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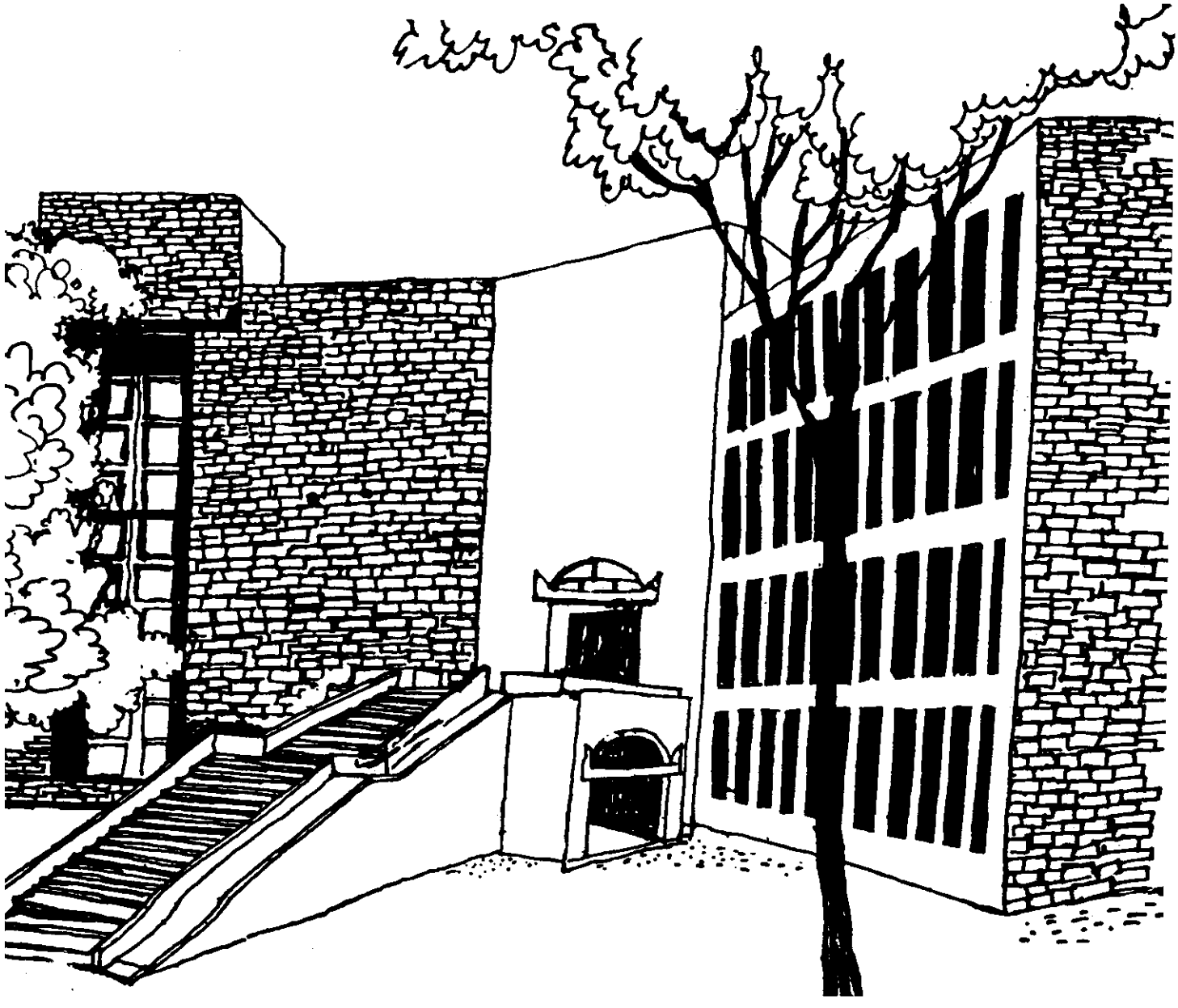

TECHNOLOGY-FINANCE-ENTREPRENEUR LINKAGES

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Abstract

Development of entrepreneurship depends not only on the supply of credit, but also on appropriate technology especially in backward areas. There have been several credit facilities offered to small firms, and there have been several studies on the efficacy of such facilities. The role of technology, and its triangular relationship with credit and entrepreneurship is much less discussed let alone researched. This study examines the contribution of national laboratories in fulfilling the technology needs of backward areas and its linkages with credit and entrepreneurship. Field study of small scale enterprises which have bought technologies from the Central Food Technological Research Institute and the Central Salt and Marine Chemical Research Institute in Karnataka and Gujarat were studied which indicated need for significant improvement in the interactions largely of technology developing agencies. Some of the implications for policy are also discussed.

Technology-Finance-Entrepreneur linkages

Industry plays a critical role in the development of backward areas through structural changes in the local economy and higher value addition. Governments, both at the central and state levels have been actively promoting location of industries in these "high risk" areas through a carrot and stick policy for the past twenty years. While licensing regulations force large firms to move into backward areas, there are attractive financial incentives which lure all kinds of firms to locate their operations in such areas. In the non-farm sector, these incentives have taken the forms of direct finance and creation of economic infrastructure such as industrial estate, power, water, transport and communication facilities. The underlying assumption here is that shortage of these factors has been the stumbling block of development, and once their supply is taken care of, the local economy would witness a multiplier effect of development.

Implicitly, the role of technology in the accelerated development process of a region is always not appreciated. While economic factors are necessary survival inputs, technological factors are required to provide competitive inuts through better products and/or cost advantages. The ripple effect of it through direct benefits to entrepreneurs and indirect demonstratlion effect on the rest of the entrepreneur community and society in general cannot be underestimated. What is therefore required is offering technological support to firms located in backward areas as a parallel pillar to economic support measures.

