



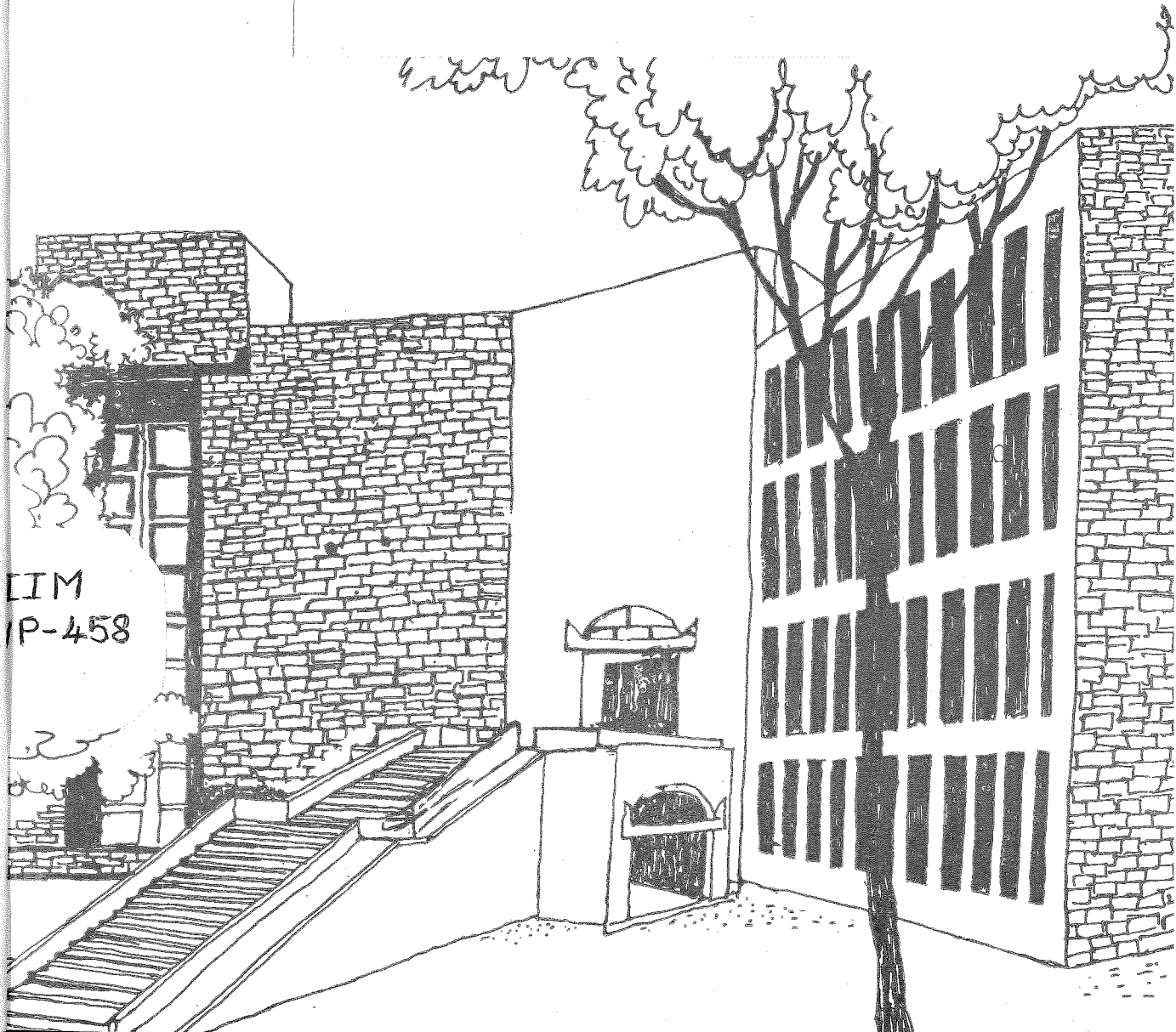
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Working Paper

LIGHTING CANDLES: IMPACT OF LEADERSHIP
ACTIONS ON INSTITUTION BUILDING

By

S. R. Ganesh
&
Padmanabh Joshi



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A B S T R A C T

This paper uses the metaphor of lighting candles to describe the process of institution building. To illustrate this, it draws upon the actions of a prolific institution builder like Dr Vikram Sarabhai in order to distil lessons about the impact of leadership actions on institution building. Through picking up an exceptional personality it attempts to demystify leadership actions surrounding the creation and development of institutions to distil learnings for less exceptional people involved in the task of institution building in various walks of life. It reports empirical data from two institutions, namely, Ahmedabad Textile Industry's Research Association (ATIRA) and Physical Research Laboratory (PRL) which were founded by Dr Vikram Sarabhai in 1947. It develops a model of leadership impact on institution building based on five concepts, namely, primacy/centrality of an individual as the core value; dominant leadership strategies of networking or creation of interacting/overlapping clusters; trusting and caring; and multiple leadership roles vis-a-vis the external environment, the internal environment and the interface between the institution and its external environment. It concludes with suggestions for the use of the model for both theoretical and practical purposes.

LIGHTING CANDLES : IMPACT OF LEADERSHIP ACTIONS ON
INSTITUTION BUILDING*

INTRODUCTION

December 30, 1971. South India. Airport of one of the fast growing cities in the country: Bangalore. Two distinguished visitors to the airport were waiting for a flight to arrive from Trivandrum in which was located the second Space Science and Technology Centre of India. One was Air Marshal Mehra, Head of Hindustan Aeronautics Ltd., the public sector undertaking primarily producing defence aircraft. The other was Prakash Tandon, former Chairman of Hindustan Lever who had come along to the airport with Air Marshal Mehra to meet Dr Vikram Sarabhai, Chairman, Indian Space Research Organization (ISRO). The flight was an hour late. When both of them went to enquire after some time, they were told that the flight carrying Dr Sarabhai would be arriving shortly. They were also told that it was a special flight. Both were taken aback since Dr Sarabhai normally took the commercial flight. When they enquired, they were told that Dr Vikram Sarabhai had passed away at Trivandrum and the special plane was carrying his body from Trivandrum via Bangalore to Bombay and thence to Ahmedabad, his home. The spark that lit many candles in a short span of 52 years had gone out.

*The research on which this paper is based was supported by a seed project grant from the Indian Institute of Management, Ahmedabad. The research was based on published and unpublished documents of the two institutions, private papers of Dr Vikram Sarabhai and Kasturbhai Lalbhai and interviews with key people involved in the two institutions. The authors alone are accountable for all omissions and commissions as well as interpretations.

In this paper, we would like to use the metaphor of lighting candles to describe the process of institution building. Like candles institutions are frail entities. Enthusing and energizing people to commit themselves to pursuit of values that transcend narrow self interests is akin to lighting candles and keeping them aglow. Even a whiff of a wind might snuff out the light and plunge the world into darkness. Lighting many candles, therefore, captures the essence of the leadership act in institution building. To illustrate this, we would like to draw upon the actions of a prolific institution builder like Dr Vikram Sarabhai in order to distil lessons on the impact of leadership actions on institution building. We have chosen Dr Vikram Sarabhai for this purpose because of his exceptional background and personality and his involvement in fields as diverse as space technology to performing arts in which he made a mark through setting up numerous institutions. Our reason for picking up an exceptional personality is both to understand the mystique surrounding leadership actions in creation and development of institutions as well as to distil learnings for less exceptional people involved in the task of institution building in various walks of life. Further, we have chosen to focus on leadership actions because we believe that this is one of the key variables in institution building and in the performance of institutions. Literature is scant on the impact of leadership actions on institution building. This can only be bridged by empirical data. Toward this we have chosen two institutions,

namely, Ahmedabad Textile Industry's Research Association (ATIRA) and Physical Research Laboratory (PRL) both of which were set up by Dr Vikram Sarabhai in 1947, the year he returned from Cambridge after completing his Ph.D. in Cosmic Rays and when he was just 29 years old. Subsequently, Vikram Sarabhai set up institutions/organizations at the rate of slightly more than one every year till his death in 1971. Figure-1 gives the range of institutions he set up during his brief life time and Appendix 1 provides a brief vignette of Dr Vikram Sarabhai.

