centigrade, the production of Hot Metal per day would increase by 1.61 tonnes. Similarly, if the Ash percentage in the Metallurgical coke is reduced by 1%, there will be an increase in production to the tune of 54.65 tonnes in a day. Reduction in differential pressure by 1 kg/sq cm will enhance the production by 523.95 tonne in a day. This means, by keeping the Blast pressure at the current level and increasing the Top Gas pressure, it would be possible to increase the production of Hot Metal, as the differential pressure would reduce (Differential Pressure is : Blast Pressure – Top Gas Pressure). The impact of Independent Variables on the Production as obtained from the Regression Equation is brought out in Table below:

Sl. No.	Item	Unit	Relation Direct/ Inverse	Impact on Prodn. of Hot Metal/Unit of Increase/ Decrease(T)
1.	Coke Quantity	Tonnes	Direct	0.180
2.	Iron Ore Quantity	Tonnes	Direct	0.601

(Contd.)

(Contd.)

3. Sinter Quantity	Tonnes	Direct	0.467
4. Differential Pressure	Kg/cm^2	Inverse	(−) 523.95
5. Blast Temperature	°Cen Gr	Direct	1.61
6. Steam Injection	T/hr	Inverse	(−) 36.46
7. Off Blast Hours	Hrs	Inverse	(−) 27.63
8. Blast Volume	Ncum/min	Direct	0.166
9. Rain Fall	mm	Direct	3.34
10. Relative Humidity	%	Inverse	(−) 3.46
11. Ash Percentage in Coke	%	Inverse	(−) 54.65
12. Sinter Basicity	Ratio	Direct	61.53
13. Maximum Temperature	°Cen Gr	Direct	1.99

From the above, it may be seen that the relationship of various parameters with the production of Hot Metal is in general in line with the actual trends, except for the relationship with maximum temperature and rain fall. As per the above results, these two parameters have positive relation with the Production of Hot metal i.e. increase in these parameters will result in increased production. This is an anomaly, as the increase in the maximum temperature and rain fall during the day should result in decline in Production of Hot Metal. This has probably occurred due to collinearity of the Independent Variables. Further, it may be mentioned that in this analysis, it was assumed that the relationship between the dependent and independent variables is linear. In case the relationship is not linear (may be curved or of some pattern), the estimated impact assessed as per the linearity equation would not be very accurate. Because of this also there may be a marginal gap in the impact arrived at with that of the actual. The effect of Maximum Ambient temperature is seen as positive on production, while in the individual Regression at Alternative-IV, it comes out as negative. This anomaly may also be due to the narrow range of variation of Maximum Temperature, being a shore based Steel Plant.

As per the results, the Steam Injection affects the

It may be seen that the relationship of various parameters with the production of Hot Metal is in general in line with the actual trends, except for the relationship with maximum temperature and rain fall.

production of Hot Metal adversely. It shows that, in case the Steam Injection is increased by 1 ton per hour, the production of Hot Metal would come down by 36.46 tonnes per day. Whenever, Steam Injection is resorted to, corresponding increase in Blast Temperature should also be effected, in order to achieve increased production levels. In this case, it may be concluded that the Blast Temperature is not increased at the rate which is required to compensate for the Steam Injection. It may be worth mentioning here that the compensating temperature increase for one gram of Steam Injection per a NM^3 of Air Blast is about 8-10°C.

From the results, it is seen that R^2 = 91.6%, and a Multiple Correlation Coefficient R = $\sqrt{0.916}$ = 0.957. This indicates that the Parameters (Independent variables) considered have a very good relation with the production of Hot Metal. From the results, it is also possible to calculate the Coefficient of Determination or R^2 as brought out below :

Adjusted R^2 (R^2 adjusted for Degrees of Freedom)

$$= 1 - \{\varepsilon'\varepsilon/(n-k)\}/\{y'\,y/(n)\}$$

$$= 1 - \{(44332331.614)/(365 - 13)\}/\{530082790.678/(365)\}$$

$$= 1 - (125944.124)/(1452281.618)$$

$$= 1 - (0.08672)$$

$$= 0.91328 \text{ and hence adjusted R} = 0.956$$

The above, corresponds to adjusted R^2 of 91.33%. This indicates that the Regression line explains 91.33% of the total variation from the regression line. In the above equation "k" corresponds to the number of variables, "n" corresponds to the number of observations, corresponds to the Residual Sum of Squares (RSS) and "y' y" corresponds to the Total Sum of Squares (TSS). One may define as FParameters as

$$F = \frac{\text{Explained Sum of Squares due to addition of successive variables}}{\text{Residual after all 13 variables are added/(degrees of freedom)}}$$

Here one finds that F for regression given by:

$$F_{13,352} = MSR/S^2$$

$$= 296.68252 \text{ (from the data)}$$

From the Table

$$F_{13,352} \approx 1.62$$

F calculated being much higher than the F from table, we conclude that significant association exists between all the explanatory variables and the Dependent variable. Significance of each variable is obtained by

taking the F value given in the result and testing it against $F_{1,364} \approx 3.84$, at 95% confidence level. Hence variables like RFAL, BLTEMP, SNTQTY, OREQTY, OFFBLHR, STMINJ and DIFFPR are significant.

Similarly, the significance of variables can be tested using the t test, t distribution with $(n - k) = (365 - 13) = 352$ degrees of freedom approximates standard normal distribution and 95% of confidence interval lies between $(-)1.96$ and $(+) 1.96$ i.e. Modulus of t–statistic must be ≥ 1.96, which we see to be true in the case of RFAL, BLTEMP, SNTQTY, OFFBLHR, STMINJ and DIFFPR, the same variables stated above. Since F value is equal to t^2 value, both results. This result is also confirmed by looking at F point levels in the current equation output in the last column. F point 100 corresponds to the F Value of Regression 296.683. This is to test whether the Regression coefficient is significantly different from zero. By subtracting the F point from 100, we get the significance of the Regression Line. As a thumb rule, if the result of subtraction is less than 5, we can consider the relationship significant. This is so in case of all the variables given above.

Thus it may be summarised that a variable is significant if:

(i) F value of the regression coefficient is greater than 3.84

(ii) Modulus of T value is more than 1.96.

By applying both the above conditions, it can be seen that the parameters i.e. Blast Temperature, Sinter Quantity, Ore Quantity, Off blast hours, Steam injection, Differential pressure and Rain Fall out of total 13 parameters are significant. Further, it may also be seen that the F point for all these parameters is above 96%. Out of all these parameters Sinter Quantity, Ore Quantity, Off Blast Hours and Differential Pressure are very closely related to the production of Hot Metal as the F Point is very close to 100.

Alternative - II

In the second alternative one the Technological/Operational Parameters have been considered and environmental parameters have been excluded. The results/output of Regression Analysis is indicated in Annexure-II. The Regression equation obtained from the analysis is as under:

"PRODN'N = 1.37* "BLTEMP"N – 53.74* "ASHPCT"N + 0.149* "BLVOL"N + 0.202 "CKQTY"N + 0.459* "SNTQTY"N + 0.605* "OREQTY"N – 26.48* "OFFBLHR"N + 52.93* "SNTBAS"N – 37.43* "STMINJ"N – 460.36* "DIFFPR" N + 765.21

A Multiple Correlation Coefficient of 0.955 obtained from the Regression Analysis indicates that the Parameters considered have a very good relationship with the production of Hot Metal. Here coefficient of determination R^2 is 91.5 per cent, which is quite good.

Alternative - III

In the third Alternative, only the Environmental Parameters have been considered. The results/output of Regression Analysis is indicated in Annexure-III. The Regression Equation obtained from the analysis is as under:

"PRODN'N = –215.76* "MAXTEMP"N –21.60* "RHUM"N –14.28* "RFAL"N + 17018.44

Unlike the trends of relationship obtained in the Alternative-I, in this Alternative, correct relationships have been obtained. All the above three Environmental Parameters affect the production of Hot Metal adversely. Any increase in these parameters would result in reduction in the production of hot Metal. It is interesting to note that, in case the maximum temperature during the day rises by one degree centigrade, there will be a drop in Hot Metal production by 215.76 tonnes. In case the rainfall during the day increases by 1 mm the production of Hot Metal will reduce by 21.6 tonnes. Similarly the increase of 1 per cent of relative humidity during the day will result in decrease in production of Hot Metal by 14.28 tonnes.

A Multiple Correlation Coefficient of 0.384 was obtained from Regression Analysis. The lesser correlation coefficient compared to the previous two Alternatives indicates that the relationship of these parameters with the production is not very close. However, they have some impact on the production.

F and t tests indicate that all the three variables are significant as F and t values of the regression coefficients are much higher. The F value from the F table for $F_{3,362} = 2.6$, against this the F values for maximum temperature is 42.3, for rainfall it is 10.7 and for relative humidity the F value is 10.7. The F Point for all the parameters is very close to 100. Thus it can be seen that the Environmental Parameters are having an impact of 15 per cent on production leaving the remaining to the technological/operational parameters.

Alternative - IV

In the fourth alternative the parameters (environmental and technological/operational) have been con-

sidered independently. The results/output of Regression Analysis is indicated at Annexure-IV. The Regression equations obtained from the analysis are as under:

It is seen that in the individual regressions of variables, F and t tests in this all do not show Sinter Basicity and Steam Injection to be very significant variables and their relationship with Hot Metal production is reverse to what is obtained in the total regression of Technological and Environmental variables, where steam injection was found to be a significant variable. This shows that due to collinearity of the independent variables, there is a reversal in the impact of Steam Injection. Accordingly, this parameter has become significant when the regression was run considering all the parameters.

It may be seen that the correlation coefficients in case of Coke Quantity, Sinter Quantity, Ore Quantity and Off Blast Hours are more than 0.7. In case of Environmental Parameters, though the correlation coefficients are less, the impact of these parameters on Production is significant. It may also be seen that in the Alternative-I, the effect of Differential Pressure on Production was negative i.e. (−) 523.95 per unit of increase in pressure, but in the individual regression (as per the above equations), it can be seen that, it is having direct positive effect of (+)1813.08. Such large swing in the impact of differential pressure may also be due to the effect of Blast Temperature which positively correlates with the Blast pressure. This reversal is also due to the fact that the variation in differential pressure is very low. Similar reversal is also observed in case of Sinter Basicity. This is also due to the narrow range of variation of this variable.

Recommendations

The estimated production of Hot Metal from the Regression Analysis considered in the Alternative-I is given at Annexure-V. It can be seen that the estimated daily production data is very close to the actuals. This means the Regression equation can be made use of for estimating the production of Hot Metal at different levels of operation of various parameters. By making use of the equation, it is possible to arrive at the optimal levels of the parameters at which the production of Hot Metal would be maximum.

An attempt has been made to fix the lower and upper limits for various Technological/Operational Parameters for the Blast Furnaces at Visakhapatnam Steel Plant. It is suggested to operate these parameters in between the limits. Current operating limits and the proposed operating limits are given in the Table below:

S. No.	Item	Unit	Present Operating Rang		Proposed Operating Range	
			From	To	From	To
1.	Blast Temperature	°Cen Gr	950	1020	1050	1100
2.	Ash Percentage	%	15.2	17.2	14.5	15.5
3.	Blast Volume	NCum/min	4200	5200	5000	5500
4.	Coke Quantity	Tonnes	4000	5600	5000	5600
5.	Sinter Quantity	Tonnes	8000	13800	12000	14000
6.	Ore Quantity	Tonnes	1600	2800	2300	2800
7.	Off Blast Hours	Hrs	0	20	0	3
8.	Sinter Basicity	Ratio	1.48	1.75	1.60	1.70
9.	Steam Injection	T/hr	6.00	9.75	8.00	9.00
10.	Differential pressure	Kg/cm^2	1.11	1.45	1.0.	1.25

The annual production of Hot Metal during 1996-97 was 32,13,500 tonnes, which corresponds to an average daily production of 8804 tonnes. By resorting to the suggested Operational Parameters, it is estimated that the production can be increased by 725 tonnes/day (an increase of over 8%). As per this, the daily production would be 9529 tonnes, which corresponds to an annual rate of 3.34 Million Tonnes. This is very close to the rated capacity of the Blast Furnaces of 3.4 Million tonnes, representing a capacity utilisation of over 98 per cent.

The main Operational Parameters, which need to be controlled are: Blast Temperature, Ash Percentage in Coke, Blast Volume, Sinter Quantity, Off Blast Hours and Differential Pressure. In line with the guidelines indicated above, the Technological/Operational Parameters may be controlled for increasing the production of Hot Metal. In order to minimise the adverse impact due to Environmental parameters, Summer and Monsoon Preparation plans should be made well in advance and the same should be strictly monitored.

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Alternative-I

Multiple Regression

Dependent Variable # 2: Production

	Independent Variable(S)		F Value	F Point	MCC	F for REGN	F Point
#12	:CKQTY	ENTERED	2688.814	100.000	0.938	2688.814	100.00
#14	:OREQTY	ENTERED	51.189	99.991	0.946	1555.369	100.000
#13	:SNQTY	ENTERED	51.188	99.993	0.953	1197.340	100.000
#22	:DIFFPR	ENTERED	7.365	99.207	0.954	915.634	100.000
#6	:BLTEMP	ENTERED	6.869	99.006	0.955	745.790	100.000
#18	:STMINJ	ENTERED	4.933	97.174	0.956	629.104	100.000
#15	:OFFBLHR	ENTERED	2.339	87.158	0.956	541.578	100.000
#11	:BLVOL	ENTERED	2.760	90.086	0.956	476.556	100.000
#5	:RFAL	ENTERED	2.831	90.028	0.957	426.093	100.000
#4	:RHUM	ENTERED	2.751	90.028	0.957	385.644	100.000
#10	:ASHPCT	ENTERED	1.944	83.448	0.957	351.695	100.000
#17	:SNTBAS	ENTERED	0.823	63.348	0.957	322.294	100.000
#3	:MAXTEMP	ENTERED	0.025	12.602	0.957	296.683	100.000

All Variables included
Selection Terminated

Current Equation

Proportion of Sum of Squares Reduced	0.916		of	530082790.678
Multiple Correlation Coefficient	0.957		Adjusted R	0.956
Standard Error of Estimate	354.886		ADJ. SE	361.374
F for Analysis of Var (D.F. = 13,352)	296.683		F Point	100.00

Variable	Regn Coeff	S. Error	F Value	T Value	Beta Coeff	F Point
#3	1.99136	12.51772	0.02531	0.15908	0.00295	12.602
#4	−3.45801	2.24586	2.37076	−1.53973	−0.02807	87.412
#5	3.33655	1.46126	5.21359	2.28333	0.04108	97.602
#6	1.60538	0.74992	4.58280	2.14075	0.03999	96.596
#10	−54.64798	37.61916	2.11023	−1.45266	−0.02686	85.142
#11	0.16600	0.09543	3.02583	1.73949	0.04272	91.590
#12	0.17974	0.25840	0.483385	0.69559	0.08760	51.180
#13	0.46731	0.08303	31.67719	5.62825	0.60436	99.988
#14	0.60097	0.08237	53.23466	7.29621	0.22734	99.994
#15	−27.62679	11.57755	5.69413	−2.38624	−0.09732	98.154
#17	61.53125	67.28178	0.83637	0.91453	0.01429	63.768
#18	−36.45778	15.6941	5.39554	−2.32283	−0.03861	97.829
#22	−523.94510	167.10477	9.83091	−3.13543	−0.05621	99.760
CONSTANT	731.86096	1217.13111				

Analysis of Variance for the Regression

Source of Variation	DF	Sum of Squares	Mean Square	F Value	F Point
Due to Regression	13	485750459.063	3736419.928	296.68252	100.00 Residual
Residual	352	44332331.614	125944.124		
Total	365	530082790.678			

Number		1		
Name	Coefficients			
INDEPENDENT1	1.991		INDEPENDENT2	−3.458
INDEPENDENT3	3.337		INDEPENDENT4	1.605
INDEPENDENT5	−54.648		INDEPENDENT6	0.166
INDEPENDENT7	0.180		INDEPENDENT8	0.467
INDEPENDENT9	0.601		INDEPENDENT10	−27.627
INDEPENDENT11	61.531		INDEPENDENT12	−36.458
INDEPENDENT13	−523.945		CONSTANT	731.861
CORRELATION	0.957			

Equation   "PRODN"N = 1.99*"MAXTEMP"N-3.46*"RHUM"N + 3.34*"RFAL"N + 1.61*"BLTEMP"N−54.65*"ASHPCT"N + 0.166*"BLVOL"N + 0.180*"CKQTY"N + 0.467*"SNQTY"N + 0.061*"OREQTYN−27.63*"OFFBLHR"N + 61.53*"SNTBAS"N−36.46*"STMINJ" N−523.95*"DIFFPR"N + 731.86

Annexure-II

Alternative-II

Multiple Regression

Dependent Variable # 2: PRODN

	Independent Variable(S)		F Value	F Point	MCC	F for REGN	F Point
#12	:CKQTY	ENTERED	2688.814	100.000	0.938	2688.814	100.00
#14	:OREQTY	ENTERED	51.189	99.991	0.946	1555.369	100.000
#13	:SNQTY	ENTERED	51.188	99.993	0.953	1197.340	100.000
#22	:DIFFPR	ENTERED	7.365	99.207	0.954	915.634	100.00
#6	:BLTEMP	ENTERED	6.869	99.006	0.955	745.790	100.00
#18	:STMINJ	ENTERED	4.933	97.174	0.956	629.104	100.00
#15	:OFFBLHR	ENTERED	2.339	87.158	0.956	476.556	100.00
#11	:BLVOL	ENTERED	2.760	90.086	0.956	424.887	100.00
#10	:ASHPCT	ENTERED	1.902	82.988	0.956	424.887	100.00
#17	:SNTBAS	ENTERED	0.618	56.646	0.957	382.050	100.00