This piece of research becomes relevant in the above context. In a triangle of relationships between the entrepreneur and the technology and financial inputs, the process of acceleration of regional development depends on the quality of servies available individually and synergistically. While a lot is known about entrepreneurs and economic inputs in these high risk areas, unfortunately, not much is known about the process of flow of technological inputs going into these ares. Here the attempt is to fill this void to some extent. This study covers technology applications in small scale enterprises located in selected backward areas.

Small Scale Sector: Its Role

The contribution of modern small scale sector with manufacturing facilities has grown multifold over the years as is clear from Table 1. These figures which are for both registered and unregistered units, reflect all round growth in terms of number, employment, investment , production and exports.

This significant role in the economic development of the country could not have been played without structural changes on par with changes in the rest of the economy, especially in the industrial sector. The structural changes in favour of modern SSEs is reflected by the growth in its contribution to the SSE sector as a whole (including traditional) in terms of value of output and employment (See Table 2). The relative position of SSEs in the total modern manufacturing factory sector covering the industries is also very significant. In fact its share has gone up from 36% to 40% in terms of employment and from 22% to 23% in terms of value of output over a period starting 1984-85.

Table 1

SSE Sector: an overview

	Total No. of units (lakhs)	Employment (Lakh Nos.)	Investment	Production of current prices	Exports
				(Rs. crores)	
1975-76	5.46	45.9	3,204	11,000	532
1980-81	8.74	71.0	5,850	28,060	1,643
1985-86	13.55	96.0	9,585	61,228	2,769
1989-90	18.27	119.6	18,196	1,32,320	7,625

Sources:

1. Mukherjee, A., Higher Increment Limits. How Far will Decision Benefit the Small Sector, The Hindu, June 6, 1991.
2. Economic Times, August 6, 1991.
3. Basic Statistics Relating to Indian Economy, 1991 Centre for Monitoring Indian Economy, Table 14.11

The structural shift in the composition of exports of SSE products is worth noting. Since the early Eighties, the emphasis has been more on export of value added products and as a result export incentives are now available only for finished products (e.g. leather). Simultaneously, the emphasis on non-traditional items has also continued (See Table 3). Share of non-traditional products in total SSE exports has gone up from 51 per cent in 1972-73 to 75 per cent in 1977-78 and further to 91 per cent in 1986-87.

Table 2

Share of modern SSEs in total SSEs

	Modern SSE		Total SSE		% of modern in total	
	1973-74	1984-85	1973-74	1984-85	73-74	84-85
Value of output (Rs. crores)	7,200	50,500	13,600	65,700	53	77
Employment (lakhs persons)	40	90	176	315	23	29

Source: Planning Commission, Government of India, 1985.

A closer look at Table 3 would reveal that the country still depends on readymade garments and leather products for more than half of its SSE exports. At the same time, engineering exports have in fact declined, though marginally. The implications are two-fold: one, India does not have a sufficiently broad based product range for exports, and still depends to a great extent on low value added items, and two, engineering products as a group, especially machinery, components and tools which reflect the structural modernisation of the sector is in fact losing ground. It is clear that a lot more has to be done to make the contribution of SSE exports wider based and future looking. In the changing Indian economic scenario, firms have to think global to be competitive. In one sense it means that the level of competition will be keener at the local level, and in another sense, firms have to be as good as the best in the world to survive in the global market place. Small firms may have to operate through export houses, still the need to have technologically competitive products is important.

Since exports depend on product quality and price competitiveness derived from technological advances, and a host of government policy and marketing variables, in the absence of focussed and concerted efforts, results may not be forthcoming easily. Introduction of pioneering and innovative products and processes is possible on a long term basis only through the involvement of national level research institutions..pa

Table 3

Major products exported from SSI

(Rs. in crores)

Product	83-84 (%)	84-85 (%)	85-86 (%)	86-87 (%)	% growth rate over 3 years
Non-traditional products					
Engg. Goods	309.41 (14)	349.10 (14)	311.00 (11)	358.00 (10)	15.9
Basic Chemicals, pharmaceuticals and cosmetics	112.50 (5)	141.33 (6)	133.52 (5)	218.37 (6)	94.1
Chemicals & allied products	18.82	25.58	26.19	26.15	38.9
Plastic products	33.93	20.60	18.02	14.35	(-) 57.7
Finished leather & products	337.54 (16)	322.60 (13)	417.88 (15)	665.39 (18)	97.1
Marine products	342.55 (16)	359.82 (14)	365.67 (13)	425.67 (12)	24.3
Processed Foods	88.45 (4)	152.00 (6)	157.00 (6)	179.00 (5)	102.4
Woollens	45.14	55.16	55.85	53.70	19.0
Sports goods	27.55	28.91	27.90	28.38	3.0
Rayon & Synthetic products	5.96	6.94	4.12	4.48	(-) 24.8

Product	83-84 (%)	84-85 (%)	85-86 (%)	86-87 (%)	% growth rate over 3 years
Processed tobacco, snuff, bidi	14.92	11.67	9.49	6.12	(-) 59.0
Readymade Garments	661.06 (31)	853.47 (33)	986.53 (36)	1353.31 (37)	104.7
Traditional Products					
Semi finished leather	42.67	39.32	39.23	42.00	(-) 2.0
Cashew Kernels & cashew shell liquid	104.55 (5)	148.17 (6)	164.65 (6)	236.64 (6)	126.3
Spices, Oils, oleoresins, curry powders and pastes	5.22	8.71	13.39	12.12	132.2
Others	13.61	29.73	38.67	24.26	78.3
Total	2163.98(100)	2553.11(100)	2769.11(100)	3647.94	68.6

Percentages are shown in parenthesis, and only for major products.