On the basis of the empirical data of leadership actions in respect of these two institutions we have developed a model for understanding the impact of leadership actions on institution building. To do this, the paper is divided into three parts:

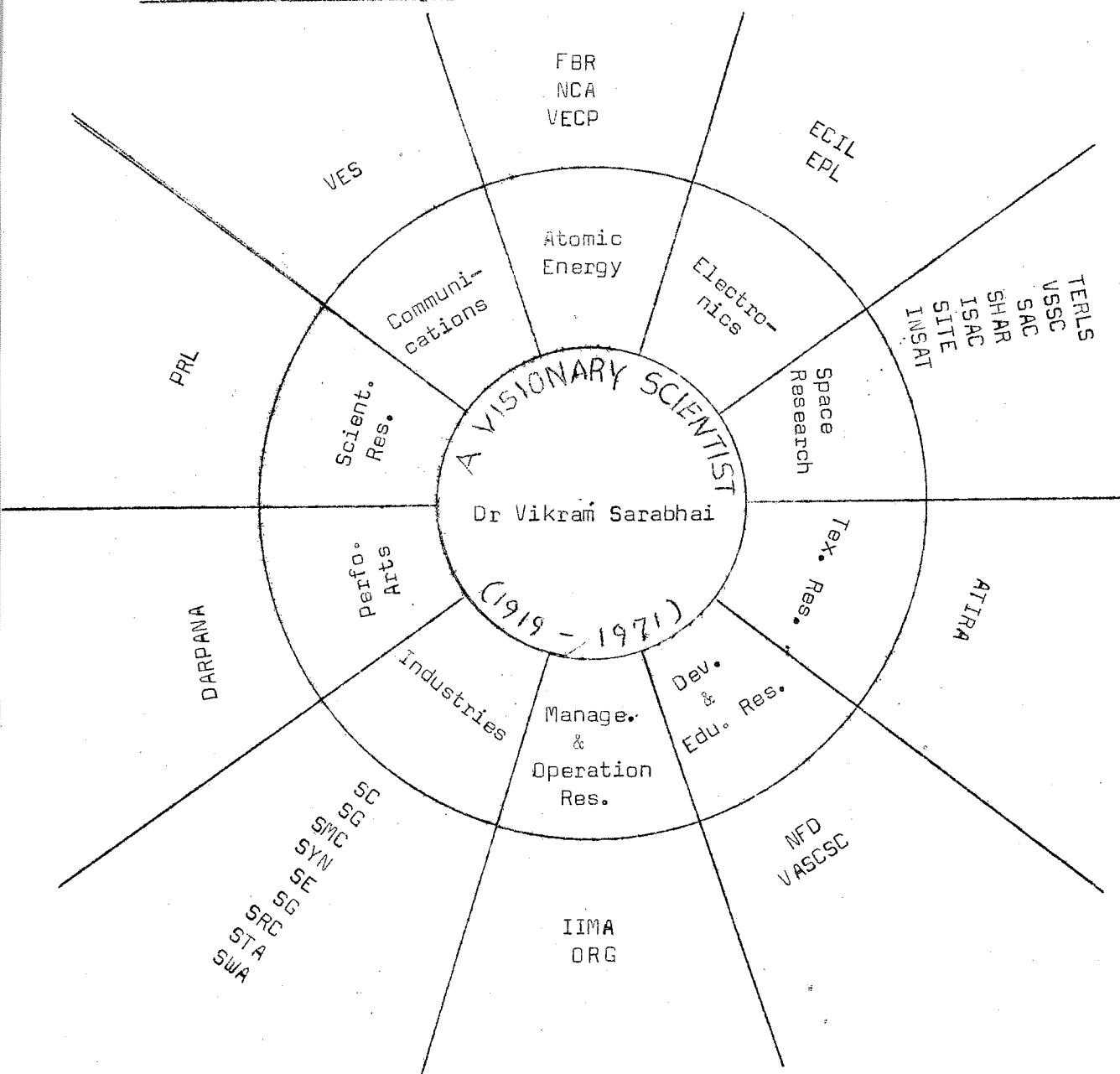
- (1) A brief review of the leadership literature to highlight the gap in terms of institution building theory;
- (2) Presentation of data on leadership actions of Dr Vikram Sarabhai vis-a-vis ATIRA and PRL with particular reference to the birth and development of these two institutions; and
- (3) Development of a model and its implications for theory and practice of institution building.

I - Leadership and Institution Building

Studies of leadership have focused on the personality of leaders, on the one hand, and on their actions, on the other. Sinha (1980) has

Major Roles in India
 Chairman:
 INCOSPAR, ISRO,
 AEC & EC
 Director:
 PRL
 Secretary
 DAE

Major Roles in the International Fields
 Chairman:
 IAEA & COSPAR
 Member:
 Pugwash
 Ekistics



DR VIKRAM SARABHAI: MULTIPLE ROLES AND INSTITUTION BUILDING EFFORTS

FIGURE - 1

<u>Scient. Res.</u> (Scientific Research)	:	PRL	- Physical Research Laboratory, Ahmedabad.
<u>Communications</u>	:	VES	- Vikram Earth Station, Arvi, Poona
<u>Atomic Energy</u>	:	FBR	- Fast Breeder Reactors, Kalpakkam
		NCA	- Nuclear Centre for Agriculture, New Delhi.
		VECP	- Variable Energy Cyclotron Project, Calcutta.
<u>Electronics</u>	:	ECIL	- Electronics Corporation of India Limited, Hyderabad.
		EPL	- Electronics Prototype Engineering Laboratory, Bombay.
<u>Space Research</u>	:	TERLS	- Thumba Equatorial Rocket Launching Station, Trivandrum.
		VSSC	- Vikram Sarabhai Space Centre, Trivandrum.
		SAC	- Space Applications Centre, Ahmedabad.
		SHAR	- Shriharikota Range, Shriharikota.
		ISAC	- ISRO Satellite Centre, Bangalore.
		SITE	- Satellite Instructional Television Experiment
		INSAT	- Indian National Satellite
<u>Tex. Res.</u> (Textile Research)	:	ATIRA	- Ahmedabad Textile Industry's Research Association, Ahmedabad
<u>Dev. & Edu. Res.</u> (Developmental & Educa- tional Research)	:	NFD	- Nehru Foundation for Development, Ahmedabad.
		VASCSC	- Vikram A Sarabhai Community Science Centre, Ahmedabad.
<u>Manage. & Operation Res.</u> (Management & Operation Research)	:	IIMA	- Indian Institute of Management, Ahmedabad.
		ORG	- Operations Research Group, Baroda.
<u>Industries</u>	:	SC	- Sarabhai Chemicals, Baroda
		SG	- Suhrid Geigy Limited, Baroda
		SMC	- Sarabhai M Chemicals Baroda
		SYN	- Synbiotics Limited, Baroda
		SE	- Sarabhai Engineering Group Baroda
		SG	- Sarabhai Glass, Baroda
		SRC	- Sarabhai Research Centre, Baroda
		STA	- Standard Pharmaceuticals Limited, Calcutta.
		SWA	- Swastic Oil Mills, Bombay.
<u>Perfo. Arts</u> (Performing Arts)	:	DARPANA-	Darpana Academy for Performing Arts, Ahmedabad.

INCOSPAR - Indian National Committee for Space Research
ISRO - Indian Space Research Organization
AEC - Atomic Energy Commission
EC - Electronics Committee
DAE - Department of Atomic Energy
IAEA - International Atomic Energy Agency
COSPAR - Committee for Space Research of UNO

done an extensive review of available literature the salient points of which are highlighted for our purpose. On the first count, leaders have been found to be more intelligent, more self-confident, more self-assured and to have better insights into themselves. They have also been found to have more integrated personalities. Extroversion, sociability and moderate egalitarianism have also been commented upon. Another significant aspect is greater interpersonal sensitivity of leaders.