All Variables included
Selection Terminated

Current Equation

PROPORTION OF SUM OF SQUARES REDUCED			0.915		OF		530082790.678
MULTIPLE CORRELATION COEFFICIENT			0.957		Adjusted R		0.955
STANDARD ERROR OF ESTIMATE			356.301		ADJ. SE		361.272
F for Analysis of Var (D.F. = 10,355)			382.050		F POINT		100.000

Variable Regn.	Coeff.	S. Error	F Value	T Value	Beta Coeff	F Point
#6	1.36773	0.73845	3.43052	1.85217	0.03407	93.365
#10	−53.74429	37.68847	2.03352	−1.42601	−0.02642	84.356
#11	0.14940	0.09455	2.4970	1.58009	0.03845	88.337
#12	0.20246	0.25685	0.62133	0.78825	0.09867	56.752
#13	0.45874	0.08222	31.12991	5.57942	0.59327	99.983
#14	0.60545	0.07952	57.96779	7.61366	0.22903	99.993
#15	−26.47550	11.55838	5.24680	−2.29059	−0.09326	97.620
#17	52.93179	67.30670	0.61847	0.78643	0.01229	56.646
#18	−37.43052	15.71762	5.67124	−2.38144	−0.03964	98.107
#22	−460.36240	164.31700	7.84937	−2.80167	−0.04938	99.375
Constant	765.20505	1130.86889				

Analysis of Variance for Regression

Source of Variation	DF	Sum of Squares	Mean Square	F Value	F Point
Due to Regression	10	485015295.783	48501529.578	382.05015	100.00
Residual	355	45067494.895	126950.690		
Total	365	530082790.678			

Number		1			
Name	Coefficients				
INDEPENDENT 1	1.368		INDEPENDENT 2		−53.744
INDEPENDENT 3	0.149		INDEPENDENT 4		0.202
INDEPENDENT 5	0.459		INDEPENDENT 6		0.605
INDEPENDENT 7	−26.475		INDEPENDENT 8		52.932
INDEPENDENT 9	−37.431		INDEPENDENT 10		−460.362
CONSTANT	765.205		CORRELATION		0.957

Equation "PRODN" N = 1.37*"BLTEMP"N − 53.74*"ASHPCT" + 0.149*"BLVOL"N + 0.202*"CKQTY"N + 0.459*"SNTQTY"N + 0.605*"OREQTY"N − 26.48*"OFFBLHR"N + 52.93*"SNTBAS"N − 37.43* "STMINJ"N − 460.36*"DIFFPR"N + 765.21

Annexure-III

Alternative-III

Multiple Regression

Dependent Variable #2 : Prodn

	Independent Variable(S)		F Value	F Point	MCC	F for Regn.	F Point
#3	Maxtemp	Entered	27.326	99.984	0.264	27.326	99.984
#5	Real	Entered	25.085	99.977	0.360	27.110	100.000
#4	Rhum	Entered	10.654	99.829	0.393	22.105	99.995

All Variables Included Selection Terminated

Current Equation

Proportion of sum of Squares Reduced	0.155	Of	530082790.678
Multiple Correlation Coefficient	0.393	Adjusted R	0.384
Standard Error of Estimate	1112.475	ADJ. SE	1117.026
F For Analysis of Var (D.F. = 3,362)	22.105	F Point	99.995

Variable Regn.	Coeff.	S. Error	F Value	T Value	Beta Coeff	F Point
#3	−215.75664	33.16803	42.31447	−6.50496	0.32002	99.991
#4	−21.60173	6.61818	10.65370	−3.26400	−0.17536	99.829
#5	−14.28486	4.36835	10.69341	−3.27008	−0.17588	99.831
Constant	17018.44468	1166.30883				

Analysis of Variance for the Regression

Due to Regression	3	82071711.397	27357237.132	22.10508	99.995
Residual	362	448011079.281	1237599.667		
Total	365	530082790.678			

Number		1		Name	Coefficients
Independent 1		−215.757		Independent 2	−21.602
Independent 3		−14.285		Constant	17018.445
Correlation		0.393			

Equation   "PRODN"N = 215.76*"MAXTEMP"N − 21.60* "RHUM"N − 14.28*"REAL"N + 17018.44

Alternative-IV

Linear Regression

Dependent Variable #2 : Prodn

Proportion of sum of Squares Reduced	0.070	Of	
Multiple Correlation Coefficient	0.264	Adjusted R = 0.259	
Standard Error of Estimate	1163.865	ADJ. SE = 1165.434	

Variable	Regn. Coeff.	S. Error	T. Value
#3	Max temp	−178.15957	34.08165
Constant	14173.27696	1033.88806	

Analysis of Variance for the Regression

Source of Variation	DF	Sum of Squares	Mean Square	F Value	F Point
Due to Regression	1	37015362.785	37015362.785	27.32606	99.984
Residual	364	493067427.893	1354580.846		
Total	365	530082790.678			

X-Value	Predicted Value	Standard Error
1.000	13995.11740	1534.37799
2.000	13816.95783	1512.43161
3.000	13638.79826	1490.94133
4.000	13460.63870	1469.92716
5.000	13282.47913	1449.40980

Linear Regression

Dependent Variable #2 : Prodn

Proportion of sum of Squares Reduced	0.075	Of	530082790.678
Multiple Correlation Coefficient	0.273	Adjusted R = 0.268	
Standard Error of Estimate	1160.925	ADJ.SE = 1162.490	

Variable	Regn. Coeff.	S. Error	T. Value
#6	BLTEMP	10.95980	2.02438
Constant	−2290.77375	2045.41890	

Analysis of Variance for the Regression

Source of Variation	DF	Sum of Squares	Mean Square	F Value	F Point
Due to Regression	1	39502984.814	39502984.814	29.31039	99.986
Residual	364	490579805.864	1347746.719		
Total	365	530082790.678			

X-Value	Predicted Value	Standard Error
1.000	−2279.81394	2350.15138
2.000	−2268.85414	2348.39222
3.000	−2257.89434	2346.63350
4.000	−2246.93453	2344.87520
5.000	−2235.97473	2343.11733

□

Algorithm for Solving Chartered Bus Routing Problem

Kampan Mukherjee & Suguna

Having identified the resemblance with Vehicle Routing Problem, an attempt has been made to develop a heuristic-based algorithm for solving chartered bus routing problem. The proposed method is an extension of solution approach for truck despatching problem. A case study for a Delhi-based bus company has been taken up for validation of the algorithm and it has been showed that the use of the proposed method leads to substantial cost savings.

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Urban transportation planning seems to be one of the mind boggling exercises for the administrative authority of a city under the pressure of population and traffic explosion. In this context the present paper includes study and analysis of the bus routing problems as a special case of vehicle routing problem (VRP) and suggests palliatives for that. The proposed methodology has been applied for solving a bus fleet planning problem of a Delhi-based transport company, which is engaged in running chartered bus service.

The Vehicle Routing Problem involves the design of several vehicle tours to meet a given set of requirements of customers with known locations, subject to a capacity constraint for the vehicles and a distance (or alternatively time) constraint for vehicle tours. The problem of scheduling was first formulated by Dantzig and Ramser (1974) and may be stated as: A set of customers each with known location and known requirement for some commodity, is to be supplied from a single depot by delivery vehicles of known capacity.

> The Vehicle Routing Problem involves the design of several vehicle tours to meet a given set of requirements such as locations, capacity constraint and a distance.

The problem is to design the routes for these vehicles subject to the following conditions:

(i)   The requirements of all customers must be met.

(ii) The capacity of vehicles may not be violated (i.e. the total load allocated to each may not exceed the capacity).

(iii) The total time (or alternatively distance) for each vehicle to complete its tour may not exceed some pre-determined level (this is usually a legal or contractual condition).

In order to solve many difficult problems efficiently, it is often necessary to compromise the requirements of mobility and systematicity and to construct a control structure that is no longer guaranteed to find the best answer but that will always find a very good answer. This is the basis of heuristics technique.

For Vehicle Fleet Planning (VFP), interestingly, very few documents make the use of optimisation algorithm of Integer Programming. Instead, when confronted with VFP, transportation analysts and operations research practitioners have usually resorted to heuristic algorithms, perhaps, as they are:

(i) easy to understand and consequently are more readily accepted by managers;

(ii) less sophisticated algorithmically and are maintained for computerised planning and

(iii) efficient in solving a wide range of problems and provide solutions that are usually accepted as 'good' or 'reasonable'.

These arguments on behalf of heuristics suggest that they will continue to be instrumental in the analysis of VRP.

According to Bodin *et al*, the heuristics fall into three broad categories:

(i) *Tour construction procedure:* It generates an approximately optimal tour from the distance matrix;

(ii) *Tour Improvement procedure:* It attempts to find a better tour given an initial tour;

(iii) *Composite procedure:* It constructs a starting tour from one of the construction procedures and then attempts to find a better tour using one or more of the tour improvement procedures.

Assuming the costs to be symmetric ($C_{ij} = C_{ji}$), the triangular in-equality of the transportation matrix is satisfied and are defined for each (ij) pair. Some of the important contributions in the above categories are:

Tour construction procedure

It includes:

(a) Nearest Neighbour Procedure (Rosenkrantz, Stearns, & Lewis);

(b) Clarkes & Wright Savings Procedures (Clarke & Wright [3], Golden);

(c) Minimal Spanning Tree Approach (Kim);

(d) Christofides Heuristics (Christofides).

Tour and Composite Improvement Procedures

The branch exchange heuristic is known best for the Traveling Salesman Problem (TSP) (for instance, Boldin *et al*, 1983). The 2-opt and 3-opt heuristics were introduced by Lin K-opt procedure, for K-3, was presented by Lin and Kernigham (1973).

The composite procedure may be stated as follows:

Step 1: Obtain an initial tour using one of the tour construction procedures;

Step 2: Apply a 2-opt procedure to the tour found in step 1;

Step 3: Apply 3-opt procedure to the tour found in step 2.

The composite tour gives excellent results and is relatively fast. Since 1959, when Dantzig and Ramser (1974), introduced the Vehicle Routing Problem and proposed a linear programming-based heuristic for its solution, the management scientists and operations researchers have mostly attempted solving Vehicle Routing Problems by heuristic-based methods. Whereas Tyagi in 1968 proposed a method which groups demand points into tours based on a 'Nearest Neighbour' concept i.e., the points are added to a tour sequentially, each new addition being the closest point to the last point added to the tour. Having grouped delivery points into M tours the Vehicle Routing Problem reduces to Multiple Traveling Salesman Problem (One for each tour). The proposed algorithm of this paper is based on this approach. His method is simpler than existing method (Dantzig & Ramser (1974); Clarke & Wright (1974)).

Bus Routing Algorithm

The proposed method of solving VRP involves the following modifications on Tyagi's algorithm:

(i) Elimination of the assumption that the distance matrix is to symmetric in nature.

(ii) Application of a heuristic method proposed by Pannerselvam and Balasubrahmanian for determining the optimal tours.

Characteristically a Chartered Bus Routing problem is similar to a truck despatching problem, as both travel through different routes transporting man or material and meet the requirements at different locations on the route. The truck despatching problem on the other hand may be considered as the generalisation of the Traveling Salesman Problem (TSP). In the later, we identify the shortest—distance route of a salesman who starts from a central point, then visits all the other given points just once and returns to the starting point. The Chartered Bus Routing problem under study may be structured as a problem of finding the best routes for a fleet of buses with the capacity matching the number of passengers expected at different points on their travel routes.

Let P2, P3, ..., Pn be the delivery/pick-up with Q2, Q3..., Qn being the demands respectively, to be serviced from a central depot P1. All interdistances (i.e. the shortest distances) d_{ij} (i, j = 1, 2, ..., n) between the points are calculated from the network using Floyd's algorithm (1964). If there is the one-way traffic between a pair of nodes, then the arcs (paths) between them are assumed as directed arcs. There are vehicles (e.g. buses) available, each having the capacity C.

Mathematically the vehicle Routing Problem may be stated as mentioned below (Golden). Let there be

(1) a set of (n–1) points P_i (i = 2, 3, ..., n) to which deliveries are made from a point P1, called the central depot,

(2) a symmetric matrix D = [d_{ij}], called the distance matrix which specifies the distance d_{ij} between each pair of points (i, j = 1, 2, ..., n],

(3) Q_i (i = 2, 3, ..., n] being the quantities to be delivered at the points P_i (i = 2, 3, ..., n).

(4) C being the capacity of the vehicle where C > max Q_i (i = 2, 3, ..., n], but C < sum from i = 2 to n Q_i, and

but $C << \sum_{i=2}^{n} Q_i$ and

(5) $X_{ij} = X_{ji} = 1$ being interpreted to mean that there exists a path between points P_i and P_j (i, j = 1, 2, 3, ..., n) and $X_{ij} = X_{ji} = 0$ means that there does not exists a path between P_i and P_j in any of the tour, thus

$$C < \sum_{i=1}^{n} X_{ij} = \sum_{j=1}^{n} X_{ji} = 1$$

The problem is now to find those values of X_{ij} which makes the total distance

$$T = \sum_{i=1}^{n} \sum_{j=1}^{n} d_{ij} X_{ij}$$

a minimum subject to the conditions specified in (2) to (5). It should be noted that no consideration has been made on number of vehicles engaged in the transportation.

The concept of truck despatching problem has been used here in order to prepare the Bus Routing Algorithm and then it has been applied to a real life problem of a transport company which runs the chartered buses. The proposed algorithm is described below:

Let P2, P3, ..., Pn be the stopping points of the bus routes with Q2, Q3, ..., Qn being the demands (i.e. the number of passengers at each point) respectively, to be serviced from a central depot (i.e. office complex) P1.

The algorithm developed for the present problem can be conveniently separated into four major stages which are as follows:

Stage 1: Determination of the shortest path between all pairs of nodes in the network and the corresponding distances.

The shortest distance data produced in this stage is assumed as the data for the present bus routing problem where almost one bus must visit each pick-up point once.

Stage 2: Finding the number of trips.

This stage involves decision on the number of trips to be made to meet the requirements at different points on the route.

Stage 3: Grouping the pick-up points.

The given points Pi, (i = 1, 2, ..., n) are divided into N groups. The number of points in a group may differ from one another since it depends upon the pick ups at each point to be made.

Stage 4: Finding the optimal number of tours.

The above stages may further be elaborated as:

Stage 1: In this stage, the shortest paths between all pairs of nodes in the network and their corresponding distances are determined using Floyd's algorithm [5].

The n nodes of the network are first numbered with positive integers 1, 2, ..., n (where 1 denotes the central

depot node). Then two matrices, a distance matrix D and a predecessors matrix P are set up with elements:

D_{ij} = L_{ij} if arc (i, j) exists

= 0 if i = j

= Big positive value if arc (i, j) does not exist, where L_{ij} is the length of the arc (i, j) and

P_{ij} = i for i = j

= 0 for i = j

The algorithm is as follows:

Step 1: Set K = 1

Step 2: Obtain all the elements of the updated distance matrix D from the relation

$$D_{ij}^k = \min [D_{ij}^{k-1}, (D_{ik}^{k-1} + D_{kj}^{k-1})]$$

Step 3: Obtain all the elements of the updated predecessor matrix P by using the relation

$$P_{ij}^k = P_{kj}^{k-1}, \text{ if } D_{ij}^k = D_{ij}^{k-1}$$

$$= P_{ij}^{k-1}, \text{ otherwise.}$$

Step 4: If k = n, go to step 5. If k < n, set K = K+1 and return to Step 2.

Step 5: Stop

Stage 2: The number of trips in bus routing problem depends upon the capacity of the vehicle and the total number of passengers which are to be picked up for a given problem. Thus, the number of trips is given by

$$N = \sum_{i=2}^{n} Q_i/c \text{ if C is a perfect divisor of } \sum_{i=2}^{n} Q_i/c$$

$$= N+1 \text{ otherwise}$$

where, N denotes the greatest integer part of $\sum_{i=2}^{n} Q_i/c$

Stage 3: The given points Pi (i = 2, 3, ..., n) are divided into N groups. The number of points in a given group may differ from one another, since it depends on the deliveries to be made. The systematic way of forming these N groups is to start with first point P1. Cor-

responding to the point P1 one considers the second row of the distance matrix D and find which point Pi (i = 2, 3, 4, ..., n) is nearer to P1. Now if the summation Q1 + Qi C, then Pi (i = 2, 3, ..., n) is the second element which is included in the first group G1. If Q1 + Qi < C, then from the given matrix D, find which of the points is nearer to Pi, where Pi is the second selected point, and include that point in G1, if the sum of the deliveries corresponding to the included points in G1 is not greater than C. This process of inclusion of points in G1 is continued until the sum of deliveries corresponding to the included points does not exceed C. To make use of the maximum capacity of the carrier, the point included in G1 at the end or at the beginning may be interchanged with the another one which is the next nearer point to the last included point, if its inclusion makes the sum of the deliveries more nearer to C. In a similar fashion we form the other groups G2, G3, ..., GN.

In case N = N + 1, there may be a group consisting of only one delivery point. The selection of this point must be such that the passengers collected at this point should not be less than half the capacity of the carrier or/and its distance from central depot P1 should not be more than half the distance of the maximum distant point from P1.

Though there may be several points having this property, but the point which is to be selected must ensure the maximum possible use of the capacity of the carrier in all the trips.

Stage 4: Having grouped the pick-up points, the bus routing problem may now be thought of as solving N symmetric/asymmetric Traveling Salesman Problems (TSPs). In each of the trips the carrier starts from the central point P1, so it is common to all the groups G1, G2, G3, ..., GN. The distance matrix D is separated into N sub-matrices corresponding to each of the G1, G2, G3, ..., GN and written in such a manner that the first row of each sub matrix denotes the distances from P1 to all the points in the group. Now the simplest procedure for finding the optimal tours in each case can be separated into the following two parts:

Determination of Better Tour

In this part of stage 4 a better tour is constructed heuristically using the distance matrix available at the end of the algorithm in the stage 1 as the initial distance matrix. Each of the diagonal elements in the shortest-path distance matrix from the stage 1 is assumed to be a very big value. Then the following steps are proposed.