Source: Nagaiya, D., Small Scale Industries in India, Handbook of Statistics, National Institute of Small Industry Extension Training, Hyderabad, Table 43, 1989.

It is clear from the above discussion that long-term growth and competitiveness of small scale firms depend on their technological superiority, among other factors.

The vital role played by the small scale sector cuts across developed and less developed regions mainly because of the wide spectrum of activities that fall into the arena of this sector. It is relevant at this juncture to discuss the extent to which small enterprises fit in with the developmental needs of backward areas.

Backward areas and small scale enterprises

Backward areas are so mainly for want of necessary resources for development. While raw material supply may be often ensured, supply of skilled manpower, economic infrastructure and purchasing power of people remain low. Also, social infrastructure such as educational and recreational facilities is scarce. This is not exactly the ideal situtation an entrepreneur would like to start on, and therefore various incentives are offered simultaneous with regulatory constraints to ensure location of industrial undertakings in backward areas.

One of the weaknesses of indiscriminate location selection through the above process is that firms soon realise problems in manpower and infrastructural support matching with their resource and technological requirements. Some of them survive, while many limp and others fail (Ramachandran, 1986).

Small scale enterprises, because of their special characteristics can not only match with the situation prevailing in backward areas to a great extent, but also can play the pivotal role of change agents because: One, their employment intensity is higher than large firms, and in fact the cost of creating a job in it ranges roughly from one-fifth (SIDO, 1980) to one-twentieth (Gupta, 1981) of a large firm. Two, they are found to utilise local resources and also meet local demands better (Harper, 1984). Three, they are at an advantage in terms of their needs for sophisticated infrastructure, transport facilities and capital requirements compared to large firms. Four, they provide a community feeling which generally is absent in the case of large firms (Harper and Ramachandran, 1984). The confidence of the community in accepting the demonstrated effects of enterprise creation is better appreciated when the people of the region can identify closely with them. This is difficult in the case of a small firm. It is clear from the above discussion that small firms can play an important role in regional development.

Small Scale Sector: Weaknesses

Small scale enterprises have several inherent weaknesses because of the small size with which they operate. These cover shortage of resources such as funds and manpower, limitations of exposure and expertise in competing in a market environment, lack of skill and knowledge to effectively manage the enterprise, and level of technical knowledge. The promotional policies of the government have virtually focused on providing the psychological inputs for entrepreneur motivation and financial assistance to meet with the fund requirements for both long term and working capital requirements. Besides, several schemes of assistance have been provided to ensure adequate supply of infrastructure and some extention services.

Financial assistance to promote small scale enterprises has been vigorously pursued especially since the Seventies. There have been conscious efforts made to promote industries in the backward area as is clear from the overall pattern of financial assistance provided by various State Financial Corporations over a period of time. As is clear from Table 4 below, more than half of their asisstance especially in the recent past has gone to backward areas. This is quite significant because these corporations provide most of their assistance to small scale sector.

Table-4
State Assistance from SFCs

(RS. crores)

Year	Backward Area	Non-Backward Area	Total
1986-87	682.1	528.7	1210.8
1987-88	674.4	610.3	1284.7
1988-89	712.8	691.9	1404.7

(Source: Report on Development Banking in India, Industrial Development Bank of India, 1989, p.51)

The picture remains the same when we consider assistance from All India financial institutions also.

Assistance from commercial banks to small scale sector has registered considerable growth as is clear from Table 5 below. Although information is not available bank categorywise, the aggregate picture in 1988, 1989 and 1990 indicates continuation of the trend.

Table 5

Bank Lending to Small Scale Sector

(Rs.crores)

	85	86	87	88	89	90
SBI & associates	2597	3062	3660	NA	NA	NA
20 nationalised banks	4798	5545	6530	NA	NA	NA
Other sch.com.banks	434	520	469	NA	NA	NA
Total	7829	9127	10659	10820	1315	15615

Source: (1) Reserve Bank of India Bulletin, June, 1990.
(2) Report on currency and finance. 1988-89, No. II, Statisstical Statements.
Both from the Reserve Bank of India, Bombay.

In all these endeavours, the need to have an appropriately competitive technology at the enterprise level has been overlooked very often. This is despite the fact that small enterprises often do not have the exposure to and capabilities of identifying latest technological developments. Competitiveness in an industrial context depends to a great extent on high quality technology which can produce competitive products at competitive prices.

Small scale enterprises are handicapped by three types of limitations in the context of technology development: (i) they lack the necessary technical and financial resources to undertake in-house R & D (ii) their awareness of and access to technology are limited, and (iii) they lack the resources to buy technology from outside. It is in this context that the setting up of national level technological research laboratories becomes pertinent.

National Laboratories

The Council of Scientific and Industrial Research (CSIR) was constituted in 1942 to promote, guide and coordinate scientific and industrial research in India through a network of laboratories located in various parts of the country. There are altogether 30 national level research institutes set up over the years to undertake scientific and industrial research in specific areas. Besides, 6 regional level general research laboratories and 2 structural engineering research centres have been set up to further the CSIR objectives. These institutions have been located in such a way as to ensure geographic spread and synergistic advantages with strengths of different locations.

Although development of a technology is an inhouse activity of these institutes, the process of technology absorption by an enterprise at commercial level involves various important stages.

Since the technologies developed by these institutions are all pioneering in nature, it is important to ensure that they took every step to smoothen the process of technology absorption by enterprise.