On the second count, leaders have been observed to exercise authority and make decisions in a group, to be accepted by their followers, to follow the norms of the group, to influence group activities toward goal setting and goal achievement and to effect change in the performance of groups. They have also been observed to succeed in getting others to follow them as well as in facilitating the interactions among various people. They have also been observed to help groups solve their problems. Through his own research effort on the functions of leadership in different situations, Sinha (1980, developed a model of a leader, particularly, rooted to the Indian milieu. He calls such a person "the Nurturant-Task Leader (NT)". The nurturant task style, according to him has two main components, namely, concern for task and nurturant-orientation. Thus, Sinha says,

"The Nurturant-Task style requires that the task must be completed, and that the subordinates understand and accept the goals and the normative structure of the group or organization and cultivate commitment to them. The Nurturant-Task

leader structures his and his subordinates' roles clearly so that communications are explicit, structured and task-relevant. He initiates, guides, and directs his subordinates to work hard and maintains a high level of productivity, both quantitatively and qualitatively. Responsibilities are pinpointed and areas of decision making are synchronized with them. He, thus, creates a climate of purposiveness and goal-orientation.

His task-orientation, however, has the mix of nurturance. He cares for his subordinates, shows affection, takes a personal interest in their well-being, and above all, is committed to their growth. He wants them to grow up and mature so that they can assume greater and greater responsibilities and spare the leader for other tasks like minding the boundary properties of the group or organization." (p. 55).

The most useful conceptualization of leadership relevant to the present study appears to be the one provided by Burns (1978). According to Burns the essence of leadership consists of inducing followers to act for certain goals that represent the values and motivations - the wants and needs, the aspirations and expectations - of both the leaders and the followers. The interaction between the leader and the follower could take two fundamentally different forms. The first is the form of transactional leadership and the second is that of transforming leadership. Transactional leadership occurs when one person takes the initiative in making contact with others for the purpose of an exchange of valued things. The exchange may be economic or political or psychological in nature. The purposes of the background parties are related at least to the extent that the purposes are within the bargaining process and subject to their being advanced by maintaining the process. The relationship does not proceed beyond this exchange. The leadership act is not one that binds the leader and the follower

together in a mutual and continuing pursuit of a higher performance. In contrast, in the case of transforming leadership one or more persons engaged with others in such a way that leaders and followers raise one another to higher levels of motivation and morality. Their individual purposes become fused into one. Transforming leadership ultimately becomes moral in that it raises the level of human contact and ethical aspiration of both the leaders and the followers. Therefore, it has a transforming effect on both. In modern times, Gandhi's actions have been cited as an example of such leadership (Burns, 1978, pp 19 - 20). Sinha's conceptualization of a nurturant task leader is more akin to transactional leadership.

The existing literature on institution building does not specifically focus on the role of leadership (Esman, 1972 and Ganesh, 1978 and 1979). However, recent research on excellent organizations by Peters and Waterman (1982) bring the focus back on the role of leadership in institution building. They also emphasise the role of leadership in shaping the values of organizational members as well as in developing distinctive organizational cultures in the same vein that Barnard (1938) and Selznick (1957) discuss the role of leaders. One way to summarise the main theme of the work done by Peters and Waterman (1982) is to conceive of excellent organizations as having four overriding orientations:

- 1) Customer orientation
- 2) Entrepreneurial orientation

- 3) People orientation
- 4) Distinctive skill orientation

Inherent in this are four central concepts which are also at the core of the institution building perspective (Esman 1972) and the general processual model of the institution building (Ganesh 1979). These four concepts are (1) organizations as services to society (Selznick 1957), (2) Organizations as idea labs (innovative thrust as mentioned by Ganesh, 1978), (3) Organizations as cultures (Clark, 1970), and (4) Organizations as extended families. The last concept, however, is not dealt with at all by Esman and only touched upon by Ganesh (1978).

One of the important contributions of the present research on excellence is the attention which it draws to the role of leaders (in various walks of life) in developing organizations around individuals and in catering to their needs for being unique and at the same time in belonging to a group through identification with a purpose which transcends individual interest (Burns, 1978). Burns' conception of transforming leadership is close to the idea of the role of leadership in institution building and to the task of pursuit of organizational excellence.

In the following section an attempt will be made to document important actions taken by Dr Vikram Sarabhai in respect of two institutions, namely, ATIRA and PRL with particular reference to the birth and development process as identified by Ganesh (1979). Inherent in

the actions which took place around the initial birth and development of these two institutions are implication for renewal and institutionalization processes (Ganesh 1979). Therefore, by focusing on leadership actions centered around the birth and development of the two institutions one can begin to appreciate the implications for the other two sets of processes. Appendices 2 and 3 provide a brief overview of the history and achievements of the two institutions. For the purposes of this study, Dr Vikram Sarabhai's actions during his active association with the two institutions, namely, ATIRA from 1947 to 1960 and with PRL from 1947 to 1971 are of interest and relevance.

II - Leadership Actions

Institutions can be conceived of as social arenas wherein unique strategies for satisfying societal needs are acted out. Leaders are key actors in these social arenas. Ganesh (1979) identified four categories of processes as important in the life of an institution. These are:

- (1) birth processes,
- (2) development processes,
- (3) renewal processes, and
- (4) institutionalization processes.

For the purpose of the present paper, we will focus on the birth and development processes. We will examine the leadership actions around selected process mechanisms identified empirically by Ganesh (1979) under the heads of "Incubation" and "Inception" in respect of birth

processes, and "Culture Creation" and "Boundary Management" in respect of development processes. Table 1 summarizes the four categories of processes of institution building (Ganesh, 1980, p. 223).

Table 1

1		2	
Birth Processes		Development Processes	
Incubation	Inception	Culture Creation	Boundary Management
1. Idea origination and nurturance	1. Choice of model	1. Recruitment	1. Identity building
2. Choice of institutional form	2. Choice of early leadership	2. Enculturation	2. Maintenance
3. Location	3. Resource mobilization	3. Decision making	3. Enlargement
	4. Support mobilization	4. Structure	4. Shrinkage
		5. Leadership style	
3		4	
Renewal Processes		Institutionalization Processes	
		Relevance Building	Impact
1. Change in leadership		1. Research	1. Dissemination
2. Regeneration		2. Dialogue	2. Transfer
3. Exit			
4. Voice			
5. Redefinition of mission			
6. Integration			

Birth Processes : Incubation

Idea Origination

In 1944 the Government of India set up an Industrial Research Planning Committee under the chairmanship of Sir R K Shanmugham Chetty with the objectives of encouraging industrial research. The Shanmugham Chetty Committee visited Ahmedabad in mid-1940 to make industrial community aware of Government of India's (GOI) interest to encourage industrial research activities. Ahmedabad being a major textile city¹, the Ahmedabad Millowners' Association (AMA) showed its interest in establishing such an institution on a cooperative basis only if GOI provided the necessary finance. While Vikram Sarabhai was studying at Cambridge University, Kasturbhai Lalbhai², an eminent industrialist and a respected member of the millowner community in Ahmedabad, requested him to study the structures and the constitutions of some textile research institutions in the U.K. and Europe, to enable AMA establish a textile research institute (Chowdhry, 1970).

In the case of PRL, when Vikram Sarabhai returned to India due to the second world war, he started doing his post-graduate research at the Indian Institute of Science (IISc), Bangalore under the guidance of the nobel laureate Professor C V Raman. While doing his research, many equipments and facilities for scientific experiments were not available. So, he had to visit many research centres or make some equipment himself.

Due to his early interest and love for scientific research, he planned to establish a scientific research laboratory in Ahmedabad. This was decided even while he was a student. This is why before returning to India after completing his doctorate in Cosmic Rays studies, Vikram Sarabhai visited many scientific research laboratories in the U.K. and Europe and studied their constitutions and organisational structures as also the trends in scientific research.

In other words, for ATIRA it was a felt need of the Ahmedabad Millowners' Association under the dynamic leadership of Kasturbhai Lalbhai and the availability of GOI's financial support which made it possible to conceive the idea of a new institution. In the case of PRL, it was mainly Vikram Sarabhai's independent initiative due to his love for scientific research and the lack of proper research facilities in India which impelled him to plan a scientific research laboratory - PRL - at Ahmedabad.