Step 1: Find the row penalties and column penalties.

Read the no. of nodes, n. Read the tour sequence from part-1 and store in the array S with dimension $(n+1)$. (For example, the tour sequence may be stored like 1-5-3-2-4-1 in array S when the total no. of nodes is 5). Read the tour length from part-1 under the variable TL. Set all diagonal elements to a very high value.

G

$$1 = 2$$
$$\text{REPEAT} = 0$$

$$J = I + 1$$

Compute

$$X = D^{(n)}_{s(I-1),\, s(I)} + D^{(n)}_{s(I),\, s(J)} + D^{(n)}_{s(J),\, s(J+1)}$$

$$Y = D^{(n)}_{s(I-1),\, s(J)} + D^{(n)}_{s(J),\, s(I)} + D^{(n)}_{s(I),\, s(J+1)}$$

IS
Y < X ?   NO

YES

Exchange the elements in the tour at locations I and J.
Set REPET = 1 and TL = TL − (X − Y).

$$I = I + 1$$

YES   IS
Y ≤ (n−1) ?   NO   IS
REPET = 0 ?   NO   G
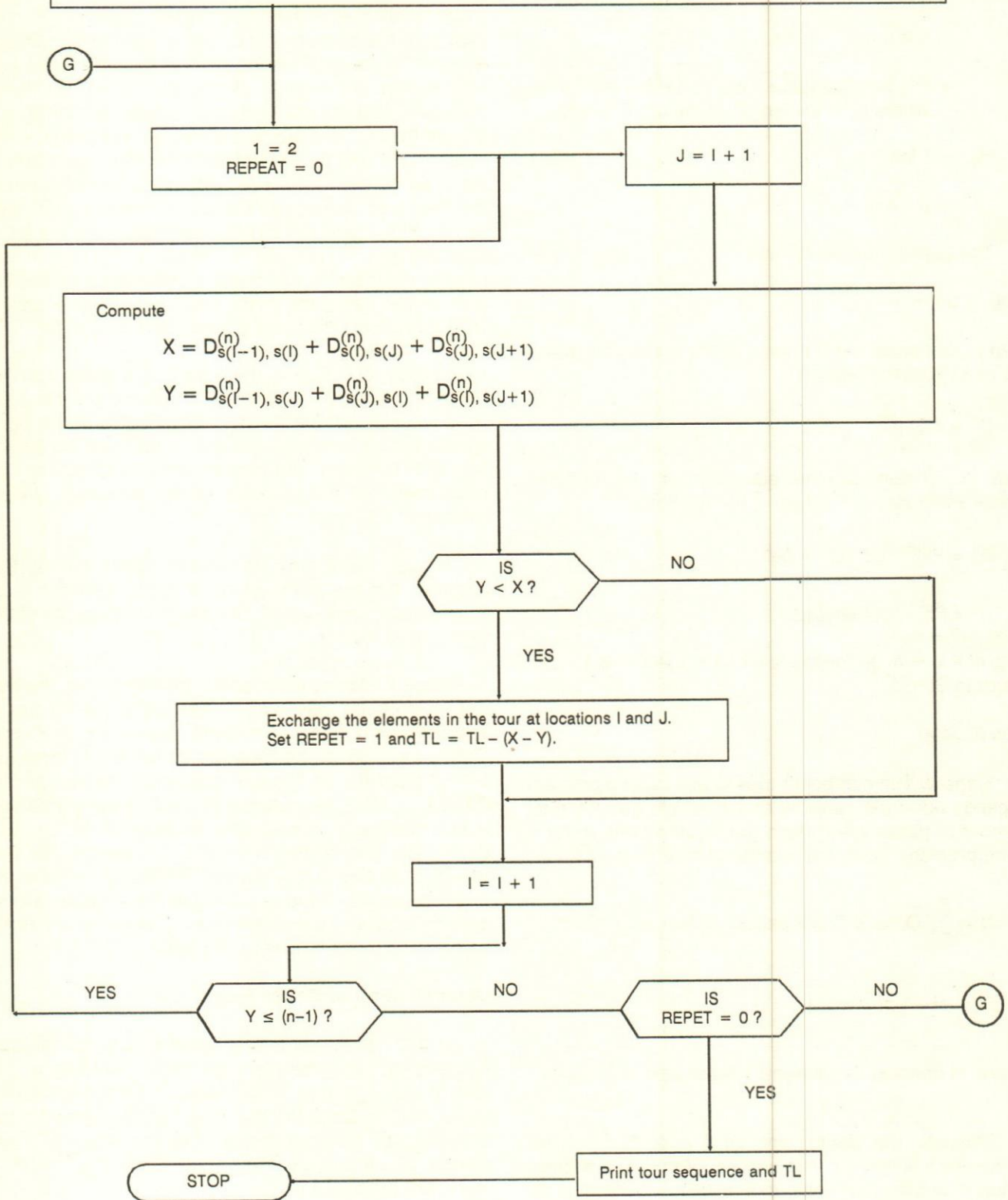
YES

STOP   Print tour sequence and TL

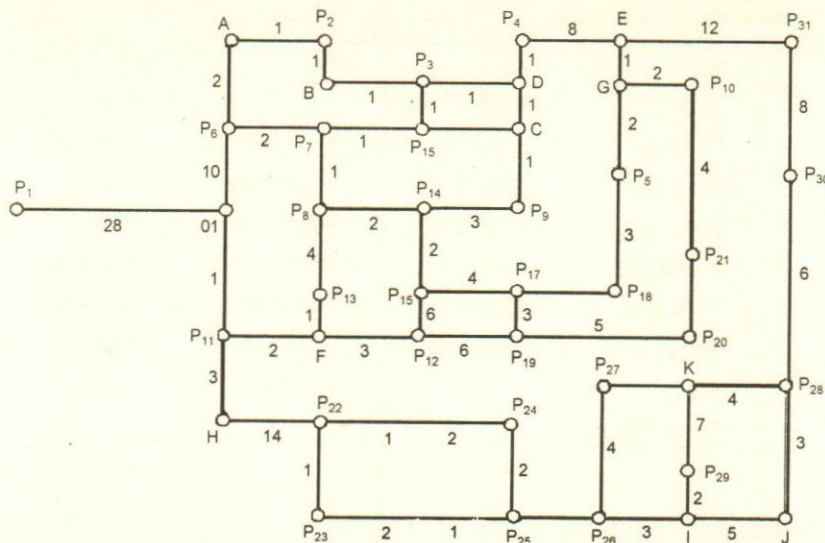**Fig. 1.** Flow Chart for Determination of Improved Route

Fig. 2. Schematic Diagram showing the Route Design.

(Penalty is the difference between the first minimum and the second minimum in any row or in any column).

Step 2: Find the maximum of such penalties.

Step 3: If there is a tie on the maximum penalty, go to step 5, if not, go to Step 4.

Step 4: Identify the minimum element in the column or row corresponding to the maximum penalty. Go to step 6.

Step 5: Identify the minimum element in the column or row corresponding to the maximum penalties such that the minimum element in that row or column is the lowest among all such minimum values with respect to the maximum penalty values under tie.

Step 6: Include the arc (p, q) the path from the node p (row p) to the node q (column q) corresponding to the minimum element identified in step 4 or step 5 in the tour sequence.

Step 7: Delete the column q and the row p corresponding to the minimum element and the element corresponding to the row q and the column p is assigned high positive value. If the arc (p, q) can be combined with one or more previously assigned links to form a chain, say x & y, then prevent the formation of the loop by assigning the element corresponding to row for the node y and the column for node x a very high positive value.

Step 8: If the number of rows or the columns in the modified matrix is 2, go to step 9. Otherwise go to Step 1.

Step 9: Include the arc with respect to the diagonal elements of the matrix in the tour sequence corresponding to the minimum diagonal sum of the matrix.

Determination of Improved tour

In this part, the tour sequence obtained in the part 1 is improved by pairwise exchange method. The detailed logical flow chart is shown in Fig. 1.

Case Study

Bus route planning problem

The company chosen for the study maintains a fleet of 12 number of 50-seater buses. It was initially registered as a private firm with a fleet of three buses and in course of time it has expanded its fleet size with present strength of work force of 37 staff.

The company is engaged in running chartered bus service to office/factory goers both during morning and evening hours. It also caters to the school bus needs of four schools.

The study has been carried out for the bus routing planning dealing with picking up and dropping of office staff to and from the office complex. Eleven number of 50-seater buses are engaged for this purpose. The situation is similar to that of a single depot – multiple vehicle routing problem where all goods have to be transported to and from a factory. The chartered bus route under the study includes 30 pick-up points (shown as points P2 to P31 in Fig. 2 and A to K and 01 being the turning points) with a total of 467 passengers to be transported. These

Table 1: Showing the existing routes of the Chartered bus

Routes	R1	R2	R3	R4	R5	R6
	P1O1	P1O1	P1O1	P1O1	P1O1	P1O1
	O1P6 (4)	O1P6 (8)	O1P11 (9)	O1P11 (7)	O1P11 (11)	O1P6 (7)
	P6A	P6P8 (6)	P11P12 (6)	P11P12 (12)	P11F	P6P7 (2)
	AP2 (20)	P8P14 (4)	P12P19 (10)	P12P16 (6)	FP13 (7)	P7P15 (10)
	P2B	P14P9 (10)	P19P20 (12)	P16P17 (6)	P13P8 (10)	P15P3 (9)
	BP3 (7)	P9P4 (6)	P20P21 (3)	P17P5 (2)	P8P14 (8)	P3D
	P3D	P4E	P21P10 (2)	P5P31 (5)	P14P9 (9)	DP4 (8)
	DP4 (12)	EG		P31P30 (2)		
		GP10 (10)				
Passengers	43	44	42	40	45	36
Distance (km.)	45	60	50	72	41	44

Routes	R7	R8	R9	R10	R11	Total
	P1O1	P1O1	P1O1	P1O1	P1O1	
	O1P11 (4)	O1H	O1H	O1A	O1P6 (0)	
	P11P12 (8)	HP22 (9)	HP22 (6)	AP2 (8)	P6P7 (11)	
	P11P12 (8)	HP22 (9)	HP22 (6)	AP2 (8)	P6P7 (11)	
	P12P16 (7)	P22P23 (10)	P22P24 (11)	P2B	P7P8 (0)	
	P16P17 (8)	P23P25 (4)	P24P25 (8)	BD	P8P14 (13)	
	P17P18 (8)	P25P26 (12)	P25P26 (7)	DP4 (0)	P14P9 (6)	
	P18P5 (9)	P26I	P26P27 (6)	P4P31 (10)	P9P4 (10)	
		IP29 (11)	P27P28 (4)	P31P30 (14)		
				P30P28 (13)		
Passengers	44	46	47	40	40	467
Distance (km.)	49	62	66	79	49	617

30 pick-up points cover the west Delhi area and P1 is the central depot (i.e. the office complex). The lap P1-O1 is common for all which is 28 km. in length. The Fig. 2 shows the bus routes design, the arc values representing the distance between pair of pick-up points in kilometers.

The existing routes along with the number of passengers picked up her stop (figures in brackets), the total number of passengers per bus route and the route length in kilometers are given in Table 1. Herein attempt has been made to analyse the existing route design so as to develop a more economic schedule of chartered bus routing. The proposed algorithm is applied and the efficiency of the algorithm is justified by the comparison of the result with the existing bus routing plan.

Software Development

For applying the proposed algorithm for solving the chartered bus routing problem, software has been developed in Turbo Pascal in MS-DOS operating system. It consists of two database files, three program files and one output file. The database files include all relevant data related to the route design, passengers expected at each pick-up point etc. On of the program files contains the program of arranging the input data in the form of distance matrix, other is exclusively for finding out the shortest distance and the third program file includes the logical steps of stage 2 through stage 4 of the proposed algorithm.

Results

The result obtained applying the above software is given in annexure I which provides the following information for each route in the sequence given below:

(i)   the route number;

(ii) the number of the pick-up points allocated per route;

(iii) number of passengers serviced per route;

(iv) the shortest tour sequence of allocated points;

(v) the tour length for the route.

At the end of the computation the total distance covered by the whole fleet per trip is given

The above result is then compared with the existing bus routing structure.

The following represents the comparison:

The total distance covered by the fleet as per proposed algorithm	= 536 kms.
The total distance covered as per the existing system	= 617 kms.
Therefore, the saving on distance covered	= 81 kms.
Total percentage of savings on distance covered.	= 13.2%
The required number of buses (routes) or in other wise, fleet size obtained by the algorithm	= 10
The number of buses used in the existing system	= 11

Thus the proposed algorithm leads to the substantial cost reduction in the following two ways:

(i) Reduction of capital investment cost by reducing one bus from the existing fleet, which subsequently reduces the interest, depreciation components of the recurring expenditure and also the cost of maintenance and operation of one additional bus.

(ii) Reduction of operating cost to the tune of 13 per cent per trip which may be doubled or

> Reduction of capital investment cost by reducing one bus from the existing fleet, which reduces the interest, depreciation components of the recurring expenditure and also the cost of maintenance and operation of one additional bus.

tripled in a day depending on the number of trips per day. this essentially leads to fuel savings, reduces the fleet cost in terms of maintenance and wear and tear of the fleet.

Conclusions

The study seems to justify the applicability and validation of the proposed methodology. However, the real life urban transportation planning problem involves some other components and relaxation of some more restrictions need to be incorporated in the proposed algorithm. The following shows some such additional considerations and complexities.

The algorithm pre-supposes the fact that all the passengers of a particular stop are boarding at a time. It does not allow the passengers at any stop to board into more than one bus, which therefore, forms a restriction.

Further, the demands at each point should have been, in reality, stochastic in nature. Factor of uncertainity should also be considered in computation of the route wise and bus wise transportation cost in any urban transportation planning situation. The solution algorithm may also be developed applying the concept of Network analysis and Graph theory.

The proposed algorithm can be equally applicable to solve logistic problem of municipal waste collection, post mail, movement of rail wagons, newspaper delivery, dairy milk supply etc.

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Annexure-I

Route Number	1	2	3	4	5
Points in route	1	3	3	4	2
Total passengers per route	35	48	47	48	47
Tour sequence	1-4	1-11-13-15	1-12-18-16	1-3-7-8-21	1-6-2
Tour Length	41 Km	38 Km	51 Km	57 Km	41 Km

Route Number	6	7	8	9	10
Points in route	2	4	3	4	4
Total passengers per route	48	48	48	48	48
Tour sequence	1-14-9	1-10-5-17-19	1-20-31-30	1-24-25-23-22	1-27-26-29-28
Tour Length	41 Km	59 Km	73 Km	55 Km	80 Km

The total distance covered by the whole fleet = 536 Kms.

Diversification of Agriculture & Food Security

R.R. Biradar & Jayasheela

Consequent with the need for the transformation of traditional agriculture in India into a profit-making market and oriented venture, this sector has undergone considerable diversification. In particular, ensuring changes in the cropping pattern in favour of cash crops and reduction in the cultivated area of cereal crops. This reduction has somewhat impaired the conventional sustainability if foodgrain production and has posed problems for food security. In the present paper these issues are critically examined in the context of agricultural sector in Karnataka.

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Agriculture in an underdeveloped country has to ensure food security, generate income and gainful employment opportunities in rural areas, through the transformation of traditional agriculture into a market oriented one. With the unstinted efforts and massive investments, the agricultural sector has undergone a considerable diversification. One such area is the change in the cropping pattern in favour of market-oriented high valued cash crops (Chand, 1996; Vyas, 1996; Nadkarni, 1996). As a result, the area under cereal crops has been brought down significantly. However, the sustainability in food grain production and productivity has been questioned. It has also been argued that diversification of cropping pattern should not take place at the cost of food security.

> Agriculture in an underdeveloped country has to ensure food security, generate income and gainful employment opportunities in rural areas.

In the context of ever-growing population and the increasing demand for food requirements and employment on the one hand, and stagnancy in cropping intensity and irrigated farming (Rangaswamy, 1990; Report of the Expert Committee, 1993) and decreasing capital formation in agricultural sector (Dhawan, 1996; Mishra and Chand, 1996; Jairath et al, 1996) on the other hand, the importance of dryland development is increasingly emphasized. The agricultural production has increased about 185 million tonnes of foodgrains and population is also growing rapidly at the rate of 2.11 per cent during 1994-95. Hence, the task of providing food requirements to ever-growing population is stupendous (Patil, 1995). In spite of massive investment in irrigation since the inception of planning era, irrigation coverage is hardly about 30 per cent of India's total cropped area. Even

after achieving the optimum level of irrigation potential, 60 per cent of the India's total cropped area still comes under rainfed agriculture (Lakshmikanthamma, 1996). Then an increasing proportion of output and employment will have to be generated from rainfed areas to feed and absorb ever-growing population and workforce. Therefore, the development of dryland zones will have to play an important role in meeting the country's future needs.

> In spite of massive investment in irrigation since the inception of planning era, irrigation coverage is hardly about 30 per cent of India's total cropped area.

Dryland zones are those where agriculture is mainly rainfed and having little or negligible area under irrigation. According to the Fourth Five Year Plan, the dry land zones are those which receive annual rainfall ranging from 375 mm to 1125 mm and with very limited irrigation facilities. As per the criteria, about 128 districts were identified as dryland areas in our country. Most of these districts are found in the southern India such as Andhra Pradesh, Tamil Nadu, Karnataka, and the rest are in Maharashtra, Madhya Pradesh, Uttar Pradesh etc.