Each of the four stages of technology absorption involves critical decisions affecting the enterprise as described below.

1. Technology acquisition: Key tasks

a. Prdouct Choice

b. Locate Know-How source

c. Mode of collaboration

d. Govt. Regulations Interpretation

e. Negotiation with Collaborator, Banker, Govt.

f. Plant Location Choice

g. Components: Import/buy/make

h. Major capital expenditure

2. Technology adaptation

a. Deciding raw material, manufacturing process

b. Deciding Component Suppliers

c. Deciding Plant & Machinery Suppliers

d. Adaptation of manufacaturing process, jigs, etc.

e. Design and manufacaturing of tools

f. Design and mfg. of tools

g. Design of building & planning and layout of facilities

3. Technology utilization

a. Establish Prodn. & Related Problem Solving

b. Acquire additional Manpower

c. Establish systems such as management information systems, productivity planning, quality control, and cost control.

d. Developing Vendors

e. Develop mkt. channels & dealer network

3. Technology Improvement and Development

a. Create Organizational context for quality assurance, cost reduction, and value analysis.

b. Environment Scanning on Customer Needs

c. All Functions Coordination

It is clear from the long list of activities and aspects of the enterprise affected by the introduction of a new technology that the implications of the processes are far reaching. These have major impact on the finances of the enterprise, especially with reference to funding from commercial banks. As mentioned earlier, technology becomes a strong factor in the success of the enterprise, and in that sense the triangular relationship between technology, finance and entrepreneur has to be examined closely.

Functioning of Technology-Finance-Entrepreneur Triangle

There is sufficient evidence from a variety of research findings to show that commercial banks have been successfully playing a key role in the development of enterprises in backward areas. There is also enough evidence to show that entrepreneurship could grow in backward areas and there is need to have positive support such as training, infrastructure and other inputs provided for the same.

There is, however, very little evidence on the role of technology, especially that of technologies which have diffused from the national level laboratories to the small enterprises. Since multiplier effects can be created by the introduction of high quality technology in backward areas, and that there are specialist institutions set up by the Government to facilitate such a process, there is an urgent need to examine the process of technology diffusion to small enterprises. There is also a need to examine the functioning of the triangular model consisting of these research institutions, financial institutions and entrepreneurs.

Research Objectives

This piece of research is intended to learn from the experience of technology diffusion from national research laboratories to small scale enterprises located in backward areas, and make policy guidelines for smooth flow of technology and finance in an integrated way.

1. Identify the process involved in the technology transfer from national level laboratories to small scale enterprises located in backward areas and to examine in detail the experiences of both the parties in terms of technology transfer. This exerise is expected to bring forth major areas of constraints that are

generally faced by entrepreneurs and facilitate identifying solutions.

2. The attitude and response of financial institutions and other development agencies such as DIC to introduction of pioneering technologies will be examined in the context of the triangular relationship.

Methodology

The three constitutents of the traingle of development in this study are technology institutions, commercial banks and entrepreneurs. Since considerable knowledge about the operations of commercial banks lending to small scale entrepreneurs already exists, the starting point was fixed as technology institution. In fact, hardly any study has been undertaken to know the experiences of technology transfer to small scale enterprises from these institutions.

It is indeed difficult to generate a list of enterprises which have bought technologies from the research institutions in the small scale sector, and located in backward areas. This is especially so because the total number of small enterprises is so large, and that no statistical enquiry records their source of technology. Under these circumstances, it was decided that the technology institutions themselves would be approached to get a list of people who have procured technology from them.

The 30 CSIR institutions, most of them having some technologies available for use in small scale sector were contacted to find more about their activities and list of licencees. Based on their response, and discussions with experts in technology and banking, it was decided that the study would focus on technologies developed and sold by the Central Food Technological Research Institute (CFTRI), Mysore and the Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar. For obvious reasons of quality of research, the number of institutions was limited to these two. In fact, these were the two institutes which could provide names and addresses of their licencees for all products.

Next, technologies with investment limits falling within SSE investment limits were identified using approximate figures available for plant and machinery costs. Subsequently, all the licencees of these SSE technologies located in the less developed areas of Karnataka (in which state CFTRI is located) and Gujarat (where CSMCRI is located) were identified. These states were selected because they have the maximum number of licencees under the respective Institute lists. (Geographical proximity, therefore is an important factor in technology diffusion). Since the

total number of licencees in each district was small, it was decided to survey as many SSE licencees as possible in the districts of Shimoga, Chitradurga, Kolar, Bidar and Mandya in Karnataka, and Bhavnagar, Jamnagar, Rajkot districts in Gujarat whcih are considered backward. In order to find out influence of urban location on the technology absorption process, a few firms in Bangalore, Ahmedabad and Baroda were studied.

The profile of the respondents in terms of their year of setting up and location is given below.

Year of Starting Unit

CFTRI Technologies

	Ahmedabad	Rest of Gujarat	Banga-lore	Rest of Karnataka	Total
Upto 1970	-	-	1	2	3
1971 - 1975	1	-	-	1	2
1976 - 1980	2	1	1	3	7
1981 - 1985	3	-	1	6	10
1986 onwards	-	-	2	8	10
Unknown	1	1	-	1	3
	7	2	5	21	35

CSMCRI Technologies *

	Ahmedabad	Rest of Gujarat	Total
Upto 1970	-	1	1
1971 - 1975	1	-	1
1976 - 1980	1	4	5
1981 - 1985	-	1	1
1986 onwards	-	-	-
Unknown	-	4	4
	2	10	12

* No licencee in the places surveyed in Karnataka.