Choice of institutional form

The choice of institutional form for both the institutions was a society under the Societies Registration Act (21 of 1860). The Societies Registration Act of 1860 provides the necessary framework for establishment of autonomous institutions for promotion of scientific and literary activities, among others. Therefore, instead of making ATIRA and PRL a part of government departments, Vikram Sarabhai advocated the autonomous form based on his study of various institutions abroad. As per the Memorandum of Association of ATIRA, the Council of Administration (COA) consisted of 7 members elected from the textile

industry, three coopted members - scientists and technologists - and three government nominated members. The Director and the Secretary of ATIRA are ex-officio members.

The objectives of ATIRA were stated as under:

1. to apply the scientific method to the problems of industry;
2. to conduct operational, applied and fundamental research to improve understanding of men, materials and processes in industry; and
3. to implement results of scientific research and technological developments.

In the case of PRL: "The aim of the Physical Research Laboratory is to serve as a STUDY AND RESEARCH CENTRE FOR PHYSICS IN WESTERN INDIA and help to raise the standard of POST-GRADUATE EDUCATION IN EXPERIMENTAL AND THEORETICAL PHYSICS."

In 1950, a Council of Management (COM) for the Physical Research Laboratory was formed with representatives from the Ahmedabad Education Society, the Karmakshetra Educational Foundation (K.E.F.)³, the Ministry of Natural Resources and the Scientific Research, the Atomic Energy Commission of the Government of India and the Government of Bombay⁴. Vikram Sarabhai drafted the constitution of the two institutions and thereby provided the framework for the institutions.

Location

For ATIRA, it was very natural that Ahmedabad was selected as the location. The initiative also came from the AMA as Ahmedabad is an important textile

centre in the western region of India. This was also acceptable to Vikram Sarabhai since he was also a millowner from the city. For PRL, Ahmedabad was selected as its location since there was no scientific research laboratory in Gujarat and Dr Sarabhai had his earlier research laboratory started at his house "Retreat" in Ahmedabad under the K.E.F. founded by his parents.

Inception

Choice of model

The AMA had earlier decided to have a cooperative organization for ATIRA. Dr Sarabhai had drafted the constitution of ATIRA. While drafting the constitution of ATIRA he had considered three basic aspects as important:

1. a cooperative structure,
2. control should not be in the hands of AMA, and
3. scientists should be coopted in the Council.

PRL also had a Council of Management represented by the government, Ahmedabad Education Society (A.E.S.)⁵ and KEF. All the powers were vested in the PRL Council consisting of scientists and representatives of GOI.

In the case of PRL, two educational trusts of Ahmedabad collaborated and established the new institution. They were the Karmakshetra Educational Foundation established by Dr Vikram Sarabhai and his

family for starting, carrying on, and helping to carry on advanced scientific research and educational activities of all types and the Ahmedabad Education Society established by Kasturbhai Lalbhai and other industrialists and educationists to establish and nurture educational institutions in Ahmedabad. Both the KEF and the AES supported the initiative of Dr Vikram Sarabhai to establish PRL at Ahmedabad.

In short both ATIRA and PRL were established as autonomous institutions governed by their respective Councils with both administrative and financial powers.

Choice of early leadership

In terms of identifying early leadership for ATIRA and PRL, Dr Vikram Sarabhai was responsible in the selection of full time Directors for both these institutions. For ATIRA, a search for an appropriate Director continued almost for a decade. Dr Sarabhai was very much concerned about choosing an appropriate head for the institution. In his words:

"The early beginnings of any institution are crucial, and the 'culture' (or lack of it) brought by the first entrants play a significant role in establishing norms, procedures and practices in the organization." (Sarabhai, 1974, p. 25)

Dr Sarabhai strongly believed that the most important and basic requirement to become a successful and an effective leader was a person's basic understanding of the human-being.

Many scientists and members of the COA of ATIRA made several attempts in India and abroad to identify an appropriate individual for ATIRA's

directorship. But, every one failed. Dr Sarabhai as a founder of ATIRA was very careful in the selection of the Director. He was very much aware of the Director's responsibilities as the head of the institution and also as an active participant in institution building. Kasturbhai Lalbhai as Chairman of ATIRA's COA fully endorsed Sarabhai's strategy in choosing a Director. It took almost nine years to get a full-time director. Till that time Dr Sarabhai continued as the Honorary Director of ATIRA. This, also helped ATIRA in clarifying its mission due to Sarabhai's involvement in every aspect of institution-building of ATIRA.

After nine years, an American attracted his attention due to his extraordinary experience in textile research and his contributions in this field. When he found him quite qualified to be the Director of ATIRA and when he was satisfied with his educational and scientific research background, he started investigations by asking two very important questions: how was he as a human being and what was his understanding of human beings. Sarabhai took his final decision only after he received favourable answers to his inquiry. He strongly believed that the humanitarian approach of an institutional leader is a basic qualification for the growth of an institution.

The most important and fundamental aspect of Vikram Sarabhai's institution building philosophy was creation of institutions around men.

He was against the government method of first constructing a building and then searching for appropriate people. His philosophy was totally different than that of others. While idea origination process was going on, he used to identify exceptional individuals to build the institution around them. This was Vikram Sarabhai's approach to producing future leaders of an institution. This was practised both in ATIRA and in PRL.

In identifying the first full-time director for PRL, Dr Sarabhai had no difficulty. It was because the decision of PRL's director was taken as early as in mid-1940's. When Vikram Sarabhai had to return to India from Cambridge during the second world war, he had joined the Indian Institute of Science, Bangalore, to work under Professor C V Raman as mentioned earlier. During that time he was doing his post-graduate research and for that purpose he was visiting various research laboratories. During one of these visits, he went to Poona to the Indian Meteorological Department where he worked on his research. Dr K R Ramanathan was, at that time, working as the Director of the Indian Meteorological Department. Vikram Sarabhai, by that time, had already planned to start a research laboratory at Ahmedabad. After meeting Dr Ramanathan, he requested him to join his proposed research laboratory. Dr Ramanathan agreed to join PRL after his retirement in 1948.

Dr Ramanathan was quite well-known due to his scientific research in Atmospheric Physics and he had also worked with Professor Raman at IIS, Bangalore. Dr Sarabhai was much impressed by his scientific research outlook and his kind nature in dealing with his subordinates. Dr Ramanathan joined PRL immediately after his retirement from Indian Meteorological Department in February 1948. He joined PRL as Professor of Atmospheric Physics and as the first full-time Director. Dr Ramanathan's selection as Director of PRL was a felicitous choice because this also helped establish PRL's identity in the scientific community in India and abroad. It was Dr Sarabhai's strategy that in starting a new institution a figure-head like Dr Ramanathan in the case of PRL and Kasturbhai Lalbhai in the case of ATIRA would help tremendously in establishing the identity of a new institution in the society and through that the growth of an institution.

It is needless to mention that as a founder of ATIRA and PRL his role was also that of a de facto director. Both Kasturbhai and Ramanathan contributed in the growth of ATIRA and PRL as "figure-heads". Both of them practically accepted Vikram Sarabhai as the de facto director and supported his strategies of institution building.

Resource and Support Mobilization

Finding figure-heads like Kasturbhai and Ramanathan, helped Vikram Sarabhai in mobilization of both resources and support. In the case of ATIRA, as mentioned earlier, Kasturbhai was an eminent

industrialist and held a prominent place among the millowners in Ahmedabad and he was respected as an elderly person. Kasturbhai was also close to people like Nehru, the then Prime Minister, Krishnamachari, the Minister for Commerce and Industry, Sardar Patel, the Deputy ^{Prime} Minister, Dr S S Bhatnagar, Director General of CSIR and Dr Krishnan, Director, National Physical Laboratory (NPL) who held high positions at the governmental level both politically and in the scientific community. Therefore, it was much easier for Vikram Sarabhai to mobilise financial resources from the GOI and the Ahmedabad millowners' Association. The AMA contributed Rs. 5 million, the GOI put up Rs. 1.9 million and promised to bear half the recurring expenditure upto a maximum of Rs. 0.15 million in any particular year (Chowdhry, 1970, p. 136).

It was not financial resources alone that helped the growth of ATIRA, but a full-fledged support from the millowners was also very necessary to establish ATIRA's identity as a textile research institution. Since ATIRA's mission was to modernise a traditional textile industry, the most difficult task was to establish its identity among the millowners so that it serves its useful purpose of modernisation and innovation. For this reason, Vikram Sarabhai used to convene regular informal meetings with the young managing agents of Ahmedabad textile industries to convince them of the role of research in modernisation. There used to be many such informal meetings where through discussions and question answer sessions, the importance of research in textile industry was emphasised.