Karnataka State is coming under dryland area. With the total geographical area of 19.04 million hectare, over 10.4 million hectares are under cultivation; of which, about 8.2 million hectares are under rainfed conditions, accounting for little over 80 per cent of the state's total net cultivated area. Even if the ultimate irrigation potential is reached (about 46 lakh hectares), 70 per cent of the state's cropped area will continue to be under rainfed farming. Thus, the development and prosperity of the dryland zones hold the key to the economic development and prosperity of the rural people and the State.

In the recent past, the farmers who come under the dryland zones in Karnataka have experienced setbacks in agricultural production due to uneven distribution of monsoon and natural calamities. As a result, farmers are reluctant to use high yielding varieties of seeds, chemical fertilizers and other modern inputs even when they are available at subsidised rate. Thus, low crop yield and unstable food production are common in the arid and semi-arid tropics of State. It has, therefore, failed to provide even minimum food requirements (225 kgs per year per person) for the population in arid tropics. Hence, the need for dryland technology as a multi-dimensional approach can't be overlooked any longer. Therefore, a proper understanding of the characteristics of different zones in Karnataka is quite necessary for an effective planning of their economic development in general and agricultural development in particular. It is in this context that the following objectives are formulated for the present paper:

a) To examine the diversification of cropping pattern and thereby looking into food security.

b) To identify the factors contributing to variations in cropping intensity.

c) To assess the zonal disparity in the per hectare yields of all crops.

d) To suggest an effective strategy to follow with existing technology for the development of dryland areas.

Methodology

The present study is based on secondary data, collected from the Directorate of Economics and Statistics, Government of Karnataka, Bangalore and other concerned departments. The reference period for the study are: 1960-61, 1970-71, 1980-81, 1989-90 and 1994-95. To identify the constraints in the growth process in different Zones of the state, the five points of time periods were chosen. The collected data were analysed by applying percentages, averages, correlation co-efficient and co-efficient of variation wherever it is possible for which the following variables were selected. Rainfall (FR), net area irrigated (NAI), Chemical fertilisers (NPK), percentage of agricultural workers to total workers (AWTW), percentage of literacy rate (LR), bovine population per sq. km. (BPSK), number of persons served by a commercial bank (NPSCB) and total road length for 100 sq. kms. of total geographical area (TRL). The Karnataka State is purposively chosen for the present paper mainly because of larger proportion of area experiences severe drought and flood menace and thereby experiencing greater instability in production ad productivity. Further, according to the Zonal Planning Teams (ZPT) constituted by planning commission, Government of India, the State is classified into four sub-zones based on agro-climatic characteristics such as rainfall, soil, temperature, irrigation, cropping pattern etc. The classified zones are as follows:

Zone I: Belgaum, Bellary, Bijapur, Bidar, Dharwad, Gulbarga and Raichur;

Zone II: Bangalore, Chitradurga, Kolar and Tumkur;

Zone III: Mandya, Mysore and Hassan;

Zone IV: Chikkamagalur, Dakshina Kannada, Kodagu, Shimoga and Uttara Kannada.

Zonal Profiles

The brief profile of the Zones pertaining to total geographical area, forest, current fallow land, net sown area, gross cropped area, cropping intensity, net area irrigated, rainfall, per capital income, population and literacy rate for the year 1994-95, is presented in Table 1. It is found from Table 1 that out of the total geographical area of the state, Zone I takes lion's share followed by Zone IV and II. The greater proportion of area under forest is covered in Zone IV followed by Zone I and II. The current fallow land as an index of poor land utilisation is found more in Zone I where the rainfall and percentage of net area irrigated is also less. Consequently, the cropping intensity in Zone I and II is low as compared to other two Zones. Out of the total population of the state, zone I accounts for major proportion followed by Zone II and IV. Regarding literacy rate, Zone I accounts for hardly 47.43 per cent whereas Zones II, III and IV account for 57.37, 50.77 and 66.70, respectively. By and large, the performance of Zone I and II is very poor as compared to Zone III and IV.

Table 1: Profile of different Zones in Karnataka for 1994-95

(Percentage)

	Particulars	Zone I	Zone II	Zone III	Zone IV	Over all
1.	Total Geographical Area	46.88	19.23	12.64	21.25	100
2.	Forest	21.12	9.45	13.53	55.89	100
3.	Land not Available for Cultivation	34.77	26.46	17.01	21.76	100
4.	Other Uncultivated Land	15.94	31.92	15.04	37.10	100
5.	Fallow Land	59.30	23.32	10.12	7.26	100
6.	Net Area Sown	60.22	17.82	11.51	10.45	100
7.	Area Sown More than Once	59.42	12.50	15.53	12.56	100
8.	Gross Cropped Area	60.11	17.11	12.04	10.73	100
9.	Cropping Intensity	115.09	110.73	120.64	118.37	115.30
10.	Net Area Irrigated	21.42	17.74	28.19	28.75	22.31
11.	Rainfall (mms)					
a)	Normal Rainfall	708	738	856	2615	1139
b)	Actual Rainfall	836	794	874	2536	1181
12.	Per Capita Income (Rs.)					
a)	Current Price	5961	7174	6496	9152	7155
b)	Constant Price	1996	2681	2212	2735	2423
13.	Population (1991)	40.14	29.38	14.18	16.30	100
14.	Density of Population Per qs. kms.	206	637	275	176	243
15.	Literacy Rate	47.43	57.37	50.77	66.70	56.05

Note: Zone I Includes: Belgaum, Bellary, Bijapur, Bidar, Gulbarga and Raichur; Zone II, Bangalore, Chitradurga, Kolar and Tumkur; Zone III, Mysore, Nandya, Hassan; Zone IV, Chikkmagalur, South Kanara, Kodagu, Shimoga and North Kanara.

Source: The Directorate of Economics and Statistics, Government of Karnataka, Bangalore.

Table 2: Cropping Pattern in Karnataka during 1960-61 to 1994-95

(Percentage)

Crop/Crop group	60-61	70-71	80-81	89-90	94-95
1. Rice	9.71	10.75	10.45	9.77	10.78
2. Jowar	28.04	20.43	18.67	19.31	18.02
3. Ragi	9.40	9.78	11.09	9.64	7.86
4. Maize	0.11	0.58	1.39	2.09	2.86
5. Bajra	4.72	5.16	6.20	4.24	2.45
6. Wheat	3.06	3.16	3.02	2.05	2.03
A. All Cereals	59.25	54.85	52.28	48.78	44.88
7. Tur	2.80	2.79	3.16	3.98	2.51
8. Bengalgram	1.49	1.49	1.31	1.85	3.67
B. All Pulses	12.33	13.27	14.36	13.59	13.72
I Total Foodgrains	71.58	68.12	66.64	62.37	58.60
9. Groundnut	8.64	9.43	7.41	9.86	9.99
10. Sunflower	–	–	0.35	4.79	NA
11. Safflower	1.36	1.46	1.48	1.64	NA
II All Oilseeds	11.78	12.85	11.74	18.70	NA
12. Sugarcane	0.68	0.95	1.45	2.19	2.87
13. Cotton	9.29	10.49	9.50	5.76	5.29
Total (1 to 13)	93.33	92.41	89.32	89.01	76.75
Actuals*	10588587	10885800	10660029	12114597	12013325

Note: * Gross Cropped Area : NA - Not Available
Source: Same as Table 1.

Cropping Diversification

The concept of diversification at micro level could be observed in terms of switch over from the area under food crops to non-food crops/high value market-oriented cash crops of move away from low value/yielding crops to high value/yielding crops (Vyas, 1996).

Table 3: Cropping Pattern by Zones during 1960-61 to 1994-95 (Percentage)

Crop/ Crop group	Zone I (Arid Tropics)					Zone II (Semi-Arid Tropics)				
	60-61	70-71	80-81	89-90	94-95	60-61	70-71	80-81	89-90	94-95
1. Rice	3.45	3.87	4.09	4.18	5.35	7.39	9.37	8.09	7.56	6.35
2. Jowar	38.61	27.88	26.45	28.94	27.31	9.76	8.30	6.62	4.00	3.67
3. Ragi	0.64	0.64	0.98	0.84	0.52	35.23	33.78	36.95	29.55	25.23
4. Maize	0.16	0.49	1.51	2.45	3.19	0.00	1.24	1.77	2.03	3.30
5. Bajra	6.57	7..50	9.45	6.61	3.95	2.59	2.63	2.61	1.34	0.33
6. Wheat	4.70	4.98	4.94	3.38	3.36	0.04	0.10	0.07	0.03	0.02
A. All Cereals	57.84	50.34	49.97	48.38	44.77	64.68	64.96	58.18	47.15	40.08
7. Tur	2.89	3.72	4.53	5.80	3.38	4.27	1.79	1.57	1.80	1.94
8. Bengalgram	1.94	2.18	2.06	2.95	5.85	0.76	0.25	0.10	0.14	0.24
B. All Pulses	10.87	13.08	14.29	15.28	15.29	15.81	14.68	14.84	10.64	10.25
Total Foodgrains	68.71	63.42	64.26	63.67	60.06	80.49	79.64	73.03	57.79	50.33
9. Groundnut	10.87	11.95	8.61	9.39	8.71	6.71	7.96	9.68	19.41	22.85
10. Sunflower	NA	NA	0.54	6.43	NA	NA	–	0.07	2.37	NA
11. Safflower	2.09	2.32	2.42	2.67	NA	NA	0.03	0.06	0.14	NA
All Oilseeds	14.70	16.31	14.37	21.27	NA	8.60	10.09	12.08	23.62	NA
12. Sugarcane	0.54	0.81	1.42	2.43	3.21	0.64	0.84	0.89	0.67	0.93
13. Cotton	13.40	15.76	14.76	7.83	7.12	2.66	2.57	1.92	1.96	1.75
Total (1 to 13)	97.35	96.30	94.80	95.21	70.39	92.39	93.15	87.92	84.04	75.86
Actuals*	6880215	6842983	6471746	7302183	7221613	1689279	1774044	1778262	2144010	2055440

(Contd. Table 3)

Crop/ Crop group	Zone III (Irrigated)					Zone IV (Coastal)				
	60-61	70-71	80-81	89-90	94-95	60-61	70-71	80-81	89-90	94-95
1. Rice	15.80	16.12	14.68	14.83	17.85	50.66	50.38	45.46	39.90	40.37
2. Jowar	9.79	9.96	8.59	6.60	5.68	4.81	4.76	4.59	3.75	2.75
3. Ragi	28.13	28.82	28.82	27.27	21.15	6.93	7.52	8.45	7.27	6.36
4. Maize	0.00	0.52	1.32	1.56	1.91	0.00	0.16	0.21	0.67	1.40
5. Bajra	0.37	0.14	0.16	0.19	0.14	0.04	0.02	0.01	0.00	0.00
6. Wheat	0.00	0.01	0.01	0.00	0.00	0.03	0.04	0.03	0.03	0.03
A. All Cereals	55.86	57.28	49.56	50.61	46.76	63.27	64.15	59.17	51.79	51.03
7. Tur	1.85	1.10	0.99	1.15	1.01	0.65	0.41	0.25	0.33	0.23
8. Bengalgram	0.56	0.43	0.25	0.23	0.43	0.63	0.40	0.12	0.19	0.56
B. All Pulses	21.12	18.61	22.56	16.25	17.83	7.51	6.34	4.92	5.99	5.82
Total Foodgrains	76.98	75.90	72.12	66.86	64.59	70.78	70.49	64.09	57.78	56.85
9. Groundnut	3.43	3.88	2.97	4.05	4.41	1.87	2.01	2.01	2.84	2.93
10. Sunflower	NA	–	0.09	2.69	NA	–	–	0.04	1.77	NA
11. Safflower	NA	Neg.	0.01	–	NA	Neg.	0.01	0.01	0.03	NA
All Oilseeds	6.37	6.08	5.68	9.63	NA	2.53	2.89	3.05	5.56	NA
12. Sugarcane	1.50	1.98	2.73	3.40	4.73	0.91	0.93	1.06	1.99	1.99
13. Cotton	0.89	0.75	0.90	2.75	3.39	0.73	0.83	1.04	3.52	2.83
Total (1 to 13)	85.75	84.72	81.43	82.64	72.71	74.94	75.13	69.24	68.86	64.59
Actuals*	1022919	1178640	1267342	1390154	1446919	996174	1090133	1142679	1278250	1289353

Note: * Gross Cropped Area; NA - Not Available.

Source: Same as Table 1

Diversification of Agriculture

The diversification of cropping pattern during the reference period by the State and Zones is indicated in Tables 2 and 3, respectively. It is obvious from Table 2 that over the last few decades, the crop cultivation has witnessed significant diversification in the State. There has been significant decline in the area under food crops such as cereals, barring few superior and market oriented crops like rice, maize etc. Significant decrease in the area is observed in the case of jowar whereas, the area under pulses have been increased marginally. Further, among non-food crops, the area under oil seeds and sugarcane has noticeably increased while cotton registered a consistent declining trend.

Though the similar situation is found in almost all the zones, the degree of diversification of cropping pattern varies across the zones and over time. It could be seen from Table 3 that the Zone II has witnessed a greater diversification in favour of commercial crops followed by Zone IV and III. Unlike the food crops, in almost all the zones, the area under non-food crops, especially oilseeds, has substantially increased during the reference period. However, the increase is visible more in Zone II followed by Zone I and IV.

The growth of zonal food production and population is depicted in Table 4. It is clear from the analysis that diversification of cropping pattern was taken place in favour of market-oriented high valued cash crops. In addition, the cultivation of oildseeds manifests the preference of farmers to drought resistant commercial crops. As a result, the foodgrains production is going to

Table 4: Growth of Population and Foodgrains Production by Zones in Karnataka during 1961-1991

Zone	Population Growth Rates (%)			Growth Rate of Foodgrains (%)		
	1961-71	1971-81	1981-91	1961-71	1971-81	1981-91
Zone I	22.53	23.83	23.00	44.87	5.85	18.25
Zone II	26.39	34.16	24.58	53.96	−0.89	9.52
Zone III	26.03	23.93	18.77	48.16	24.59	12.83
Zone IV	24.19	24.48	13.13	39.08	15.15	3.93
Total	24.22	26.75	21.12	46.22	8.91	12.78

Source: Same as Table 1.

be affected in the future. The food security encompasses the availability of foodgrains, purchasing power (per capita income), adequate employment opportunities and easy access to civic amenities. Due to the non-availability of data, only foodgrains and per capita income are taken into account to throw some light on food security in different Zones during the reference period. It could be seen from Table 5 that the availability of foodgrains (per person per year) has registered increasing trend till 1970-71 in almost all the Zones and 1980-81 onwards it has shown declining trend in all the Zones and more so in Zone II and IV, where the diversification was taken place to a larger extent since 1980-81 onwards. This could be attributed to decline in the total production of foodgrains (see Table 6) and diversification of cropping pattern from food crops to non-food crops. However, the present position of foodgrains availability in Zones I and III shows relatively better situation as compared to Zones II and IV. The similar situation is also found in Karnataka as a whole during the same period. Regarding the per capita income of the each Zone, it is obvious that where the diversification was taken place to a greater extent, the purchasing power in term of per capita income *per se* will not judge the food security. So far as the per capita availability of foodgrains is concerned, the much diversified zone is going to be affected unless yield-augmenting technology is introduced at the earliest.

Table 5: Food Security by Zones in Karnataka for the Selected Years

Zone	Per Capita Foodgrains (Kgs.)*					Per Capita Income (Rs.)				
	60-61	70-71	80-81	90-91	1994-95	60-61	70-71	80-81	90-91	1994-95
Zone I	181	214	183	176	204	240	614	1347	4051	6391
Zone II	134	163	121	106	114	263	585	1453	4580	6874
Zone III	173	205	206	196	236	273	674	1483	4038	7094
Zone IV	178	199	184	169	194	544	1130	2026	6451	7835
Total	167	196	169	157	180	296	685	1528	4696	7155

* : Per Person Per Year (Kgs.)

Source: Same as Table 1.