It was surprising that several of the addresses in CFTRI list who were supposed to have bought technologies from them denied having done so. Some of them were in altogether different industries such as steel and metal products without ever having thought of moving into food industries. Some of the addresses were incorrect or incomplete. This apparently means that the CFTRI list is not entirely that of licencees, but of people who at some

point or other might have evinced interest in obtaining their technologies. it raises questions about the seriousness with which CFTRI maintains record of their licencees for administrative and academic references in future.

Altogether, 47 SSEs could be contacted from the CFTRI list, of which only 35 have bought their technologies from it. The remaining 12 firms have obtained technologies from other sources, not always food related.

In the case of CSMCRI, out of 22 addresses obtained, contact could be established with 14. This list did not have names and addresses of non-CSMCRI licencees. Data collection was extremely difficult at the stage of locating respondents. Since the addresses were often incomplete and geographically scattered, it became expensive to undertake the survey both in terms of time and money. There were instances of addressees moving their residence beyond district level, and also not being available for interview when contacted. It was not possible to take prior appointments due to communication constraints in most cases.

Overall Picture

Based on the data collected through in-depth interviews, it is clear that a large majority of the licencees are not entirely satisfied with their experience with these two Institutes. The figures given below shows the break up of firms under different status categories during the various phases of setting up and absorbing technologies.

Exhibit 1

CFTRI Technologies

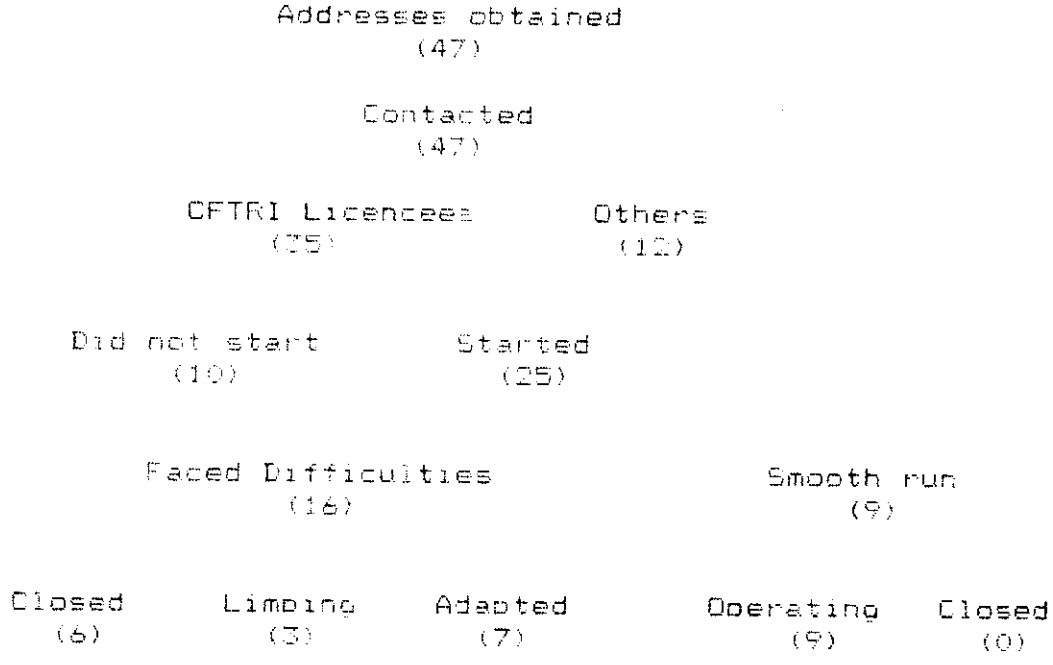
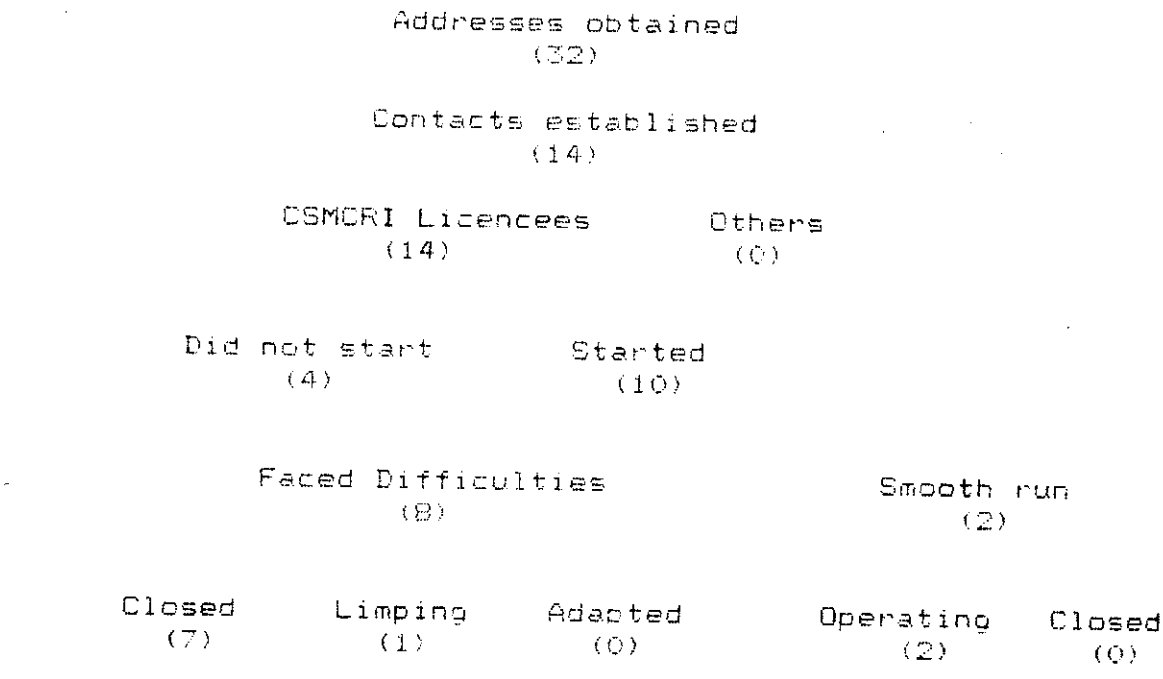