At the PRL, Kasturbhai Lalbhai was Chairman of its Council and other eminent scientists represented the AES, the KEF, the GOB and the GOI. Here also due to Kasturbhai's high status and his relationships with the GOI, the PRL started getting financial resources. In so far as support, scientists like Bhatnagar, Krishnan and Ramanathan recognised Vikram Sarabhai's visionary thinking and his scientific insight which convinced them to recommend to the Government to support PRL. The support thus came from the scientific community.

In the following section, Dr Vikram Sarabhai's role in the development of ATIRA and PRL will be discussed with specific reference to culture creation and boundary management.

Development Processes

Two key aspects of institutional development are culture creation and boundary management. In respect of culture creation, we would like to focus on Dr Vikram Sarabhai's actions in respect of recruitment and enculturation as well as his use of interacting and overlapping clusters for developing both the vision and support for it as well as for functioning of the institution. The concept of interacting and overlapping clusters was noted first by Chowdhry (1970) who was closely associated with Sarabhai in building ATIRA. The concept of interacting clusters is contained in the concept of enabling, functional and normative linkages as used by Esman (1972). In respect of boundary management, we would like to draw attention to identity building which infuses distinctiveness into an institution (Clark, 1970).

Recruitment

In ATIRA, Vikram Sarabhai decided to recruit young scientists with knowledge of scientific methodology and intentionally avoided the requirements of previous experience. He believed in ignoring previous experience because by taking away experienced and trained people from universities and research institutions, vacuum would be created and that would weaken other institutions. He also strongly believed that

"the application of the scientific method by fresh and trained young minds would be able to produce better results in the textile industry than the application of "previous experience" gained in industry. According to Dr Sarabhai, early experience seemed to indicate that traditionally preconceived job requirements and predetermined hiring procedures were unlikely to yield results when they were related to new institutions intended to perform new roles. Since the research workers had neither knowledge nor experience of textiles, each was apprenticed to periods varying from 6 months to a year to a textile mill with the object of learning about the technology and the problems of the textile industry" (Chowdhry, 1970, p. 137 - 138),.

At the PRL, young students with training in scientific methodology were admitted in the post-graduate and doctoral programme of the laboratory. There were two areas: (a) Atmospheric Physics, and (b) Cosmic Rays. They worked on their scientific research problems under the guidance of Ramenathan and Sarabhai and identified the areas for their future research. This was not only their individual development but it was also an institutional development of PRL.

Enculturation

Culture is the most important and a basic aspect for any new institution. Operating culture of an institution determines how the institution

functions. Functions include both academic as well as administrative tasks. According to Vikram Sarabhai a very important or a basic requirement of an institutional leadership was to provide the appropriate operating culture and this would be created by the attitudes and assumptions of the men in it rather than by the formal organizational structure.

In other words, the operating culture appropriate to an institution is largely determined, on the one hand, by the nature of its primary objective, and on the other, by the assumptions and behavioural norms of people involved.

Both ATIRA and PRL were fortunate to have Vikram Sarabhai as the founder and the Director during their early periods. He was mainly involved in formulation of the research programmes of both the institutions. Scientific research was given top priority. Sarabhai, Bhatnagar and Krishnan played important role in the formulation of scientific research programmes and also identified appropriate operating cultures for ATIRA and PRL. Therefore, he created such an operating culture that administration played supportive or a service role and helped the institutional growth through implementation of research programmes.

Sarabhai identified the need of an appropriate culture not only for scientific research institutions but he advocated an appropriate operating culture for any organization such as a business enterprise, a government department, an academic institution like a University or even the army. In short, according to Sarabhai, no innovative mission can be achieved without an appropriate operating culture.

Interacting and Overlapping clusters

"In government all doors were open to Vikram, and support was easily forthcoming" (Tandon, 1980, p 113).

One of the most important strategies which helped Vikram Sarabhai in creating institutions like ATIRA and PRL was creating clusters of individuals with whom he interacted and through whom he interacted with others. This is very much akin to the concept of networks in the seminal work of Boissevain (1974).

There were three interacting clusters which played a significant role in the growth of ATIRA. Chowdhry (1970) throws considerable light on this. In ATIRA's Council of Administration, the first interacting cluster consisted of Kasturbhai Lalbhai, Bhatnagar, Krishnan and Vikram Sarabhai at the policy level. Second Cluster was at the research level and it consisted of physical and social scientists. The textile industry had the third cluster of young managing agents. The third cluster members were related with the millowner members of the council and they had academic and professional relationships with the research workers. Vikram Sarabhai represented all the three clusters and, therefore, he linked all the three clusters. Dr Vikram Sarabhai was an elected member of the Council of Administration of ATIRA; he was a young scientist and, therefore, he represented the second cluster of the research workers; and he was a young managing agent at Calico Mills and, therefore, represented the third cluster of young managing agents of textile industry. Thus, he played multiple roles via-a-vis these two institutions.

ATIRA's council consists of three parts: (1) elected members, (2) coopted members and (3) government nominees. Every part had an eminent scientist who was known both in the government and in the scientific community.

The millowners, the representatives of the government and the scientists came close to each other in the council since ATIRA was a joint venture of these three parties. The three scientists, Bhatnagar, Krishnan and Sarabhai knew each other very well and due to their common professional interests, they trusted and respected each other. They created a culture required for a scientific organisation because they were scientists and they knew nothing of the government's bureaucratic system.

Another very important aspect of this cluster which helped ATIRA was that every member of the first cluster was involved in an institution building activity himself. They were also represented on each other's councils. In the Council of Scientific and Industrial Research, Bhatnagar was the Director-General, Kasturbhai Lalbhai and Krishnan were members and Vikram Sarabhai was on CSIR's Scientific Committee. In the PRL Kasturbhai Lalbhai was the Chairman of the Council, Bhatnagar and Krishnan were members and Vikram Sarabhai represented KEF as a trustee. Their mutual trust and commitment to each other's institution building activities strengthened as a result of their coming together in the councils.

The second interacting cluster of young researchers played a significant contribution in helping Vikram Sarabhai in the growth of ATIRA. He represented the second cluster as a young researcher with a scientific

training and he did not have any background in textile research. Vikram Sarabhai decided that every researcher of ATIRA should study the textile technology and try to identify various problems faced by the mills. For this purpose, they went to mills and studied the textile technology and came in touch with the people involved in the mills. So in this way with the help of their scientific background they had their on-the-job training in local textile mills. Thus, Dr Sarabhai also sowed the seeds for on going research and dialogue with the users (Ganesh, 1979), which helped in institutionalization.

The third interacting cluster of young managing agents at the local textile mills helped the research workers to have a smooth entry into this new environment. This group of young managing agents had their higher education abroad but they were looking for appropriate positions in their family-managed textile mills. The early work of researchers at ATIRA, helped them to come out from this difficult situation. A psychologist, a statistician, a chemist and a physicist who formed the first nucleus of professionals at ATIRA identified and convinced the young managing agents about the need to establish supervisory training and a personnel department, a quality control department and chemical and physical testing laboratories, respectively. The young managing agents appreciated and welcome these new functions and, therefore, they involved themselves in looking after these new activities. By doing so, they provided a bridge between the researchers of ATIRA and their family members who were managing

the family-owned textile mills.

In this way, due to their family relations with the millowners' group, their academic and professional relationships with ATIRA's young researchers and their social relations with Vikram Sarabhai, the managing agents started taking more and more interest in ATIRA's work. Thus, creating interacting clusters of individuals at different levels helped Vikram Sarabhai in ATIRA. At PRL, Vikram Sarabhai tried to use the same concept of creating interacting clusters of individuals as one of the most important strategies of institution building. He was an elected member of the PRL Council, he was a young research scientist and was also a professor of Cosmic Rays. In the Council, there was a cluster of the same individuals similar to the ATIRA Council. Kasturbhai Lalbhai as Chairman of PRL Council, Bhatnagar and Krishnan representing the GOI and the AES respectively and Sarabhai as a founder member and scientist formed the first cluster at the policy level. Vikram Sarabhai played multiple roles in that he represented the Council, the faculty and was a young researcher at the PRL. In the PRL Council he actively participated in the policy-making process; as a member of the PRL faculty he was playing his role in implementing the research programmes and as a young researcher he helped identify scientific areas where further research was required. Thus, Sarabhai acted as a role model to both the faculty and the students inspiring them through his example as an innovative scientist and a dedicated researcher.