Table 6: Correlation Co-efficient of the factors Influencing the Diversification of Cropping Pattern

Crop/Zone	RF	NAI	NPK	AWTW	LR	BPPSQKM	NPSCB	TRL
Zone I								
1. Rice	0.2569	0.8995*	0.8445*	−0.3265	0.8198*	0.8674*	−0.9532**	0.9090**
2. Jowar	−0.3113	−0.6090	−0.5059	0.7265	−0.4802	−0.6462	0.7311	−0.6131
3. Ragi	0.4319	0.7569	0.6862	−0.5055	0.6455	0.8458*	−0.8952*	0.7955*
4. Maize	0.1620	0.9815**	0.9883**	0.1504	0.9683**	0.8987*	−0.9609**	0.9982**
5. Tur	0.659	0.9978**	0.9860**	0.0451	0.9770**	0.8517*	−0.9500**	0.9879**
6. Groundnut	−0.7287	−0.5996	−0.6465	−0.2338	−0.5680	−0.9210**	0.7986*	−0.7486
7. Oilseeds	−0.5438	0.8283*	0.8325*	0.2922	0.8841*	0.3697	−0.5588	0.7119
8. Sugarcane	0.0292	0.9906**	0.9999**	0.2037	0.9930**	0.8311	−0.9186**	0.9829**
9. Cotton	0.3212	−0.7580	−0.8255	−0.6756	−0.8503*	−0.4578	0.5434	−0.7127
Zone II								
1. Rice	−0.3015	0.8672*	−0.2250	−0.1987	−0.2265	0.2735	0.1575	−0.1715
2. Jowar	−0.9939**	−0.3407	−0.9966**	0.8651*	−0.9967**	−0.3510	0.9769**	−0.9919**
3. Ragi	−0.6349	−0.4349	−0.7142	0.3142	−0.7122	0.4285	0.4830	−0.5581
4. Maize	0.9154**	0.4652	0.9121**	−0.9836**	0.9125**	0.6216	0.9779**	0.9688**
5. Tur	−0.6189	−0.7371	−0.6418	0.9426**	−0.6417	−0.7321	0.7574	−0.7345
6. Groundnut	0.9487**	0.2635	0.9684**	−0.6624	0.9680**	0.0275	−0.8570*	0.8977*
7. Oilseeds	0.9479**	0.2647	0.9679**	−0.6612	0.9675**	0.0253	−0.8558*	0.8968*
8. Sugarcane	−0.0517	0.4395	−0.0674	−0.5073	−0.0665	0.8569*	−0.1793	0.1114
9. Cotton	−0.8861*	−0.0703	−0.8305*	0.8752*	−0.8321*	−0.6959	0.9479**	−0.9199**
Zone III								
1. Rice	0.3645	−0.8650*	−0.7764	0.5674	−0.7193	−0.9257**	0.7809	−0.8061*
2. Jowar	0.3920	−0.8242*	−.9717**	0.8025*	−0.9768**	−0.5242	0.7888*	−0.9231**
3. Ragi	−0.1779	−0.2533	0.6192	0.3813	−0.6899	0.0528	0.2155	−0.4649
4. Maize	−0.7447	0.9971**	0.9380**	−0.9021*	0.8947*	0.7533	−0.9885**	0.9825**
5. Tur	0.9869**	−0.8021	−0.5863	0.8010	−0.5238	−0.5367	0.8647*	−0.7107
6. Groundnut	−0.1970	0.0115	0.3391	−0.4601	0.4276	−0.5957	−0.1056	0.2406
7. Oilseeds	−0.1525	0.4657	0.7924*	−0.6551	0.8536*	0.0113	−0.4641	0.6752
8. Sugarcane	−0.6706	0.9612**	0.9886**	−0.9248**	0.9663**	0.6457	−0.9516**	0.9987**
9. Cotton	−0.2416	0.6067	0.820*	−0.7290	0.9257**	0.1906	−0.5934	0.7847
Zone IV								
1. Rice	0.7115	−0.0725	−0.9714**	0.9637**	−0.9746**	−0.5009	0.7830	−0.9539**
2. Jowar	0.6046	−0.2908	−0.9261**	0.882*	−0.9589**	−0.3322	0.6875	−0.8430*
3. Ragi	−0.6282	−0.3607	0.2783	−0.3709	0.1756	0.8268*	−0.5685	0.4556
4. Maize	−0.5947	0.3904	0.9060**	−0.8598*	0.9455**	0.3116	−0.6758	0.8018*
5. Tur	0.9660**	−0.0742	−.7669	0.8167*	−0.6993	−0.9814**	0.9481**	−0.8417*
6. Groundnut	−0.6000	0.4218	0.9022**	−0.8543*	0.9427**	0.3160	−0.6795	0.7928*
7. Oilseeds	−0.6086	0.3807	0.9147**	−0.8704*	0.9521**	0.3288	−0.6889	0.8143*
8. Sugarcane	−0.5586	0.3104	0.9005**	−0.8570*	0.9397**	0.2756	−0.6448	0.8069*
9. Cotton	−0.5490	0.3435	0.8904*	−0.8437*	0.9325**	0.2614	−0.6350	0.7889*

Note: * Significant at 10 per cent level.   ** Significant at 1 per cent level.

Source: Same   Table 1.

Factors Influencing the Cropping Pattern

Though the cropping pattern is quite sensitive to the market mechanism viz., price (Vyas, 1996), here an attempt is made to identify the non-market factors that are largely attributed to change in cropping pattern over a period of time. It can be observed from Table 6 that the change in cropping pattern is quite responsive to the infrastructural facilities such as banking, transport, education as an index of informatic technology, irrigation and modern inputs such as chemical fertilisers (NPK) etc., in Zone I. In Zone II the rainfall, chemical fertilisers (NPK), education and banking facility are highly correlated with change in the cropping pattern. Any change in the above mentioned indicators result in considerable change in the cropping. In Zone III, education, chemical fertiliser (NPK), transport facility and percentage of agricultural workers are emerged as major factors influencing the cropping pattern. Further, in Zone IV chemical fertilisers (NPK), education, irrigation and transport facility are important variables contributing to change in cropping pattern.

In nutshell, it is found that the factors such as irrigation, chemical fertilisers (NPK), rate of literacy and transport facility are positively correlated with the non-food crops in general, and oilseeds and sugarcane in particular. Thus, any increase or change in these factors tends to fluctuate in the area under market-oriented high value cash crops.

> It is found that the factors such as irrigation, chemical fertilisers, rate of literacy and transport facility are positively correlated with the non-food crops in general, and oilseeds and sugarcane in particular.

Cropping Intensity and Crop Yields

Cropping intensity shows the intensity of land use for crop cultivation. In the conventional sense, cropping intensity is defined as the percentage of gross cropped area to the net cropped area (GCA/NCA × 100). An increase in cropping intensity over a period of time is generally considered as an indicator to assess the performance of agricultural development since it shows how effectively and intensively land is being utilised. It could be observed from Table 7 that the cropping intensity in almost all the Zones has witnessed an increasing trend. However, the increase in cropping intensity is found more in Zone I and III as the area under irrigation

in these zone has significantly increased over a period of time. Moreover, Zone I and II still have the greater potential of cropping intensity to increase as the land use intensity to increase as the land use intensity is lower as compared to the other zones.

Table 7: Cropping Intensity in different Zones in Karnataka during 1960-61 to 1994-95 (Percentage)

Zone	60-61	70-71	80-81	89-90	94-95
Zone I	101.91	103.30	105.73	112.53	115.09
Zone II	102.33	106.68	104.70	110.40	110.73
Zone III	108.88	114.18	117.64	117.33	120.64
Zone IV	112.30	117.43	114.04	117.06	118.37
Over All	103.52	106.22	107.69	113.14	115.30

Source: Same as Table 1.

Table 8: Growth of Net Irrigated in different Zones of Karnataka during 1960-61 to 1994-95 (Percentage)

Zone	1960-61	1970-71	1980-81	1989-90	1994-95
Zone I	3.44	7.38	9.83	17.86	21.42
Zone II	10.97	21.49	15.38	18.54	17.74
Zone III	16.87	19.73	22.18	24.11	28.19
Zone IV	32.26	33.89	25.85	26.55	28.75
Over All	8.39	13.31	13.75	19.56	22.31

Source: Same as Table 1.

An effort is made to identify the factors contributing to growth and instability in cropping intensity. It is obvious from Table 9 that irrigation, rain fall, chemical fertiliser (NPK), rate of literacy, transport facility, access to credit etc., have emerged as major factors determining the cropping intensity in Karnataka in general and in Zone I and II in particular. Among which irrigation, chemical fertilisers (NPK) and education are highly correlated with cropping intensity. Any changes in these factors result in considerable changes in cropping intensity.

The yield per hectare of food crops, oilseeds and commercial crops is explained in Table 10. It is clear from the table that over the time, the cereal crops, oilseeds and commercial crops have registered an increasing trend in the area and productivity. Among food crops, productivity of cereals has increased to 1389 kgs in the year 1994-95 from 490 kgs per hectare in 1960-61. Similarly, pulses also registered an increasing trend but comparatively less than the cereal crops. These changes have occurred after the introduction of green revolution in the country. The oil seeds like groundnut, sunflower and safflower have

Table 9: Correlation Co-efficient on Factors Influencing the Cropping Intensity in different Zones (1961-1995)

Variable	Zone I	Zone II	Zone III	Zone IV	State
1. Rainfall (mms)	−0.0816	0.8197**	−0.8996*	−0.7041	−0.8429*
2. % of Net Area Irrigated	0.9825**	0.6795*	0.9664**	0.8912*	0.9839**
3. NPK Fertilisers (Kgs/Ha)	0.9952**	0.8870**	0.8178*	0.5685	0.9928**
4. % of Cultivators to Total Main Workers	0.2555	−0.7310*	−0.8946*	−0.5280	−0.9283**
5. Literacy Rate (%)	0.9992**	0.8856**	0.7596	0.5836	0.9961**
6. BPSK	0.7622	0.0626	0.7182	0.5670	0.7041
7. NPSCB	−0.8682*	−0.7743*	−0.9867**	−0.6975	−0.8729*
8. Total Road Length	0.9553**	0.8185**	0.9065**	0.4342	0.9540**

Note: * Significant at 10 per cent level.   ** Significant at 1 per cent level.
Source: Same as Table 1.

also registered remarkable growth rate in productivity. Among commercial crops, cotton has displayed an increase in productivity over the years because of the introduction of high yielding variety of seeds.

Table 10: Crop Yields in Karnataka for the selected years (Kgs./Hect.)

Crop/Crop group	60-61	70-71	80-81	89-90	94-95
1. Rice	1291	1709	2302	2006	2445
2. Jowar	388	703	878	689	657
3. Ragi	757	838	1122	1140	1433
4. Maize	1080	3427	3110	2805	2873
5. Bajra	257	375	335	547	402
6. Wheat	237	380	541	506	723
All Cereals	490	750	1045	944	1389
7. Tur	309	503	373	377	395
8. Bengalgram	350	467	515	334	502
All Pulses	270	354	290	331	377
Total Foodgrains	518	775	881	934	1152
9. Groundnut	490	759	601	781	788
10. Sunflower	–	–	431	405	–
11. Safflower	174	172	513	596	–
All Oilseeds	409	625	519	612	788
12. Sugarcane*	72	78	79	80	96
1. Cotton	66	85	115	216	253

Note: * Production in tonnes.
Source: Same as Table 1.

Table 11 presents the zone-wise crop yield for the reference period. The data reveals that the yield per hectare of all crops in all the zones has registered significant growth rate. However, it is not the same in all the zones during the reference period. It is obvious that the yield per hectare of all the crops is quite high

in Zone III and IV as compared to Zone I and II. Moreover, this gap has also been widening to a greater extent. It might be attributed to adequate credit facility, irrigation, intensive use of NPK and HYV seeds etc., in the zones where the yield per hectare is quite high.

Conclusions

The above analysis presents the diversification of cropping pattern, cropping intensity, production and availability of foodgrains both at Zonal and State level which reveals as follows:

1. In spite of massive investment in the development of irrigation, Zone I and II are still very poor in irrigation potential as compared to Zone III and IV. However, the growth rate of area under irrigation is found to be more in Zone I.

2. The cropping intensity has increased more in Zone III and IV over the past few decades in Karnataka.

3. Irrigation, fertiliser (NPK), rainfall, education and transport facility are highly correlated with the change in the cropping intensity, particularly in Zone II and followed by Zone I.

4. Diversification of cropping pattern is taking place in favour of market-oriented high value cash crops in the State in general and Zone II and IV in particular.

5. The diversification into non-food crops has an adverse impact on the availability of foodgrains and positive impact on per capita income. Irrigation, fertiliser (NPK), literacy rate and transport facility are remarkably responsible for the diversification, especially in Zone II and IV.

Table 11: Crop Yields by Zones for the selected years (Kgs./Hect.)

Crop/Crop group	Zone I					Zone II				
	60-61	70-71	80-81	89-90	94-95	60-61	70-71	80-81	89-90	94-95
1. Rice	1085	1692	1856	1583	2155	1186	1845	1862	2213	2724
2. Jowar	376	619	692	639	704	584	1346	1329	1044	1196
3. Ragi	717	846	974	841	984	800	811	818	1117	1488
4. Maize	1084	3280	2625	2562	2886	618	3750	2381	3242	2881
5. Bajra	257	364	294	542	398	256	499	232	615	446
6. Wheat	237	368	537	504	723	245	2248	1346	1128	1104
All Cereals	390	645	752	791	1005	700	1022	1155	1318	1732
7. Tur	334	474	338	370	412	266	713	727	454	322
8. Bengalgram	367	467	449	333	498	200	450	449	245	597
All Pulses	259	345	268	336	384	277	437	322	303	369
Total Foodgrains	370	583	644	681	847	616	914	986	1131	1454
9. Groundnut	429	723	552	688	742	788	830	623	848	781
10. Sunflower	–	–	365	368	–	–	–	829	533	–
11. Safflower	174	172	513	596	–	–	110	513	633	–
All Oilseeds	364	593	477	525	742	663	726	595	798	781
12. Sugarcane*	65	74	69	69	89	72	83	85	88	86
13. Cotton	65	85	98	200	206	70	82	144	191	273

Note: * Production in tonnes.
Source: Same as Table 1.

(Contd. Table 11)

Crop/Crop group	Zone III					Zone IV				
	60-61	70-71	80-81	89-90	94-95	60-61	70-71	80-81	89-90	94-95
1. Rice	1728	2148	2736	2664	3128	1275	1523	1905	1927	2251
2. Jowar	527	824	900	956	1309	1071	2140	1299	1741	1438
3. Ragi	715	871	986	1194	1399	584	898	1082	1277	1415
4. Maize	–	3098	2498	3823	2673	–	3345	2783	3096	2995
5. Bajra	275	411	786	619	752	487	921	158	615	KRR
6. Wheat	167	951	1519	1125	1296	720	1029	930	408	244
All Cereals	949	1222	1616	1670	2098	1138	1445	1734	1831	2118
7. Tur	285	502	315	364	284	125	894	712	451	503
8. Bengalgram	260	466	449	422	553	399	464	447	373	649
All Pulses	267	290	321	329	337	359	357	352	350	417
Total Foodgrains	762	993	1211	1344	1612	1056	1347	1628	1677	1944
9. Groundnut	608	1094	1012	1092	949	896	970	947	1280	1373
10. Sunflower	–	–	1702	648	–	–	–	1057	486	–
11. Safflower	–	1000	516	–	–	171	171	507	607	–
All Oilseeds	422	823	716	774	949	720	765	767	887	1373
12. Sugarcane*	91	84	100	107	117	67	81	84	99	107
13. Cotton	83	86	144	378	292	120	82	142	306	232

Note: * Production in tonnes.
Source: Same as Table 1.

6. Yield per hectare of all crops in all the zones has registered an increasing trend, except a few crops in some years. However, the yield per hectare of all crops in Zone I and II is quite low as compared to Zone III and IV. this gap is also widening over the past few decades.

7. Agriculture in Zone III and IV is getting prosperous mainly because of irrigation, intensive use of chemical fertilizers (NPK), access to credit and transport facilities.

8. It could be noted that the Zones which have the some extent comparative advantage in the crop yield seem to be moving towards specialisation in their agricultural activities.

Based on the above analysis, some policy suggestions are made below:

a) In arid and semi-arid tropics like Zone I and II, where the agricultural activities are largely dependant on monsoon, the intensive use of rain water should be ensured through appropriate means of watershed development programmes.

b) The diversification of cropping pattern should be on the lines of yield-augmenting technology to increase the productivity so that the sustainability in foodgrains production can be ensured.

c) In arid and semi-arid tropics, the productivity of all the crops should be increased through an effective implementation of suitable technology and providing the necessary requirements so that the gap in productivity can be reduced.

d) It is a pre-requisite to provide infrastructure facilities such as access to credit, transport, education etc., in the arid and semi-arid tropics along with the existing dryland technology to facilitate the growth process. Wherever the watershed development programmes are in progress, these infrastructure facilities can be super imposed. Apart from the above, few non-farm activities should be promoted to reduce the vulnerability of agricultural workers in rural India.

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Productivity of Regional Rural Banks Credit in Haryana

Amar Chand Kaushik

Survey data from 135 beneficiaries of two regional rural banks in Haryana, who had been financed and formed the assets using the credit has been examined in the present study. Beneficiaries engaged in non-agricultural activities had registered high productivity of credit than those of agricultural activities. Among various factors human labour use, credit formed assets and dependency ratio had significantly determined the levels of productivity. The analysis to suggested that policies should be directed to supply adequate credit and other necessary infrastructural facilities to the beneficiaries.

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Despite the various achievements during the last five decades of Independence and planning experience rural poverty could not be alleviated significantly. Realising the importance of rural credit, banks were nationalised and massive rural developmental programmes were launched to offset the weakness of the commercial and Co-operative banks (Banking commission, Report 1972). Therefore, a third type of banking machinery called Regional Rural Banks (RRB) were established in 1975 with the specific objectives to fill the credit gaps left by commercial and co-operative banks. Various evaluation studies viz. Govt. of India (1985), IFMR (1984), Kalkundrikar (1990), Kaushik (1993, 1996), Malhotra (1986), Naidu (1988) NIRD(nd), Padmanabhan (1990) and SBI (1984) etc. depicted the impact of credit on rural development through income generation of the rural poor ignoring the productivity of credit (rate of return). While the assessment of productivity is very essential to see the viability of credit in this aspect.

> **Regional Rural Banks were established in 1975 with the specific objectives to fill the credit gaps left by commercial and co-operative banks.**

The present study makes an attempt to (i) estimate the productivity of credit through income generation of the beneficiaries (2) identify the major influencing/determining factors of credit productivity and (3) draw policy implications.

Methodology

The study is confined to thirteen branches of two regional rural banks i.e. Haryana Kshetriya Gramin Bank, Bhiwani and Gurgaon Gramin Bank, Gurgaon covering five districts, Bhiwani, Rohtak, Mahendragarh,

Gurgaon and Faridabad of Haryana. From the selected 13 branches of the RRKBs a sample 135 beneficiaries[1] who had acquired and retented the assets by using Banks credit were taken up from different occupational categories.[2]

The primary data[3] regarding assets, income, etc. were collected through a scientifically pre-tested schedule by direct personal interviews of the sample beneficiaries. Adequate discussion were also held with the concerned villagers, staff of the RRBs and beneficiaries.

Productivity of credit assets may be considered as a proxy for the return on investment in different types of activities. More explicitly, it estimates net return per unit of invested credit. Productivity may be treated as the ratio of income generation to investment (credit assets).

$$\text{or } P = \frac{Y_{gi}}{C_{ai}} \times 100$$

> **Productivity of credit assets may be considered as a proxy for the return on investment in different types of activities.**

where, p : Productivity of credit assets per beneficiary in percentage.