Exhibit 2

CSMCRI Technologies



It is pertinent to find out more about the reasons for different entrepreneurs ultimately reaching often different points. In the rest of this paper, the factors contributing to these situations are explored and explained.

Findings

Although the sample size is small, detailed discussions with respondent entrepreneurs threw considerable light into the triangular relationship among technology, finance and entrepreneur. Commercial banks seem to have been fair in their approach to entrepreneurs, and there was no complaint against any bank raised by the respondents. Banks have in general stood by the firm in times of difficulties, and have raised alarms only when they were not sure about the security of their lendings. There is no evidence to suggest that banks have advised entrepreneurs either positively or negatively about procuring technologies from the national laboratories. Most of the entrepreneurs started their units with own funds with borrowings largely for working capital. Banks have provided funds not so much based on sound appraisal of the technologies as based on their faith in the financial soundness of the borrower best judged through earlier interactions.

Performence of the respondents seems to have been affected by the quality of technology and the nature of support received during the process of technology absorption. As is clear from the chart shown above, experiences of entrpreneurs can be analysed under different heads.

(a) **Started - running smoothly**

Both the institutions do not have a very satisfactory situation with only 9 out of the 25 CFTRI licencees and 2 out of the 10 CSMCRI licencees starting and running enterprises using the procured technologies. This is essentially because the technologies which were transferred such as for making maida, atta, rice bran and nutritional food of CFTRI and salt production technology of CSMCRI to small enterprises were simple and easily understood. There was no possibility for ambiguity and communication gap arising between the Institute and entrepreneur in such instances since most such situations did not involve entirely new products and processes. Entrepreneurs are also often exposed to similar situations elsewhere. In cases where the Institutes had already got pilot level production their inherent learnings remained strong.

One of the reasons for the poor rate of smooth run and technical succeess could be lack of institutional follow up and interest in the licencees. The major constraint seems to be funds to undertake follow-up, assuming that the scientific curiosity to know what happens to one's own research output exists. It is indeed heartening to note that the CFTRI has started a technology audit service in the recent past which could solve the problems partially.

(b) **Started - but faced difficulties**

The 16 CFTRI and 8 CSMCRI licencees who procured technologies from these respective institutions fought for survival, but yielded different results. While 7 out of 8 of the CSMCRI know-how takers failed and closed their enterprises, the corresponding figure for CFTRI was a list brighter at 6 out of 16. The cases of adapted, limping and closed are discussed below.

(i) **Adapters:**

This category of entrepreneurs, probably, are the best of the whole lot, including the smooth sailers in the first instance itself. They have faced challenges, but did not give up. Technological problems were faced with a cool head and they creatively developed innovative ways of adapting the technology to their conditions and requirements. 7 out of the 16 CFTRI licencees studied here have been successful entrepreneurs because of their adaptive capabilities. These include technologies for papad press and destoning machine.

It may not be out of place to quote the experience of an entrepreneur who bought technology developed by another CSIR laboratory. In a typical instance, an entrepreneur in Orissa, bought technology from the Central Institute for Medical and Aromatic Plants (CIMAP) for extracting essential oil for perfumes from palmarosa grass in the mid Seventies. Faced with cattle menace in the grass field, he approached the CIMAP for help. He was advised to dig a trench around the field the cost of which, when estimated, came to be prohibitive. Eventually, he made wire fencing which was much more practical and cost effective (Rao, 1986).

The picture in the case of CSMCRI is grim with none out of the 8 entrepreneurs able to adapt their technology successfully in the face of difficulties.

The unfortunate part is that neither of the Institutes seems to have attempted to find the problems encountered by entrepreneurs and improved on the mother technology for the benefit of future licencees. It is generally imperative that a new technology (both process and product) would most often face some or other problems before perfecting itself. This is especially when no pilot operation has been done, and the technology has to be scaled up from the laboratory level to commercially viable level. In this process many assumptions regarding technology as well as cost would not hold good. Technology adaptation is an iterative process which needs a persistant, hard working and creative mind. Had the learnings of technology adapters been documented and passed over to subsequent licencees, the process of 'reinventing the wheel everytime' could have been avoided.

(ii) **Limping:**

There are a few entrepreneurs who have not either attempted to or succeeded in adapting the new technology. They survive, but with negligible profits, if any. This category of people do not seem to be as persistant as the adapters.

There are also instances where entrepreneurs have not explored possibilities of support from the institutes. For instance, Mr. Swamy in Davengere in Karnataka bought simple wheat milling technology from CFTRI. Altough the output from his machine was much less than promised, he never bothered to approach CFTRI for help. This could be because for Swamy, that particular business proposal was not a critically important factor economically and psychologically. The firm thus continued to operate sub-optimally. It would be unfortunate to blame the Institute entirely for his predicament.