To sum up in Chowdhry's words (1972):

"Wherever Dr Vikram Sarabhai went he created living intellectual networks of overlapping clusters in a community so that the members of such clusters became 'carriers' of new ideas and were able to perform innovative tasks within their professions and communities." (p. 17)

Lastly, in Dr Sarabhai's words:

"In research laboratories and in other developmental tasks, it seems important that the chief executive, besides being involved in policy-making and administration, maintains direct contact with his professional role." (Sarabhai, 1974, p. 36)

Leadership style

The crux of culture creation is the style of leadership. To use

Dr Sarabhai's own words:

"There is no leader and there is no led. A leader, if one chooses to identify one, has to be a cultivator rather than a manufacturer. He has to provide the soil and the overall climate and the environment in which the seed can grow. One wants permissive individuals who do not have a compelling need to reassure themselves that they are leaders through issuing instructions to others; rather they set an example through their own creativity, love of nature and dedication to what one may call the 'scientific method'. These are the leaders we need in the field of education and research." (Sarabhai, 1974, pp 172 - 173).

He believed that an institution based on caring for people gave assurance to individuals to innovate and to respond to situations creatively.

Two events show how Dr Sarabhai put this attitude into practice.

When he was Director of PRL and Chairman of ISRO, he had called a senior accountant from Bangalore for discussing an issue regarding accounts. He was to discuss with him along with a senior scientist of PRL. The moment the

accountant entered Dr Sarabhai's room, he enquired how he was and how his family was. He took a couple of minutes to answer. Immediately, Sarabhai asked him why he was so worried. Finally, the accountant revealed that since his father was not well, he was under tension. Promptly, Dr Sarabhai told him to go back and take care of his father and to come to Ahmedabad only when his father was all right. The accountant told Dr Sarabhai that he was ready for the discussion. But, Dr Sarabhai refused to discuss. The senior scientist of PRL also tried to convince Dr Sarabhai to discuss the issue. But, Dr Sarabhai flatly refused and asked his secretary to arrange for the return journey of the accountant. (based on interview data).

There are many incidents as remembered by the people who worked under him and they still remember the personal care and concern showed by Sarabhai to his people. Another incident would suffice to drive home the point fully:

"He has come. Tell him."

"I didn't do it. You tell him."

"No, you tell. I feel scared."

"What is it, Kane?"

"The meter is burnt, Sir. We passed too much current."

"Oh, I see. Well, don't worry. How else would one learn?"

Next time you will be more careful."

That, in a nut-shell, was Professor Vikram Sarabhai. Meters were scarce those days. In fact, we did not get a new one for almost two months and the work was held up. But the human qualities of this great man were evident even before he took courage in both hands and shaped the destiny of the scientific institution that was to be PRL, and brought it national and international repute. Visionaries there are many and finally nothing succeeds like success; but in the case of Vikrambhai one could see straightaway that he had to succeed; there was just no other alternative!"
(Kane, 1972, p 20)

Sarabhai was opposed to rigid controls and often wrote and spoke against controls which he believed "damaged innovative behaviour and consequently the growth of new institutions" (Chowdhry in Sarabhai, 1974, p xiv). According to him, "the economic analogue

of horizontal controls is competition. They are implicit and do not have to be imposed from above." (Sarabhai, 1974, p 33)

Dr Sarabhai was a part-time Director in ATIRA and the routine administrative work was left to the research workers. Since every one was new to the textile industry, all of them including Dr Sarabhai jointly explored and learnt. They jointly identified relevant areas of enquiry. The researchers planned their own work, worked out their own budgets and implemented their plans. Thus, horizontal controls were more in operation (Chowdhry, 1970, p 147). Combined with the early circumstances and Dr Sarabhai's thinking against control, helped in creating an atmosphere in which there was no control maintained from above.

At PRL also, initially, independent scientific research was going on. Professor Ramanathan was the first full-time Director and Dr Sarabhai was founder and head of the Cosmic Rays Department. The first decade of the PRL was devoted to educational training and due to Dr Sarabhai's full-time involvement in the growth of PRL, no hierarchical control system was started.

Trust was an important element of both personal and organizational relationships for Dr Sarabhai. As mentioned earlier, he received absolute trust from Kasturbhai Lalbhai and his colleagues and the Councils of both ATIRA and PRL. While he was himself from an eminent family in Ahmedabad, his ease of movement across various groups was

due to the quality of trust that he was able to ^{engender} ~~endanger~~. Because of trust, he was able to enthuse the young researchers to try new ideas. He, himself, generated ideas constantly although many were later found not to be practicable. He liked people who were willing to take risks in a calculated manner and constantly encouraged them. His ability to gauge men very quickly has been noted by various people (Divatia, 1972, p 19).

Sarabhai also believed in developing people systematically. This is one reason why he preferred to take young people and to provide them with opportunities for development in both ATIRA and PRL. He remained accessible to his people in both the institutions because he was aware of the important role played by feedback in managing an organization. Because he had vision, he was able to enthuse people to come to India after their studies and work abroad, and contribute towards the country's growth. Therefore, during his many trips abroad he always took time off for meeting with young Indian professionals. In the words of Bhavsar (1972), "one meeting used to be enough for inspiring that young man to return to the homeland to do his bit of work." (p 22).

Decision-making and structuring

Decision making in both ATIRA and PRL was largely done by the respective Councils and the Directors. Both at ATIRA and PRL,

Vikram Sarabhai was the de facto Director. Therefore, he was actively involved both in policy-making at the Council level and he was implementing the policy as the institutional head. Both Kasturbhai and Ramanathan had tremendous faith and trust in Vikram Sarabhai and in his visionary thinking. Therefore, they appreciated and wanted that Vikram Sarabhai made the decisions.

"Vikram became attracted to communication theory and systems not for their own sake, but because he realised that through their use, an organisational framework could be developed which would make work more efficient, creative and meaningful." (Sondhi, 1980, p 143)

In many organizations that he established, he set up committee systems. For every research area and for every administrative unit there used to be a committee. Every committee had a Chairman. And every chairman used to report to him directly. But this was certainly not a hierarchical control system. Every individual research scientist used to report to him directly. Through this his feed-back system used to work very effectively. Because of every committee he was kept aware of the area progress or problems and since every member of this committee also reported to him so he knew what was going on at individual level.

Vikram Sarabhai had recruited the first faculty at both the institutions and it was his strategy to first develop the individual faculty member which would result in institutional growth. Therefore, at ATIRA, an exercise of working and learning together was provided to the first four research workers by sending them to the textile mills

to understand the complete process. This experience helped them not only in understanding the textile process together but also in understanding each other so well that it helped Vikram Sarabhai to progress fast in development of ATIRA. During the period 1949-50 to 1956-57 71 consulting assignments were completed; the number of research projects per year increased from 10 to 17 and the scientific, administrative and other staff increased from 30 to 206 (Chowdhry, 1970, p 140).

Similarly, at PRL, except for very few faculty members, the early period was devoted to scientific training. Here, again, students and scientists worked and studied together and developed an esprit de corps. Common experiences through group work with administration acting as support under Dr Vikram Sarabhai's guidance contributed to the emergence and nurturance of an organic structure in both ATIRA and PRL.

PRL was his own institution where he was responsible in establishing a school of Physics and also he established his own identity as a scientist. Vikram Sarabhai's own image as a scientist and PRL's growth as a scientific research institute were very much interwoven. Even while Dr Ramanathan was designated as full-time director of PRL, Vikram Sarabhai was the founder of PRL and also was responsible for the growth of PRL. It was Vikram Sarabhai whose personal relations with the leaders of scientific community in India and abroad and also his relationship with the GOI and people like Nehru and Indira Gandhi

which made availability of resources and support easy and possible. Though he tried many scientists to make them a second-line leader at PRL, it seemed that they were identified as excellent scientists but not as second-line leaders. Therefore, after trying many scientists both from within and outside the institution, he identified a computer expert trained at PRL and who showed through his working that he could successfully translate Sarabhai's philosophy in managing under his direct guidance. Till Sarabhai was Director, there was no move or question of replacing him during his life-time. It was absolutely clear that he would continue as Director of PRL during his life-time, but due to his involvement in many scientific and developmental tasks he identified a second-line man who was his trusted man and to him he delegated financial powers upto a certain extent to facilitate functioning.