Yg : Income generation over pre-credit period per beneficiary (Yg = Yt–Yr). Yt starts for post credit period income and Yr pre-credit period income.

Ca : Credit assets or the amount of credit invested per beneficiary in forming or improving assets.

i : Number of beneficiaries.

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1. This study is a part of a sample of 390 beneficiaries of the 13 branches of the two Regional Rural Banks. But for the analysis of productivity only 135 beneficiaries who had acquired the assets, retented and generated additional income due to RRB's credit have been taken into account.

2. Different occupational categories are: small farmers, marginal farmers, agricultural and other labourers, rural artisans and petty shopkeepers.

3. Data collected during 1988-89 and relate to the year 1987-88.
   $P = b_0 + b_1 Lh + b_2 Ar + b_3 Yr + b_4 Wh + b_5 Ca$
   where P is productivity of credit
   b_0 is constant (intercept) b_1, b_2 etc. are co-efficients of explanatory variables.

In this way productivity is determined by income generation and credit assets. While income generation further depends upon various independent variables, such as the size of landholdings, pre-credit asset holdings, precredit income level labour use, and credit assets. In order to study the relative significance of the various explanatory variables influencing productivity Chi-square and multiple regression analysis have been used. To quantify the results the type of regression models used are shown as under:

$P = $ f (Lh, Ar, Yr, Wh, Ca)

$P = b_0 + b_1 Lh + b_2 Ar + b_3 Yr + b_4 Wr + b_5 Ca$

The following explanatory variables have been taken into account to explain the variation in productivity of credit assets.

Landholdings (Lh)

Land is the most significant factor in agriculture in production studies, land may be considered in various forms and indications. In the present study net operated area in acres have been considered to assess the impact of credit assets along with landholdings.

Pre-Credit asset holdings (Ar)

Productivity of credit assets depends not only upon the credit assets, but-also upon the pre-credit asset holdings of the beneficiaries. Pre-credit assets are measured in terms of money. Under these assets the agricultural implements draught animals (Camels, bullocks, etc.) the assets (tools) of artisans and the stock values of businessmen have been taken into account in monetary terms.

Pre-Credit income level (Yr)

Precredit income level may also be a significant factor affecting productivity as it may be used to partly finance the purchase of intended assets or may be used in acquiring complementary or supplementary factors and materials to use the credit assets more effectively.

Credit value turned into assets (Ca)

It is that part of net credit value which is actually invested in the form of assets (Purchased assets by utilising the credit of the banks). Its chief aim is to assess the impact of credit on productivity of credit assets.

Labour input (Wh)

This is an important determinant of productivity. Fuller utilisation of credit necessitates matching hours of work on it. Therefore, the number of labour hour is considered an another explanatory variable. Human labour has been measured in average daily working hours of beneficiaries, since the effectiveness of the credit depends upon the skillful handling of the credit assets by providing adequate time.

Dependency ratio

This has been measured in terms of earning members of the family. It is the ratio of total family size to the number of earning members in a family. The ratio is considered superior to the family size as a variable affecting work performance of a beneficiary. It affects labour supply, capacity and quality of work.

Skill status

Skill is an important factor affecting productivity. Without matching skill the productivity of assets is adversely affected. Quite often, it may lead to wastage, accidental damages and excess capacity. It is a qualitative variable and has been taken in to account in three sub categories of the beneficiaries namely skilled beneficiaries having experience of atleast five years or acquired some formal training in the area of activity of financed, semi-skilled beneficiaries having experience of atleast two years and had been skilled by their senior beneficiaries in their respective field and unskilled beneficiaries (who were neither experienced nor acquired the necessary skills prior to financing.

All these explanatory variables (quantitative and qualitative) have been associated with productivity of credit assets to determine their influence on it.

Empirical Results

For assessing the productive efficiency and effectiveness of credit in the form of assets productivity of credit assets has been estimated. The study reveals that the productivity of credit was about 66 per cent for the total sample. It suggests that on the average, one rupee worth of credit investment yielded of 66 paise. In other words an earning of one rupee required an investment of Rs. 1.52 in the form of assets (Table 1).

It has been observed that the credit productivity for non-agricultural activities (rural industries and small business) was higher (70.5 per cent) compared to all other agricultural activities (agriculture and animal hus-

bandry) (60.8 per cent). It suggests relatively the more efficacy and effectiveness of credit in non-agricultural activities than that of agricultural activities.

Table 1: Credit-productivity of the Beneficiaries Engaged in Various Economic Activities

Activity	Number of beneficiaries	Average Productivity of Credit (%)
Agriculture	38	53.18
Animal husbandry	16	79.00
Agricultural Activities	54	60.83
Rural Industries	54	72.39
Small Business	27	66.70
Non-agricultural activities	81	70.49
Total	135	65.89

Source: Field Survey Data.

An analysis of percentage distribution of productivity of the beneficiaries engaged in various activities (Table 2) reveals that a majority of the beneficiaries (nearly 49 per cent) were in lower middle groups of the productivity due to lower income generation with the help of credit assets. About 19 per cent of beneficiaries showed their productivity was greater than one (more than 100 per cent). Similar ranges of credit productivity were found in each individual economic activity/sector. It suggests that these beneficiaries earned more than the value of their credit investment. Thirty two per cent of the beneficiaries had their productivity in the range 51-100 per cent.

Table 2: Distribution of Different Classes of Beneficiaries According to Credit Productivity

Credit productivity range (%)	Number of beneficiaries engaged in				
	Agriculture	Animal husbandry	Rural industries	Small Business	Total sample
1-25 (lower)	8 (21)	1 (6)	7 (13)	7 (26)	23 (17)
26-50 (lower middle)	13 (34)	4 (25)	19 (35)	7 (26)	43 (32)
51-75 (upper middle)	12 (32)	4 (25)	14 (26)	3 (11)	33 (24)
76-100 (high)	2 (5)	3 (19)	3 (6)	3 (11)	11 (8)
Above 100 (higher)	3 (8)	4 (25)	11 (20)	7 (26)	25 (19)
Total	38 (100)	16 (100)	54 (100)	27 (100)	135 (100)

Note: Figures in brackets show percentage distribution.
Source: Field Survey Data.

Chi-square analysis of the data reveals statistically insignificant association between credit productivity and the type of economic activity.

Factors of credit productivity: Chi-Square analysis

The association between credit productivity and its plausible explanatory variables is tested using both quantitative and qualitative variables which have been classified into contingency tables amenable to Chi-square analysis. Table 3 presents major economic characteristics and performance of variables for various strata of credit productivity. Table 4 outlines credit productivity of beneficiaries in relation to the paraouts such as land holdings, pre-credit assets, labour input, etc.

Table 3: Economic Characteristics/performance of Beneficiaries Classified According to Credit Productivity (Mean Value Corresponding to Respective Productivity Ranges)

Credit productivity (%)	Size of land holdings (acres)	Pre-credit assets (Rs)	Pre-credit income level (Rs)	Labour used (hours)	Credit Size (Rs)	Credit Gap	Dependency Ratio
1-25	3.0	14000	7959	3.4	4992	3429	5.6
26-50	2.7	12000	5568	4.3	4203	3303	5.3
51-75	2.7	11207	6694	5.2	4030	2567	5.1
76-100	5.5	10305	10500	7.6	3756	2544	5.0
Above 100	4.7	8206	8765	11.3	2905	1863	4.8

Source: Field Survey Data.

Table 4: Credit Productivity Classified According to Size of Land Holdings of the Beneficiaries

Credit productivity (%)	Number of beneficiaries having land-holdings (acres)		
	upto 2.5	above 2.5	Total
Upto 50	10	11	21
Above 50	7	10	17
Total	17	21	38
Mean (%)	52.3	53.9	53.2

Note: Calculated Chi-square (x^2) value is 0.16 (df = 1), Table value is 3.84 at 5 per cent level.

Source: Field Survey Data.

Size of landholdings has been considered only for the beneficiaries engaged in agriculture. It has been revealed that there is positive and statistically insignificant association between size of landholdings and credit productivity. It implies that the size of landholdings has not influenced the levels of productivity.

The association of credit productivity terms out to be insignificant with pre-credit assetholdings as well as pre-credit level of income though the association is marginally negative with the former and positive with the later. The assets of most of the beneficiaries were traditional poorly maintained and low in value. In a number of cases the assets were of no or very limited use in the activities financed with credit. The factor was of considerable importance in weakening the association. Similarly pre-credit income level had little influence on credit productivity. Credit productivity has been found to be positively and significantly associated with the total labour input on the credit assets and their allied activities. It suggests that factors proportion tends to become more appropriate as the labour input is increased.

An inverse and statistically significant association is found between credit productivity and credit size. The relationship suggests that productivity tends to decline with increase in credit size and hence credit assets. The relationship is explained in the alternative regression analysis also.

> **An inverse and statistically significant association is found between credit productivity and credit size.**

Credit gap defined as the difference between credit required and credit disbursed appears an another important variable affecting credit productivity. The Chi-square analysis reveals an inverse and statistically significant association between the two variables. Credit productivity has shown a declining trend with the rising credit gap and vice-verse.

> **Credit gap defined as the difference between credit required and credit disbursed appears an another important variable affecting credit productivity.**

Beneficiaries' skill is a qualitative aspect of labour input and is found to be an important factor of credit productivity. Labour on the basis of this qualitative variable has been classified as skilled semi-skilled an unskilled. The skill status of the beneficiaries is found to have a positive and statistically significant association with credit productivity. Dependency ratio which affects the supply and quality of labour is found to have statistically significant and negative association

with credit productivity. The ratio was classified lower (upto 5) and upper (above 5) ranges and set against the three (lower, middle and higher) ranges of credit productivity.

Table 5: Credit Productivity Classified According to Pre-credit Assetholdings of the Beneficiaries

Credit productivity (%)	Number of beneficiaries having assetholdings (Rs)			
	1-5000	5001-10000	Above 10000	Total
1-25	8	5	10	23
26-50	13	15	15	43
51-75	14	11	8	33
Above 75	16	11	9	36
Total	51	42	42	135
Mean (%)	67.3	66.7	63.4	65.9

Note: Calculated Chi-square (x^2) value is 4.86 (df = 6), Table value is 12.59 at 5 per cent level.
Source: Field Survey Data.

Table 6: Credit Productivity Classified According to Pre-credit Income of the Beneficiaries

Credit productivity (%)	Number of beneficiaries having income level (Rs)			
	1-3500	3501-6400	Above 6400	Total
1-50	18	31	17	66
51-100	12	20	11	43
Above 100	3	10	13	26
Total	33	61	41	135
Mean (%)	52.3	70.4	70.1	65.9

Note: Calculated Chi-square (x^2) value is 6.67 (df = 4), Table value is 9.49 at 5 per cent level.
Source: Field Survey Data.

The effect of the explanatory variables taken together on credit productivity is analysed in the following sections.

Factors of credit productivity

The relative significance of the various explanatory variables influencing credit productivity through multiple regression analysis has been studied. Regression models are fitted for the total samples as well as for four individual activities.

In all, five repression models have been estimated (Table 12). All of these estimated regression models are statistically valid as the values of computed F statistic are significant at 1 per cent level of significance.

Table 7: Credit Productivity Classified According to Labour use of the Beneficiaries

Credit productivity (%)	Number of beneficiaries using labour input (hours)			
	1-4	5-6	Above 6	Total
1-50	51	12	3	66
Above 50	12	23	34	69
Total	63	35	37	135
Mean (%)	44.8	74.3	93.9	65.9

Note: Calculated Chi-square (x^2) value is 53.56 (df = 2), Table value is 9.21 at 1 per cent level.
Source: Field Survey Data.

Table 8: Credit Productivity Classified According to Credit size of the Beneficiaries

Credit productivity (%)	Number of beneficiaries according to credit size (Rs.)			
	1-3000	3001-4000	Above 4000	Total
1-50	4	23	39	66
51-100	20	15	8	43
Above 100	15	3	8	26
Total	39	41	55	135
Mean (%)	89.8	68.8	46.8	65.9

Note: Calculated Chi-square (x^2) value is 39.10 (df = 4), Table value is 13.28 at 1 per cent level.
Source: Field Survey Data.

The coefficient of labour input (Wh) is found to be positive and statistically significant at 1 per cent level in each economic activity as well as in the total sample. It suggests a positive and significant association between labour input and credit productivity in various activities analysed. This implies that if the labour input is increased the credit productivity also tends to increase and vice-versa. Similar observation has been found in Chi-square analysis. The relationship suggests that an increase in labour input brings about a fuller utilisation of the asset causing an increase in productivity.

Credit size (Ca) is found to be another factor influencing the levels of the productivity. The relationship between the two is negative and statistically significant at 10 per cent, 1 per cent and 5 per cent level of significance in agriculture, rural industries and the total sample respectively. Its implication is that the higher the size of credit, the lower is the productivity. Similar result is arrived at Chi-square analysis. One of the main reasons for the low productivity in the high valued credit assets as found in the survey was the existence of larger credit gaps in such assets, the gap tended to increase with the value of credit assets.

Table 9: Credit Productivity Classified According to credit gaps of the Beneficiaries

Credit productivity (%)	Number of beneficiaries with credit gap (Rs)	1-1500	1501-3000	Above 3000
1-50	15	24	27	66
51-100	17	18	8	43
Above 100	16	5	5	26
Total	48	47	40	135
Mean (%)	76.4	63.0	56.7	65.9

Note: Calculated Chi-square (x^2) value is 16.22 (df = 4), Table value is 13.28 at 1 per cent level.

Source: Field Survey Data.

Table 10: Credit Productivity Classified According to the skill status of the Beneficiaries

Credit productivity (%)	Number of beneficiaries			
	skilled	semi-skilled	unskilled	Total
1-50	7	22	37	66
51-100	16	12	15	43
Above 100	14	4	8	26
Total	37	38	60	135
Mean (%)	84.5	60.0	58.2	65.9

Note: Calculated Chi-square (x^2) value is 21.14 (df = 4), Table value is 13.28 at 1 per cent level.

Source: Field Survey Data.

The beneficiaries in upper credit ranges, therefore, had to co-finance their assets as a result of which they were found to be hard up in meeting the subsequently cost of maintenance. The maintenance cost factor was

Table 11: Credit Productivity Classified According to Dependency Ratio

Credit productivity (%)	Number of beneficiaries with dependency ratio		
	1-5	Above 5	Total
1-50 (lower)	25	41	66
51-100 (Middle)	30	13	43
Above 100 (higher)	15	11	26
Total	70	65	135
Mean (%)	79.0	51.9	65.9

Note: Calculated Chi-square (x^2) value is 11.01 (df = 2), table value is 9.21 at 1 per cent level.

Source: Field Survey Data.

found to be important particularly in agriculture and rural industries. In a number of cases the lack of maintenance led to deterioration in the quality and productivity of assets. The negative relationship between credit productivity and credit gap (found in bigger loans) has also been evidenced by the Chi-square analysis (Table 8). In the typical rural business environment in the domain of Regional Rural Banks credit, therefore, does not seem to produce economics of scale. In this way the higher bigger assets were not maintained by the poor beneficiaries due to their lower income level, while the smaller assets were properly maintained by their smaller resources and income level. This factor is found statistically insignificant in the activities of animal husbandry and small business. The survey shows that in these activities, the other factors like skill, labour use and mental inclination of the beneficiaries played a vital

Table 12: Credit Productivity in Various Economic Activities: Summary of Regression Results

Activity	Model specification	Explanatory variables and their coefficients					R^2	$\bar{R}^2$	$F(n_1 n_2)$	Constant
		Lh	Ar	Yr	Wh	Ca				
Agriculture	PA	3.004	−0.335	0.424	11.907[*]	−3.389***	0.640	0.584	11.372[*]	7.343
		(1.155)	(1.210)	(0.676)	(5.665)	(1.682)			(5,32)	
Animal husbandry	PH	–	3.684	−0.242	19.183[*]	−7.009	0.855	0.802	16.190[*]	−24.611
			(1.278)	(0.097)	(7.832)	(1.367)			(4,11)	
Rural industries	PR	–	0.682	1.287	12.634[*]	−9.367[*]	0.902	0.894	112.315[*]	7.695
			(1.111)	(1.889)	(14.710)	(2.796)			(4,49)	
Small business	PS	–	0.206	0.570	17.654[*]	−0.465	0.940	0.929	86.592[*]	−39.446
			(0.313)	(0.407)	(13.785)	(0.187)			(4,22)	
Total sample	PT	–	0.656	1.622	9.170[8]	−5.624[**]	0.692	0.683	73.019[*]	82.342
			(0.824)	(1.263)	(12.318)	(1.975)			(4,130)	

Note: L Lh, Ar, Yr, Wh and Ca stand for landholdings, pre-credit asset holdings, pre-credit income level, labour input and credit size respectively.

2. The marks * denotes significant at 1 per cent level, ** significant at 5 per cent level and *** significant at 10 per cent level.

3. Figures in brackets are ''t'' values.

Source: Figures in brackets are ''t'' values.

role in determining the levels of productivity. Landholdings in agriculture are found to be statistically insignificant in relation to credit productivity.

> The maintenance cost factor was found to be important particularly in agriculture and rural industries. In a number of cases the lack of maintenance led to deterioration in the quality and productivity of assets.

Pre-credit assetholding and pre-credit income level of the beneficiaries are also found to be statistically insignificant in influencing productivity. The similar result is corroborated in the Chi-square analysis. The survey reveals that it was due to inadequacy of pre-credit asset of the beneficiaries in terms of quality and quantity. The inadequacy and poor quality of the pre-credit assets was largely due to the beneficiaries poverty and consequent lack of their maintenance.