(iii) **Closed:**

This category of entrepreneurs closed down their new business in the face of problems. 6 out of the 16 CFTRI and 7 out of the 8 CSMCRI licencees have closed down their business. They took such a decision under two types of circumstances. One, when they realised that the returns on their time required to adapt the technology and make it commercially viable would be lower than their possible incomes from alternative engagements. Two, they realised the futility of trying to adapt or losing the technology, and interest in it.

An entrepreneur with a degree in mechanical engineering had a bitter experience when he decided to manufacure superior quality silicagel crystals based on a CSIR technology sold by the National Research Development Corporation (NRDC). Despite his best efforts, he could not perform the ion-exchange process successfully. On his enquiries with the NRDC and the Regional Research Laboratory at Jorhat, he found out that the technology was developed at the laboratory level and was never tested at pilot plant level by the CSIR laboratory. He was all the more shocked when he realised that although they had sold the technology to other four entrepreneurs all of whom had the same problem, they never bothered to find out the defects in the technology nor stop selling it. What really happens is that the technology institution apparently believes that their responsbility ends once the know-how has been sold. This is of course a wrong approach. Not only that they should have responsibility to demonstrate the process at the commercial level, but also it would be natural to expect anybody, especially scientists, to have curiosity to know the fate of their 'babies'. As in several other cases, the com-

mercial bank which had financed the project appreciated the problem, and took a sympathetic attitude.

An entrepreneur who acquired technology for making table salt had mixed experiences with CSMCRI. He said that he had to wait for six months and intervention by a Member of Parliament before he could get the technology, although he had paid Rs.1,000/- initially itself as the fee. He was, however, happy with the three day training in salt making, but felt bitter that CSMCRI changed training programme dates without informing him. Eventually, when he started commercial production he realised that the actual cost of production came to Rs.1,400/- per ton, much above the prevailing market price. He closed down he unit after producing only two tonnes. Established enterprises find it easier to drop a product if found unviable and move to other products.

CSMCRI technology for filter aid was found to be below the level of accepted quality by an entrepreneur in Bhavnagar itself. Except for one stage which was demonstrated on a pilot plant, all the other operations were demonstrted only at the laboratory scale. The costs of raw materials as well as equipments as estimated by CSMCRI were on the lower side, compared to realities. Also, imported filter aids were available at lower prices. Although he complained to the Director of CSMCRI about his technology relted problems, he said he received only a cold response. Finally, they gave up filter aid and started manufacturing precipitated silica and hydrated calcium silicate. Although the difficult days, he received sympathetic response from his commercial bank and State Financial Corporation. This was especially because the entrepreneur showed prudence and switched over from the unviable product to other viable products. He received constant encouragement from the District Industries Centre too.

A firm in Ahmedabad which procured water softening technology from CSMCRI had to give up the product as the scaled up version of the technology from laboratory to commercial level failed to yield desired results. Although the Institute's scientists made a few attempts, they also could not rectify the problems. Finally, the firm dropped the product line.

(c) **Did not start**

Several of the licencees never started using the newly acquired technology. There are a variety of reasons ranging from lack of interest to lack of awareness prior to acquisition.

There are also instances quoted by respondents about unscrupulous consultants charging higher amounts as fee from entrepreneurs in Rajkot for technology from CFTRI for manufacture of garlic powder. One Mr. Bhatt bought the process know-how from CFTRI and

sold the same to six others in Rajkot itself before disappearing from the scene. This happens mainly because know-how fee for most of the technologies is very small and people get tempted to get involved in such activities. There was also an instance in Karnataka where one Mr. Chary convincingly duped four innocent rural people by promising to provide attractive CFTRI technologies at low charges. Since their names and addresses appear on CFTRI records the consultant seems to have cheated both the Institute as well as the entrepreneurs. He might have got their names entered as interested parties.

Discussion

A close look at the respondents indicates that their attitude to new technology as a concept, and response to challenges are different depending on their perceived objectives, and the extent of risk involved. As shown in Exhibit 3, first generation entrepreneurs having heavy stakes really struggle hard for survival. Very often they find innovative ways of overcoming problems. The attitude and commitment of traders and businessmen also tend to be different.

Technology Buyers

Already in Business

First Generation Entrepreneurs

High Stakes

Struggle for survival

Traders

Existing Manufactures

Largely curious, partly serious	Serious diversifiers	Want quick returns New areas are attractive. Think it is easy to enter and harvest overnight. Realise difficulties when technology papers are read or after plunging	Engg./ Science education	Engg./ Science thru work
Buy tech. as it is cheap	Give up only if solutions are difficult		Technology is part of their life; they pursue. Psychological entry barriers are low. Risk/ return assessment is better/realistic Know/can identify sources of equipments, consultancy	
Do not start or give up in the face of difficulties because opportunity costs are high. Generally risk averse				

As far as the Institute and banks are concerned, these differences should not have made any difference.

The findings bring out the unfortunate picture of pioneering technologies or appropriate technologies not being able to create the required ripple effect in the development of backward areas. The findings do not indicate any significant difference between urban and rural based firms in terms of the process of technology absorption and problems faced. Location in a forward or backward region per se cannot therefore be held responsible for the prevailing situation. Entrepreneurs felt that they would have been better off had the technology/agencies been a little more helpful

like the commercial banks. This indicates that should the quality of technology improves, there is an almost sure chance of creating ripple effects in the economies of the backward areas by the enterprises.

The performace of banks has not been criticised may be because they have a long and wide experience of business financing which enables them to create sound systems and procedures, standardised over a period of time to meet with the needs of the situation. Development of backward areas has been a major concern of financial institutions since the Seventies, and especially with the implementation of the recommendation of the Committee headed by Sivaraman (1981). Menon (1979) has noted the extensive activities of commercial banks in the backward areas. The cumulative effect of learning is indeed substantial. It could also be because these enterprises never crossed the early stages of technology utilisation / adaptation putting the attitude of the banks to acid test. Since fundamental defects were noticed in the technologies, the solution did not lie in further financing. Very often situation demanded technical inputs.