Identity building

In its first decade, ATIRA acquired experiences and built its identity as a cooperative institution by serving industrial needs. Sarabhai as a young managing agent interacted with the other managing agents socially as well as professionally to develop the identity of the institution as a cooperative technological venture in the textile industry. 71 consultancy reports and 17 research projects were undertaken between 1949 and 1957 as noted earlier. He was also influential in attract^{ing}ed 23 new members during this period to the original 71. The emergence of a strong identity for ATIRA vis-a-vis

the traditional textile industry was also reflected in the seven fold increase in the manpower of the institution during the first decade.

Unlike ATIRA, for PRL, this was not a very difficult task. The people involved in the growth of PRL were well-known and were also accepted by the scientific community both in India and abroad. Ramanathan, Bhatnagar and Krishnan were well-known scientists. Sarabhai had also just established his identity as a scientist due to his association with the Cambridge University and the Indian Institute of Science. Due to all these factors PRL established its identity as a scientific research institution very quickly. By mid-50's PRL was recognised as an important centre for global cosmic ray study. In 1953, Vikram Sarabhai made a proposal to the Special Committee for the International Geophysical Year for a world-wide study of variations of cosmic ray intensity and this was accepted. This placed PRL on the world map of advanced scientific research institutions. Both Sarabhai and Ramanathan actively participated in drawing up programmes of work in various disciplines of Earth Sciences including Geomagnetism and Cosmic Rays.

III - Model and Implications

Granted that Dr Vikram Sarabhai was an unusually endowed person, his actions in respect of the birth and development of two institutions devoid of the mystique that surrounds leadership, do offer insights

which are more widely applicable by less endowed personalities. One of the ways of understanding the impact of leadership actions on institution building is to outline the essence of Dr Sarabhai's actions. This can be done around three guiding strategies he used, as evident from the data in the previous section. These three strategies rest on one single pivotal value. The pivotal value is the primacy and centrality of an individual. The three guiding strategies he used to build institutions around this pivotal value are:

- 1) Networking strategy or creating interacting and overlapping clusters internally as well as externally to produce both a vision for the institution as well as to translate the vision into actions in terms of research programmes and projects;
- 2) Trusting strategy or creating a climate of trust providing freedom of action to the individuals, ensuring autonomy and emphasising horizontal control; and
- 3) Caring strategy or creating a climate of caring through emphasising the approachability of the leader, through open channels of communication and through emphasising the role of administration as support to the core tasks of the institution.

Dr Sarabhai was able to translate these strategies into actions because of the multiple roles he played vis-a-vis both the external

environment of the institution as well as the internal environment of the institution. These roles were both formal as well as psycho-social. Thus, Professor Pisharoty of PRL says:

"He was a master in managing people. He would give half-a-dozen different problems to half-a-dozen different people. Each would be made to feel that he was Dr Sarabhai's favourite and, therefore, had been entrusted with the problem nearest to Dr Sarabhai's heart.

Niliyateasou mayi mayyamayam
Itisma sarvaha kalitabhiramah
Narayaneeyam

(He is deeply interested in me, and me alone.
Thus thought everyone and remained joyous and happy.)

However, as far as Dr Sarabhai was concerned, all were equal to him, none he disliked, none he favoured. It was

Samoham Sarvabhuteshu
Na me dweshosti nacha me priyah.

- Gita

(To me, all are equal. I hate none; nobody is my favourite)"
(Pisharoty in Yashpal, 1980, pp 94 - 95).

The work of Peters and Waterman (1982) also emphasises the importance of vision as well as that of an organizational culture built on trust and caring in the excellent organizations. One of the ways of understanding the strategy of creating interacting and overlapping clusters in excellent organizations covered in the study is to look upon the linkages such organizations build with the users as well as with various functional people within the organization. Therefore, it is interesting that the model that emerges as a result of examining the leadership actions of Dr Vikram Sarabhai in respect of creation of two research institutions closely parallels the experiences of the

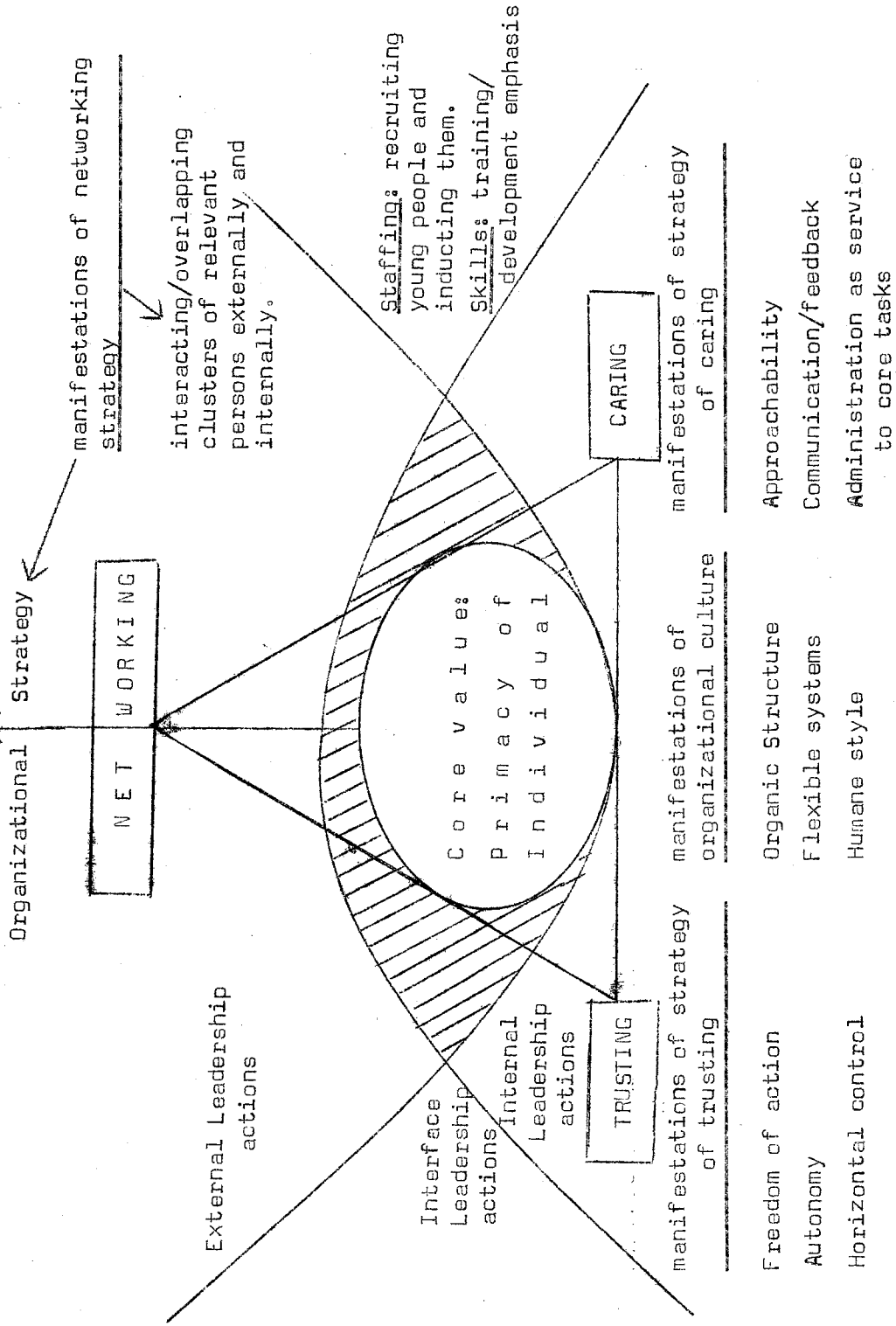
impact of leadership actions on excellent business organizations. Kotter's recent study of fifteen general managers also supports the point that leaders use "agenda setting" and "network building" strategies to achieve the organizational ends. (Kotter, 1982, pp 59-94). Therefore, the model that has emerged appears to have a wider applicability in terms of leadership actions and their impact in diverse organizational settings. Figure 2 summarises the model and highlights that the leadership actions may be focused in three ways, namely,

- 1) Externally orientated leadership actions,
- 2) Internally orientated leadership actions, and
- 3) Interface leadership actions.