Conclusions

Productivity of credit was calculated to be 66 per cent. Productivity for non-agricultural activities was found to be higher than that of agricultural activities. Average productivity was experienced in the lower and lower middle levels. Human labour use, credit assets, and dependency ratio had significantly determined/influenced the levels of productivity. While pre-credit asset holdings and income could not influence. An inverse relationship between credit assets and credit productivity had been experienced due to low income generation further due to credit inadequacy (credit gap), lack of co-operant factors of production, lack of appropriate skill and infrastructural facilities. Hence it is suggested for the banks to supply adequate credit alongwith skill and training facilities to the beneficiaries.

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Book Reviews

Gender and Employment in India *by Papola T.S. and Alakh N. Sharma,* (ed.) Vikas Publishing House Pvt Ltd, Delhi, 1999, p. 439, Rs. 495.

As the title suggests, this collection spans a wide range of issues related to 'women' and 'employment' in India. The book is long with 17 essays (including a comprehensive introduction one by the editors). The material is in six parts.

Part I comprises of three essays on 'Trends and problems of measurement of women's employment'. Visaria, P. has analysed different issues related to employment; work participation rates (WPRs), the gender and industrial composition of work force and the level of unemployment. The author finds that the NSS data is more reliable than the census data for WPRs. Inter-state differentials in female WPRs were observed along with low urban female WPR than rural FWPR. The economic reforms were found to have no impact on WPRs and the general level of unemployment-rural and urban declined between 1987-87 and 1993-94 he also noticed a marked all in workers in agriculture—11% points and a major gain in tertiary sector of 7 points. He observed a tendency of increase in the proportion of casual labour with simultaneous increase in their real wages. He emphasised the strengthening of the database, doing away with the distinction of 'main and 'marginal' worker and the need to raise productivity.

Kundu has studied the trends and pattern in employment growth for women and compared them with males for all levels and obtained the similar results as those of Visaria. Kundu observed higher WPR for males than females, for people above 5 years of age. Data from 1971 to 1991 shows increase in female WPRs and unemployment, both in rural and urban areas, along with immiserisation of casual labour.

Suryanarayanan investigated the sources o the gaps and the biases in women employment data and pointed out the underestimation of female participation in economic activity. Limitation of data on different

count was stressed to have a better policy towards development of women and suggested the strengthening the NSSO database.

Recent trends in women workers in agriculture are analysed by J. Unni in part II, Employment and Poverty of women in Rural Areas. She highlighted the increasing casualisation of the workforce in rural areas with declining proportion of wage earners in rural households. The number of days of employment available to females was a lower labour household than males. The evidence indicated that the increase in real wages in the 1980's was not sustained in the 1990's for both the male and female workers in agriculture and males in non-agriculture. Limited option of migration to non-agriculture, declining real wages and rising rural poverty was cited as the problems of women in agriculture.

Parthasarathy and Nirmala examined the female marginalisation and casualisation in India and found that the hypothesis of female marginalisation is validated but technology did not have any definite impact on it and did not explain low female WPR and unemployment rate. They found an association between unemployment and non-agriculture workers.

Chadha found that the non-farm sector in rural India has expanded and it now has a big share of modern small scale industrial sector. So there was a movement of labour from agriculture to more productive non-agriculture sector till 80's but fell steeply between 1987-88 to 1993-94 for the rural males and female workers. The speedier slowdown of female was due to the difference in their education and skill level. The status of education, which is going to be very important in the future job market, is still very poor especially in rural areas—that too among females. 50 per cent of rural females and 40 per cent of rural males are still found to be illiterate—needing a strong public policy intervention.

Nisha Srivastava in part III entitled Women's employment in organised and informal sector stressed that an increase in women employment will improve

their economic independence and self respect and highlights the discrimination against women in employment and wages paid to them across all states and all sectors. However employment grew faster than males during 1981-96 and mainly after the reforms. The new technology, computerisation, etc has changed the face of the job—now more skill is required. It works, however against the workers in general and females in particular with lower skill and education.

Mukhopadhyay while investigating the informal sector observed that both the size of the unorganised sector and the women's participation in it increased in rural as well as urban areas. However women were pushed to the bottom end of the informal sector—mainly they are part time (77.61%), concentrated in small units and working with low wages.

Part IV has three articles. First by Deshpande and Deshpande on gender based discrimination finds low female WPRs and they are mainly in the primary sector (90%) in rural areas and in the services sector (59%) in the urban areas. The authors concluded that many discriminations against women—more female casual workers than males, higher unemployment rates, low wages, etc. exists by industry, occupation and education. The Differentials were found to be narrower in Mumbai than in urban India. Investment in female education is low and increased with age group.

Geeta Gandhi also analysed the gender discrimination and said that there is poor incentive to girls to acquire schooling because rate of return off education is lower for females (9.6%) than males (10%). Parental background and quality of schooling were found t be important especially for female education. Education also has impact on fertility, quality of child, female WPRs, poverty eradication, etc. In India, unlike many other countries, the private rate of return to education was increasing with increase in the level of education both for males and females. Chaudhary studied the trends in employment of female children in major states for 1961-91 and observed an increasing trend in the proportion of full time students and a decreasing trend of 'nowhere students' and child labour. Nowhere girls were in majority and large as compared to boys. The bias in nowhere children is more important in urban areas. Female child labour is negatively associated with infrastructure development, enrollment in middle school, state PCI and positively with urbanisation, literacy, etc.

Banerjee in part V on the impact of structural adjustment programme contended that work opportunities increased in agriculture in India and in services in urban areas. However work itself is not able to empower women—but factory work may improve her condition. No link was found between exports and feminisation.

Jayanti Ghosh observed increased participation of women in recognised paid employment between 1980 and 1990's and focusses on the reasons of the feminisation–like trade liberalisation, emphasis on exports, technological and organisational changes. She also noticed many disturbing trends in Asia as well in India as discrimination against women, deterioration in their status, unemployment and underemployment of women and casualisation of women labour.

Indira Hirway shows that structural adjustment programme hits women through increasing unemployment, deterioration in working conditions widening wage gap between males and females, increase in poverty, etc. the author has raised certain important issues and challenges for women workers in India.

Part VI concentrates on the interventions required for promoting employment of women. Mahendra Dev discusses about three types of employment–wage employment, self-employment and special programmes for women. It critically reviews different Government programmes and concludes that participation of women in them has increased. Public works programme was more useful in drought conditions and DWCRA in AP than in any other state. He stressed on the involvement of NGO's and panchayats and the focus of the social security programme towards female employees.

Renana Jhabwala, however, talked about labour interventions as a tool to reduce poverty especially in the unorganised sector. The effect of labour interventions as a tool to reduce poverty especially in the unorganised sector. The effect of labour market on poverty is mainly through—lowering wages and earnings and generating large-scale unemployment. In rural areas women work for fewer days and get lower earnings than males in both agriculture and non-agriculture households. SEWA was found to be a success story in many areas, therefore need to be expanded in scope and coverage.

The book contains an excellent and detailed study of the issues raised. It is an important and useful addition to the literature on the subject and would be of good use for academics, practitioners and policy makers.

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TQM in Indian Engineering Industries by Dr. Sunil Sharma, Business Publications Inc., Bombay, 1997, p. 353.

Total Quallity Management (TQM) has come to be accepted as a major management strategy and a tool to bring about a transformation in an organisation. It finds application in diverse corporate functional systems such as design, manufacturing, marketing, financial controls, supplies, purchases and HRD. In areas of materials management, TQM has come to be considered as an integrated approach encompassing vendor development, approval of suppliers, inspection of incoming supplies, quality control during manufacturing, product testing, quality assurance and customer satisfaction. It has helped in unearthing, as Dr. Sunil Sharma describes, "hidden capacities of production lost beneath layers of ineffectiveness and inefficiencies in every area of manufacturing". TQM is the answer and the tool to attain unique competitive advantages and to meet the emerging challenges of globalisation.

The main aim of the book under review is to identify critical success factors for development of TQM and find out difficulties faced by the Indian companies in implementing TQM. The author has set for himself these objectives: to identify, conceptualise, analyse and appraise the different elements of TQM system in a manufacturing entity; to assess the need, adequacy, capability and potential of Indian manufacturing companies to develop TQM approach, to identify areas where TQM would have repercussions and to analyse impact of foreign collaboration. Unlike most books written on TQM which have relied on expanding already expounded theories on the subject by such venerated authorities as Crosby, Juran or Taguchi or have become compilation of case studies, 'TQM In Indian Engineering Industries' by Dr. Sunil Sharma is an excellent treatise on the subject with original contributions in several areas. The book is backed up with data from 66 Indian Manufacturing companies from engineering industry with potential for export. In this context, the book is unique and is a comprehensive guide book for the Indian corporate sector to develop and implement TQM. The book provides attributes and presents extensive suggestions for improvement. The author very rightly recommends TQM as an 'inevitable business strategy' for the Indian industry.

The present book has been developed from the author's research work. Spanning over 350 pages, the book is supplemented with tables, appendices and a list of references. The study is divided into six chapters. The first chapter details the objectives of the study, the research design, major findings and limitations of the work carried out. Major scope of the work encompasses a comprehenisve study of TQM in manufacturing Industries namely electronics, light engineering, automobiles, textile and chemical industry; determination of critical attributes of TQM and an inter-industry comparison with respect to attributes of TQM.

Second chapter is devoted to the review of existing work on TQM. Various models of TQM such as Oak land Model, Integrated Model, as developed by Sohal, Tay and Wirth; Building Blocks (Zairi et al), Japanese CWQC, Taguchi's Total Quality (Taguchi Function) are some major concepts which have been discussed quite exhaustively. The author has traced the evolution of TQM and has analysed in detail the linkages and inter-relationship with functions as CWQC, Taguchi Function, Total Prevention Maintenance, JIT, FMS, OPT, AMT, Condition Based Maintenance, MRP-II, Total Safety Systems, Process Capability, Product Liability, Design Assurance, Suppliers and Customers. TQM involves every member of an organisation in solving quality problems. A continuous programme of education and training of employees is required. Humanistic aspects of TQM are also discussed in this chapter. Ishikawa has proposed seven elemental tools (Q-7) for new tools to improve quality of design and as a part of quality design. This chapter which forms the core of the book is an excellent analytical study carried out thoroughly and provides detailed information on TQM and related areas at one place.

The third chapter brings out difference between ISO 9000 and TQM approaches. The author considers ISO 9000 as a technical system of TQM with emphasis on formal written down procedures, instructions, guidelines, check lists etc. TQM on the other hand is a total management philosophy, customer focussed and integrated with company's strategy, mission and vision. TQM is integration of technical system with social system. Employees, customers and processes form key issues in TQM implementation and none of these issues can be dropped.

Fourth chapter details the methodology adopted by the author to collect data from industry. The author has selected a statified random sample for the study. The industry groups have been chosed on the basis of their contribution to exports in the area of manufactured goods. This way, the author has identified industry groups of Electronics, Automobiles, Light Engg., Heavy Engg., Textiles and Chemicals. A minimum stratum size of 10 has been considered for each group. The data collection has been carried through response to questionnaire as well as through interview of top executives.

The fifth chapter deals with data collected and its analysis and interpretation. The author has identified fif-

teen attributes or Critical Success Factors (CSF) as crucial factors for the development and implementation of TQM. Inter industry comparisons have been carried out with reference to these attributes and the industries have been rated according to their development status in each of these attributes. The author has also developed a total composite score rating based on CSF and rated the industries (sectors) studied. As per the rating measure developed, Heavy Engineering emerges the winner with composite score of 71.89% with Textiles at the bottom with a composite score of 52.16%. In terms of point scores, the author has arrived at the following order: Textiles Electronics Light Engineering/Chemicals Automobiles Heavy Engineering.

The sixth chapter, which is a part of chapter five, deals with conclusions and recommendations. Against each of the TQM attributes the author has endeavoured to identify weaknesses and strengths in the relevant function/sub-function of the industry. For example, 75% of the companies across all the industries use basic design guidelines; simultaneously 80% of the companies do not do carry out documentation of design guidelines. Similarly under TQM attribute of Vendors Control, nearly all the companies have systems for identification and documentation of purchase specifications but there is a marked weakness in industries such as Chemicals, Textiles and Automobiles in carrying out process capability studies of vendors. The inference derived for Automobiles industries is quite surprising as normally this industry is heavily dependent on vendors and vendor development occupies a very significant place in their functional set up. The conclusions so arrived at constitute very important findings of the study as these provide clear perceptions of the state of art and practice of TQM in each industries to a practicing manager. These findings have led the author to formulate recommendations under each of the CFM for an industry.

The book has a few weak areas. The study does not cover white collar environment, service sector and the processing industry. The white collar and the service sector is becoming more pronounced and dominates in many business sectors in employment, services and turnover. It is also an area where customer service occupies as the single largest requirement. TQM has an important application in such environments. Discussion on TQM in white collar job environments is highly limited.

Self-assessment or self-appraisal has been recognised as a major management strategy towards quality management. A number of Quality Awards have been developed in various countries with common objectives of Quality Awards have been developed in various countries with common objectives of providing recognition as well to encourage self assessment. Malcolm Baldrige National Quality Award in the USA, Deming prize in Japan, European Quality Award, Rajiv Gandhi National Quality Award have created their impact. The philosophy and the underlying approach of these awards is common to TQM. Self-assessment and the awards so instituted cannot be left out from any serious study of TQM.

TQM and productivity are interlinked. So is connection between TQM and profitability. Inclusion of some material on these issues would have enhanced the utility of the book.

Dr. Sharma has provided executives, practicing managers and consultants a clear understanding of the concept of TQM and working methodology to design and implement an efficient TQM system to create a superior organisation with a focus on quality and customer service. The book presents readers with a clear message that an organisation must adopt TQM in all areas. It is the quality of products and the quality of the service to customers that differentiates a world class company from an average company. TQM provides solutions to such vexed objectives as cost effectiveness, consistency and reliability, dependability for delivery on schedule, customer service, competitiveness and increased market share.

The book shall be of great use to practising managers who will find it a complete source of information. It should also prove to be useful for management consultants who will find back-up data from industries as provided in this book highly useful in designing TQM systems. The book shall be useful as a reference book for students of management and business studies who want to understand the evolution and the development of the concept of TQM and who wish to adopt TQM as their career.

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Economic Growth and Rural Poverty: The Indian Experience 1960-95, *by Vinita Kumar,* **Concept Publishing Company, New Delhi,' 1997, p. 282, Rs. 400.**

Alleviation of poverty has always been the main slogan of political parties in India. The planners and policy makers brainstorm considerably while formulating strategies for effective implementation of different programmes aimed at raising the income of people living below poverty line. Process of growth in the developing countries have revealed that economic

growth, although, necessary for the reduction of poverty, is alone not sufficient for poverty alleviation. Various programmes initiated to assault poverty would succeed only if they are properly planned and honestly implemented so that the trickle-down principle of development is realized. Various programmes and policies relating to reduction of poverty in rural areas during the 1960-95 period covering different phases of agricultural, industrial and institutional development in India are discussed in this book. As the book is based on national level published statistics, spatial variations in poverty and its diverse causes are not discussed. The book has seven chapters. First six chapters are devoted to different aspects of rural poverty and Govt. policies and programmes related to benefit different target groups since 1960. Various problems encountered and future prospects for reduction in rural poverty and suggestions and recommendations for effective implementation of developmental programmes in rural areas are discussed in chapter seven.

Analysis of different rounds of NSS data indicates a steep decline in average size of land holding, failure of land reforms to reduce skewed distribution of operational land holding and no significant decline in landlessness. All these factors if considered in isolation would tell that rural poverty has aggravated during the study period. However, to prevent erosion of real income of the poor including marginal farmers who spend significant part of their household budget on food grains, the Govt. of India has been stabilising prices of essential commodities through market intervention and price subsidisation. It is observed that the growth in agricultural productivity resulting from introduction of HYV crops and intensive cultivation has significantly enhanced the crop yield leading to increase in gross income of small and marginal farmers. Intensive cultivation and growth in agricultural productivity has also resulted in increased demand for agricultural labour and higher wage rate. But inflationary rise in prices has diluted the impact of rise in income and the net result was only modest increase in real income of the small and marginal farmers and agricultural labour. In India there is very little scope for expansion of area under cultivation. As such the focus has always been on intensive cultivation and improvement in crop yield which provides limited opportunities for employment generation in the agricultural sector. To absorb the increasing surplus labour in the rural areas, the Govt. has been promoting land saving and labour intensive on-farm activities like dairying, poultry and pisciculture as they provide employment and supplementary income to the rural poor. Non-farm sector promises encouraging prospects for employment generation and reduction of poverty in future. Therefore, the central and state Governments are providing various incentives and initiating different support programmes

for healthy growth of industry, service sector, trade and construction activities in the rural areas. Since the growth of on-farm and non-farm sector activities has far exceed the growth in agricultural production, the book concludes that the poverty in the rural areas has declined over the 1960-95 period.

While reviewing the implementation of various developmental programmes initiated by the Govt. of India since 1960s, the author has lauded the Operation Flood Programme implemented by the National Dairy Development Board (NDDB) for development of dairy sector. She is critical about leakages and corruption in various other programmes particularly Integrated Rural Development Programme (IRDP), Public Distribution System (PDS) and various Wage Employment Programmes of the rural poor. Dr. (Mrs.) Vinita Kumar has been holding important positions in different Departments of the Govt. of India like Industry. Finance, Rural Areas and Employment. She has wide knowledge and access to factual information. Therefore, one would have expected from her a critical evaluation of different programmes targeted at the rural poor. The second level at which the book falls short of expectations is the sketchy recommendations for effective implementations of different developmental programmes. Surprisingly the author has recommended to continue Govt. assistant for the IRDP and Wage Employment Programmes where corruption is rampant at all levels. On the other hand, there is no mention for support to activities that have been successfully implemented by the NDDB.

Despite these, this book is an useful addition to the literature on poverty and employment in the rural areas. As the book provides good reference material, the teachers and researchers would greatly benefit by reading this book.