Banks, however, could be held responsible on one count, that is for financing projects whose technical feasibility and economic viability were untested. Loan appraisal process of banks does not always examine the details very often, especially the capabilities of entrepreneurs in implementing and managing unproven technologies. Banks should have always done detailed entrepreneur appraisal too in such cases. Besided, it should have kept a close watch on the operations of the clients until their activities got stabilised.

There are also instances of banks and financial institutions financing the same technology successively without realising that their own earlier borrowers had often got into technical problems. In one instance, a technical know-how developed by the IIT, Delhi for making briquqets was used by 13 entrepreneurs, all funded by the same financial institution. All of them fell sick owing to poor quality of product. It was later that the defect was located at the end of machinery fabricator who did not follow IIT specifications fully. There are many instances of same technology being funded by different agencies, and all developing technical problems.

It is evident from the above that financial agencies should activate their internal and external networks to check technical feasibility. Computerisation of borrower's records will facilitate this to a great extent.

It is, however, clear that entrepreneurs should have been careful about choosing any product for manufacturing by examining the feasibility of the technology thoroughly. Entrrepreneurs are often carried away by the name and status of the technology institution, and then to believe that experts there would always

know better than themselves, and what they offered would not be bad. They also tend to believe that a central government institution such as CFTRI/CSMCRI would be responsible for their activities by helping them in times of need. Yet another factor is often their greed to make quick money by implementing projects based on new technology which was available for a small price before anybody else got the same idea.

Since most of the know-hows are made out of extrapolations from the laboratory level, it is fair to inform the entrepreneur the truth about it. Often these institutes also get carried away by the number game of larger number of technology buyers year after year, and the higher earnings the institutes get. This is because of a wrong perception about their role and responsibilities. These national laboratories have to ensure that the resources of the country do not get blocked up in unproductive assets. Entrepreneurs would be better warned if the document detailing process know-how mentioned the limitaions of the technologies clearly. Results of experiments both at the laboratory and pilot level should be started in it. Scientists should desist from 'over selling' their products because of the potential dangers involved.

Learning is a continuous process, and technologies should get upgraded. From the angle of sustaining a competitive advantage also this is important. This is possible only if there is a free flow of information between laboratories and industrial units. There is need to have an ongoing communication between the laboratories and the entrepreneurs who bought technologies. This does not seem to happen as is clear from the repeated bitter experiences of different entreprenerurs using the seme technology.

Technology absorption process can be long and risky in many cases. For entrepreneurs with low level of knowledge and exposure, even some of the simple technologies of the institutes might look complicated. This means that such entrepreneurs should be treated on par with venture firms with equity support from venture capital companies.

There are two main reasons for the above argument. one, although these entrepreneurs receive normal package of credit, the debt component is high resulting in high interest commitments. Any delay in the commercialisation of the product would affect project viability as the clock of the bank starts ticking the moment funds are disbursed, and not when the product is commercially produced and sold. This in fact is a general problem leading to sickness, and the remedy lies in cutting the debt component. What is required is high equity contribution to reduce the interest charges. In other words, bank financing should have both a debt and an equity component which can be bought back by the entrepreneur after a specified period. If there are administrative difficulties in implementing such a scheme, there could

be preference shares issued (or equivalent ownership pattern) with minimum fixed dividends arranged after a period.

Two, these entrepreneurs need extra funds to meet technology stabilisation and market development purposes. Following the practice of ICICI to capitalise the initial market development expenses, the project cost of these entrepreneurs should have provision for it.

Bank officials have to be discrete and provide for capitalisation of initial technology and market development expenses during project appraisal. There could be provision to pay for the services of technologists from the institutes. or elsewhere. As in the case of venture capital applications, there should be thorough scritiny of the entrepreneur and appraisal of his capabilities. This can weed out several potentially sick companies.

The technological laboratories have to ensure that their scientists are not only the very best in technological skills and knowledge but also have the highest level of insight into the realities of the world. They have to keep track of the implementation of the technologies by their licencees and introduce refinements. This means that the orientation of the scientists should be one of out going in nature and information seeking. Some of the respondents felt that the scientists were not fully familiar with the realities of the world. There is thus need to have a pool of scientists who would take time off and spend time in industry for a period. The suggestion to permit officers of the IAS to take five year's leave without pay and work in industry and return to their Service without loss of seniority may be extended to the scientists. The scheme in the IIMs to encourage faculty to take one year off without pay after three years of service to work elsewhere in India or abroad is another attractive way of ensuring that the scientists were upto date theoritically and practically.

The research agenda of the laboratories has to be decided with long term competitiveness of the country in mind. Considering the limitations of funds and manpower resources available, some choice of areas will have to be made, but this has to be based on the national priorities. This means that these institutes have to develop some strategic plan for their activities. Under such conditions, there can be targetted research such as the one undertaken by the CFTRI in the Seventies when it introduced Double Seven, a substitute for Coca Cola.

Finally,institutional image. There seems to be need to build up a positive image for these institutions. There is the question of credibility as is clear from the experiences of several entrepreneurs. Despite bitter experiences entrepreneurs still show a lot

of confidence in them which means that they still have some good image in the minds of the public, and entrepreneurs in particular. It will not be a problm to build on this situation by improving the services offered to entrepreneurs. This will result in better consulting opportunities and more revenue for the institutions part of which can be shared by the scientists and consultants there.

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