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Export-led Versus Balanced Growth in the 90s, (New World Order Series Vol. 13) *Editors Sir Hans Singer, Neelamber Hatti, Rameshwar Tondon,* **B.R. Publishing Corporation, Delhi, Rs. 1000 ($120).**

The debate on balancing between endogenous and exogenous components in economic growth and development, perhaps, is as old as the history of modern world. These issues have had varying degrees of significance and dimensions over different period depending on one, the economic and social outlook of

different countries/country blocks and two, the prevailing market environments. For instance, economic growth was the central interest of Adam Smith and many other classical economists of the 19th century. During the first half of the 20th century, the topic dropped out of vogue, as micro-economic analysis came under the sway of partial and general equilibrium theory. With the great depression of the 30s, macro economic analysis became obsessed with unemployment. After the II World War, a number of economists again became interested in economic growth. However, much of the new research was designed to exploit the availability of new economic statistics, particularly National Income and products statistics, which Simon Kuznets pioneed.

The change in outlook at the international spectrum and the ideological inculcation levels, thereof, by individual economic and geographical units towards their competitive advantage brought in the inevitable growth and development disparities in the global economic system. These disparities, intra-regional as well as interregional have been projected as inspiration for individual countries to change their economic and social priorities. At the same time widening of these gaps in growth and development remained as concerns for these economies to get along in the desired lines of changes, at least in the short run. within this background, trade oriented liberal growth paradigme of the post war global economic thought brought out two broad classifications for individual economies — Inward looking ones and the Outward looking ones. This categorisation has been on the basis of economic and trade policies of individual economies to grow on a global perspective. Hence, the level of trading activities and the terms of trade have been the focuss of analysis. The state units, on the other hand have been balancing between their factor endowments, prevailing engine of growth and distribution components. Their competitive advantage/disadvantage in balancing the domestic economic and social structure with the global systems have been detrimental in carrying forward with the desired dimension of growth. The book under review is an excellent documentation of intellectual approaches to the economic growth issues of the sort mentioned above. Research papers and articles constituting this 400 page book investigates in elaboration, the whole spectrum of international trade led economic growth and development scenarios. The entire book deals on the theme of Prebisch-Singer hypothesis, developed in the 50s. This hypothesis hangs around the basic phenomenon of primary commodities dominating the export basket of less developed countries while the manufactured items in the case of the developed ones, which in turn lead to a deteriorated terms of trade for the former. The reasons of this is simple. Income elas-

ticity of demand for primary commodities is less than the one for manufactured goods (Engel's Law). Trade and merchandising by developed and developing country blocks have therefore, been the thrust area in this edited book. There has been a perfect mix of theoretical discussion on growth models and the empirical reasoning in a most all the essays. Section A. deals with articles covering the basic and crucial areas of growth like employment and human resource utilisation patterns in trade led economic structures. The progress of North-South trade, factor endowments, scale economies and competitive advantages are accommodated in this. Further an elaborate analysis is made in this section on the role of government Vs. private sector towards an effective engine of economic growth. Section B. is an illustration of impacts and implications of trade and openness in developing countries. This section deals with the deteriorating terms of trade in developing countries. Articles covering empirical analysis in this section attempts to highlight the need for an improved terms trade for developing countries to accelerate their growth levels. Section C is a review and reinterpretation of Prebisch-Singer hypothesis. The basic work of Singer based on UN documents and Prebisch (1950) on long run data, which reveals the falling terms of trade in developing countries' primary goods compared to the manufactured items of developed countries have been critically reviewed here. Differing views and reasonings have been demonstrated vividly. More importantly, it provides an elaborate literature review in the field. Capital goods importation and low elasticities of export demand were the main issues presented by Prebisch (1950 & 59) and Singer (1950). To investigate their empirical relevance, some generalisation of the basic model have been attempted in this section (see for instance, Thomas Ziesemer. p. 197). Hence, the falling Net Barter Terms of Trade (NBTT) and Income Terms of Trade (ITT) are differently interpreted in this section.

Part D is a demonstration of East Asian miracle models. The investment-profit nexus in East-Asian industrialisation patterns have been analysed towards the core issues of accumulation and allocation, with the role of state and the market forces. This section, further covers areas like market friendly methodologies and perspectives on market failures. The efficiency of industrial policies — conceptual issues, the doctrine of its ineffectiveness, resource endowments, investment and profitability areas are widely discussed in this section. Country cases are presented for more clarity in the above areas for their present economic policies and future options. The last section (part E) deals in trade policy options for the Centre and Periphery towards an integrated trade orientation and growth. This section argues on whether the choice of industry that the state

protects and promotes is of importance for the future viability of industrial strategies and instruments. The role of efficient and effective macro-economic policies have been emphasised towards this. In total this book is an excellent intellectual discourse on the fundamental economic growth paradigms in different countries and country block. Of course this will be a good reference material for all, particularly economic practitioners.

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Evaluation Frame Works for Development Programmes and Projects *by Dr. Reidar Dale.*

This book deals with the evaluation of organised development work with the frame of reference being the development programmes and projects in developing countries. All the major topics and dimensions of evaluation such as context, perspectives, methods and management of evaluations are connected, by Dr. Reider Dale, in a systematic manner. It connects the evaluation of development schemes with the whole matrix of planning, implementation and monitoring of such schemes. The scope of analysis has been extended from projects to various types of programme by taking cognizance of the complex and processual nature of societal development. The book has been written in a simple language and the text is supplemental by original diagrams and textboxes containing detailed exampled. The presentation has a broad sweep but the specific issues are not explored in great detail to keep the focus broad and appeal to wider audience.

The people are the main focus in the evaluation of the development work. Therefore Dale has defined evaluation as "a more thorough examination, at specified points in time, of programmes or projects or parts of them, usually with emphasis on impacts and additionally, commonly on efficiency, effectiveness, relevance, replicability and sustainability". Formative evaluations have been emphasised which aim at improving project performance including its execution as distinguished from summative evaluations conducted at completion of the projects.

The core variables of evaluation have been defined by Dale — (i) Efficiency, as the amount of outputs created and their quality in relation to the resources (Capital and personnel) invested, (ii) Effectiveness, to what extent the planned outputs, expected effects (immediate objectives) and intended impacts (development objectives) are being or have been produced or achieved. (iii) Relevance, to what extent the programme or project is addressing or had addressed problems of high priority, mainly as viewed by stakeholders, particularly the programme's or projects beneficiaries and any other people who might have been its beneficiaries. (iv) Impacts, the longterm, largely indirect consequences of the programme or project for the intended beneficiaries and any other people, (v) Sustainability, the maintenance or augmentation of positive changes induced by the programme or project after the latter has been terminated. (vi) Replicability, the feasibility of replicating the particular programme or project or parts of it is another context, i.e., at a later time, in other areas, or for other groups of people.

All these variables have been discussed in context of comprehensive evaluation. The benefit-cost ratio calculated through the benefit-cost analysis has been deemphasised. Since cost effective considerations make sense only in relation to the highly subjective judgements about individual lives of the people to be served, which has been emphasised by Dale that both planners and evaluators need first and foremost to be equipped with relevant experience, sensibility and an ability to solve and reason in qualitative terms.

The main purpose of evaluation is to improve learning. Dale emphasises that the evaluators must seek the underlined factors which explain their findings. The approach to finance programme evaluation should be from the point of view of the enterprise receiving the credit in its societal context. The evaluation should address the issues of (i) internalising societal change by making it community led and participatory and self managed. (ii) empowerment and institution-building. (iii) influencing gender relations and empowerment of women. (iv) protecting the ecological environment. He states that the evaluations themselves can be of participation in the evaluation, including the voices of intended beneficiaries and helping communities to use evaluation findings to strengthen their response.

The author presents four models of the process of evaluation and discusses the organisational aspects of evaluation, the presentation of the evaluation report and using the latter as a management tool in a programme with process planning. The methods of evaluation has been discussed in the book in terms of sources of information, quantitative and qualitative approaches, the evaluation indicators and suggestions on sampling methods. Dr. Dale concludes that, "almost always, a basically qualitative design is the most appropriate, or even only, applicable approach in evaluations of development work". However it includes quantitative data and its statistical manipulation for specific purposes. The book under review is a welcome edition to the literature on evaluation and it would be of interest to planners, managers, administrators, evaluators and

reviewers of development works. The book would also be to interest to national and international donor agencies and students of development studies.

Review of Handbook of Applied Economic Statistics *by David Giles and Aman Ullah* (Editors), Marcel Dekker Inc., 1998, 625 p. US $195.

Collection of economic data, measurement of variables and analysis of key economic relations and hypotheses broadly describe the area of economic statistics and econometrics. The volume under review synthesises some important theoretical developments in the area. With contributions from top researchers, it contains surveys of and new research in frontier issues in econometrics. The eighteen chapters here are divided into three sections:

1. Applied Economic Statistics (Chapters 1-5)

2. Econometric Methods and Data Issues (Chapters 6-14)

3. Model Specification and Simulation (Chapters 15-18)

The opening section covers "important statistical issues in microeconomics and development economics". For reasons obscure to this reviewer, these papers deal with issues in poverty and inequality. The topics covered in the book have much wider applications.

Chapter 1 by Davies, Green and Parsch examines the usage of data to make welfare comparisons. Theoretical foundations of various measures of inequality and social welfare and estimation of their empirical counterparts for meaningful welfare comparisons are discussed. Kramer (Ch.2) discusses the statistical issues in the ranking of bundles of commodities in terms of some accepted notion of inequality. In discussions of equity in societies, the scope of lateral movement across classes is important. Chapter 5 (by Massoumi) surveys evaluation and comparison of such mobility situations.

Ravallion (Ch.3) examines the persistence of poverty in geographical clusters and provides a new method for testing the persistence using two competing hypothesis — an individual versus a geographical model. Deolalikar examines the demand for health care in developing countries when information on quality of healthcare is scant and applies his econometric innovations to Indonesian data.

Most of economic theory has its foundation in individual behaviour. Examining such behaviour using aggregate data is justifiable only if the aggregates can be consistently disaggregated into individual relations and vice versa. Chapter 6 by Russell, Breunig and Chiu is perhaps the first comprehensive treatment of aggregation problems on the demand and supply sides as they relate to empirical estimation.

Two chapters in this volume address time series issues. Terasvirta (Ch.15) analyses modelling of non linear economic relations over time focusing on regime switching models. Seasonal variation in time series is the subject of Ch. 16 (by Franses). It surveys literature that explicitly incorporate the seasonality. This is useful since the such variation is a result of rational behaviour by agents. Correlation across space received relatively less attention from economists. Anselin and Bera (Ch.7) survey the relatively new field of "spatial econometrics" with emphasis on the specification of structure of spatial correlation in linear estimation. This literature borrows from statistical developments in regional sciences and urbAn economics. Ravallion's chapter contains application of spatial econometrics.

Recent years have seen the increasing use of data that has both time and cross sectional dimensions. These are called panel data. Baltagi (Ch.8) surveys linear and nonlinear methods in panel data analysis. However, it is well known that misspecified linear models have serious consequences in the panel context. Ullah and Roy (Ch.17) derive nonparametric estimates for panel data methods and apply them to the ICRISAT-VLS panel to study calorie-income relationships.

One issue ignored in a lot of empirical work is that most survey data is based on complex random sampling from a finite population whereas much of inference is based on the assumption of continuous random sampling from an infinite population. Ullah and Breunig (Ch.9) examine how ignoring sampling schemes impact inference. Correct inference also requires well specified econometric models. DeBenedicts and Giles (Ch.11) survey the literature on diagnostic tests for model specification. Hadi and Son (Ch.13) analyse the treatment of "unusual" observations or "outliers" in the data set. The authors address the twin problems of detection of outliers and their treatment in regressions and suggest an alternative to the computer intensive quantile regressions approach. Doufor and Torres (Ch.14) develop a general theory of union-intersection and sample splits in various specification tests and apply the theory to two classes of econometric models.

Chapter 10 by Golan, Judge and Miller suggests a new approach to simultaneous equation models that is more flexible and more robust than the currently used methods. Chapters 12 and 18 deal with simulation is-

sues. Veall's chapter surveys development of the more recent bootstrapping technique. In contrast to other simulation methods (e.g. Monte Carlo methods), bootstrapping technique. In contrast to other simulation methods (e.g. Monte Carlo methods), bootstrapping techniques are tailored to the data in hand and are particularly useful in small samples. Another technique that has gained currency with the advent of greater computing power is calibration, the process where data is employed in order to measure specified characteristics of the system. Pagan (Ch.18) provides an interesting survey of this technique.

Overall, the volume is an extremely handy reference for a wide range of social scientists and applied statisticians. It will beautifully complement standard texts or other handbooks as teaching material for advanced courses.

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Financial Intermediaries and Industrial Development by *Saghir Ahmad Ansari*, **APH Publishing Corporation, New Delhi, 1998, p. 155, Rs. 300.**

The book under review analyses the role of specialised financial institutions especially Industrial Development Bank of India (IDBI), Industrial Credit and Investment Corporation of India (ICICI) and State Financial Corporations (SFCs) in meeting the term requirements of the industrial sector and their contribution to industrial development of the country. The study covers a period of twenty years from 1970-71 to 1989-90.

The book consists of eight chapters. Chapter one and two introduces the study and its subject matter respectively. The third chapter deals with the structure of financial intermediaries in India. Chapters four, five and six make in- depth assessments of the overall operations and functioning of IDBI, ICICI and SFCs respectively. Chapter seven brings out the aggregative role of all financial institutions in the industrial development of the country. The contribution of the financial institutions in the establishment of new projects and expansion and modernization of existing projects in different sectors and their role in creating strong industrial base and removal of regional imbalances in the country have been examined in this chapter. Finally chapter eight concludes findings of the study and offers suggestions for increasing the role of FIs in rapid industrial development.

The author points out that the absence of an organized and developed capital market for meeting medium and long term fund requirements of industrial necessitated the development of a battery of financial institutions by the Government. The financing requirements grew in such a pace and diversified way that the government had to promote a number of financial institutions to render specific role by each of them. To begin with, IFCI was set up in 1948 to make medium and long term credits more rapidly available to industrial concerns in India, particularly in circumstances where normal banking accommodation was inappropriate or recourse to capital issue method was impracticable. The necessity for setting-up of SFCs in 1951 aroused out of the difficulty realised by the IFCI to cater the financial requirements especially of the small and medium enterprises. ICICI was set up in 1953 as a privately owned investment corporation for assisting the private industries, provide foreign currency loans to industries and develop underwriting facilities in India. Prior to the setting up of IDBI in 1964, a fairly wide network of financial institutions had emerged in India. Though those institutions had succeeded fairly, but they had not adequately meat the requirements of long-term finance and of rendering promotional services to the industries. Therefore, IDBI was established as an apex institution to provide term lending to industries of fill the gaps and coordinating and supplementing the operations of financial institutions providing term finance to industries.

The author by assessing the role of financial institution states that the financial institutions have played very important role in industrial development of the country not only through providing increased financial assistance to industries, but also through various promotional and developmental measures. During 1970-90, assistance sanctioned as well as assistance disbursed by financial institutions have increased by 25 per cent per annum. Institution-wise, IDBI contributed largest share in the total assistance of all financial institutions by March 1990, followed by ICICI, SFCs, IFCI, LIC, UTI, SIDCs, GIC and IRBI. The growing significance of their role is revealed from the fact that the ratio of institutional disbursement of assistance to capital raised by the corporate sector in the market was 3.7:1 in 1975-76, which increased to 9.8:1 during 1979-80. However, the ratio declined to 2.7:1 in 1984-85 and further to 1.8:1 in 1989-90 because the capital market in the eighties emerged as a rapidly growing source of investable funds to the corporate sector. The fact emerges that industrial concerns however, still depends more on financial institutions to finance their ventures than raising funds directly from the capital market.

The book also presents disaggregative analysis of financial assistance of the financial institutions in terms

of composition of assistance, assistance in terms of sector wise, industry wise, purpose wise and state wise. The author observes that four-fifth of the assistance by the financial institutions were in the form of loans in rupee and foreign currencies. Other important forms of assistance to industries were underwriting of capital issues and guarantees. Private sector has been the largest beneficiary of assistance granted by financial institutions. In terms of industry wise assistance the author reveals that more than half of the assistance has gone to growth-oriented basic and capital goods industries which helped in the creation of strong industrial base in the country. Another notable feature the author mentions here is that IDBI and ICICI had taken greater interest in the development of non-traditional growth oriented industries where as SFCs had paid greater attention on the development of consumer goods industries and services.

In terms of state wise analysis, the study presents that developed states have received larger per capita assistance while backward states have got a very low per capita assistance. The author makes a special case of North Eastern States and advocates creation of a new financial institution focussing exclusively on them. Incidentally, the government has already created such an institution called North-Eastern Development Financial Corporation (NEDFi) in August 1995.

On the assistance to the backward areas, the author states that regional level institutions like SFCs are better placed as compared to national level institutions in financing projects located in backward areas of back-ward states. Therefore, to accelerate industrial development of the backward areas, existing state level institutions viz., SFCs and SIDCs, should be strengthened and expanded, opines the author.

About the strength of the financial institutions, the author comments that IDBI and ICICI commands confidence of the investing public, while SFCs have failed to sustain the confidence of the public and hence the SFCs increasingly depend on IDBI and Government. However, the author recommends that SFCs should make efforts to mobilise greater part of their resources from the general public.

Important limitation of the book readers may feel is its coverage period. As the book limits its coverage upto 1990, it fails to capture the important developments taken place in the industrial as well as financial sector as a result of the economic reforms programmes since 1991. Keeping aside this, the author has been successful in his attempt to analyse the assistance by financial institutions and has drawn some interesting conclusions on evaluating the role of these institutions fulfilling overall national objectives and priorities.

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