The externally orientated actions enable mobilisation of support and resources for the institution around a vision through creation of interacting and overlapping clusters in the environment. Internally orientated leadership strategies and actions enable creation of organic structures, horizontal control systems and styles of functioning which emphasise symbols and rituals which reflect the autonomy and the freedom of action for an individual in the organization. The interface leadership actions enable both the development of an institution through attracting people to a vision and through establishing mechanisms of research, dialogue, dissemination and transfer (Ganesh, 1979).

In effect, the interface leadership actions map the environment on to the organization and the organization on to the environment.

In the preceding section, we have provided ample evidence of actions



Impact of Leadership Strategies and Actions on Institution Building and Organization Development.

of Dr Vikram Sarabhai in respect of these three categories of leadership actions through multiple roles in the ATIRA and the PRL settings. He continued to play similar roles in respect of the numerous institutions he founded during his brief life time.

The important lesson that any institution builder can learn from a study of Dr Sarabhai's style and actions are the following:

- 1) In order to develop institutions it is important to place an individual at the center of all the institution building efforts. The task of transforming and transactional leadership is to provide a vision with which a number of individuals will identify and to provide meaningful exchange relationships.
- 2) Leadership actions have to constantly nurture trust, creating interacting and overlapping clusters both within and outside the institution. Any default on any of these is likely to lead to breakdown of the "institutional" aspects of the organization resulting in its decline and decay.
- 3) It is important for an institution builder to identify and play multiple formal and psycho-social roles both within and without the institution. While this is not a new point because various writers have talked about the multiple roles that have to be played by chief executives, their link with the institutional element is rarely emphasised. Decline in performance of institutions could also be traced to inadequate roles,

both formal and psycho-social, to translate externally orientated, interface and internally orientated leadership strategies for institution building (Ganesh, 1978, 1982).

- 4) While organizational culture has always been emphasised as being critical to the development of institutions, the importance of building in trust and caring has not been adequately emphasised in the writings. This is, in the words of Peters and Waterman (1982), "back to the basics".

We expect that this paper will stimulate examination of experiences of practitioners in a new light and generate insights without being cluttered with jargon which tends to confuse rather than enlighten. The work of Sune Carlson (1951), Mintzberg (1973), Rosemary Stewart (1967, 1976) and, more recently, that of Kotter (1982) are all examples of such research in respect of managers. The work of Rosemary Stewart and others (1980) in respect of the National Health Service in U.K. moves the research setting on to non-profit organizations as does the work of Kotter and Lawrence (1974). It is also possible to develop a very quick check list of institutional health through an examination of any institution on four aspects, namely:

- 1) existence of a shared vision;
- 2) number, nature and scope of interacting and overlapping clusters both externally and internally;

- 3) trust as evidenced within the institution and as evidenced by the institution vis-a-vis its public and as evidenced by its various publics vis-a-vis the institution; and finally
- 4) caring as evidenced by concern for performance in the institution, existence of multiple channels of communication, approachability of leaders and the centrality of the primary task of the institution as evidenced by the attitude of the administration.

On the basis of a quick diagnosis, it is possible for institutional leadership to initiate actions on one or more fronts to reinstate the individual at the centre of institution building. This is an imperative not because it is theoretically fashionable, but because it makes good practical sense whether one is in business or whether one is in a scientific or a research institution. This paper is an effort to urge both theorists and practitioners to move in this direction so that many more candles may be lit than are snuffed out through ignorance and narrow self interests.

Notes

1. Ahmedabad has often been called the Manchester of India.
2. Kasturbhai Lalbhai was an eminent industrialist of Ahmedabad who was a member of the Council for Scientific and Industrial Research (C.S.I.R.) set up in 1942. He was Vikram Sarabhai's patron. For details of his life and work, please refer Tripathi, D (1981). Dynamics of a Tradition, New Delhi: Manohar.
3. The Karmakshetra Educational Foundation was established in 1945 by the parents of Dr Vikram Sarabhai for starting, carrying, and helping to carry on advanced scientific research and educational activities of all types at his initiative.
4. Till May 1, 1960 Gujarat was part of the Government of Bombay. Due to the political trends for lingual states Bombay was split up into two states, viz., Gujarat and Maharashtra. The new government for Gujarat assumed office on May 1, 1960.
5. The Ahmedabad Education Society was established in 1935 for the purpose of starting, helping and carrying on educational activities of all types in Ahmedabad. Kasturbhai Lalbhai was the first Chairman of AES.

Appendix - 1

Dr. Vikram Sarabhai - A life sketch

Vikram Sarabhai was born in Ahmedabad (Gujarat) on 12th August 1919 to Ambalal Sarabhai and Sarladevi Sarabhai. Ambalal Sarabhai was a well-known industrialist. Vikram Sarabhai never attended any public, primary or secondary school, but, had his early education upto the secondary school in a private school started by his parents at home. This school was established by Dr Maria Montessori, an educationist from U.K. Highly educated and capable teachers were provided for all subjects. Besides the school, there were other factors that contributed to the development of Vikram's personality.

Vikram Sarabhai had the unique opportunity of meeting and interacting with well-known intellectuals and public men of the country during his early years. People like Tagore, Gandhi, Nehru, Sardar Patel, Annie Besant, among others visited the Sarabhai household.

Vikram Sarabhai went to St John's College, Cambridge in 1937. He took his B.A. with Physics and Mathematics and started his research in Nuclear Physics. Due to the second world war he had to return to India and joined the Indian Institute of Science (IIS), Bangalore to continue his post-graduate research under Sir C V Raman, the nobel laureate. Sir C V Raman influenced Vikram Sarabhai to choose Cosmic Rays for his post-graduate research.

In Bangalore, he met the famous dancer and creative artiste Mrinalini Swaminathan. He married her in 1942.

At the end of the second world war, he returned to Cambridge and was awarded the Ph.D. in 1947 for his thesis "Cosmic Ray Investigations in Tropical Latitudes".

After his return from Cambridge, he started his hectic career as a scientist, an industrialist and as an institution builder. Figure-1 summarizes his career.

Vikram Sarabhai published 87 scientific research papers. Under his guidance 22 students completed their Ph.Ds. He was a visiting scientist at the MIT and is considered the father of the Indian Space Programme.

Dr Sarabhai was a modest human being and showed care and concern to the people who worked with him.

In a short span of 52 years, he devoted his life to the tasks of national development and the welfare of mankind. His vision was to modernise India with the help of science and technology.

Appendix - 2Ahmedabad Textile Industry's Research Association (ATIRA),
Ahmedabad.

- Established : In 1947 as a Cooperative body
- Objectives : 1) to apply the scientific method to the problems of industry;
- 2) to conduct operational, applied and fundamental research to improve understanding of men, material; and
- 3) to implement results of scientific research and technological development.
- Main initiators : Dr Vikram Sarabhai and Kasturbhai Lalbhai with the support of the Ahmedabad Millowners' Association and the Government of India.

Cumulative performance indicators (1949 - 1981):Academic:

- | | |
|---------------------|-----|
| 1) Doctoral thesis | 37 |
| 2) Papers published | 700 |
| 3) Books | 14 |
| 4) Encyclopedia | 1 |
| 5) Films | 4 |

Links with Industry:

- | | |
|---|-----------------|
| 1) Number of members | 210 |
| 2) Membership revenue | Rs. 50 lakhs |
| 3) Total staff in 1981 | 330 |
| 4) Products, processes, instruments patents | 130 |
| 5) Products (commercial use) | 50 |
| 6) Royalty revenue | Rs. 3 lakhs |
| 7) Interfirm reports | 95 |
| 8) Consultancy | 60 |
| 9) Consultancy revenue | Rs. 35.20 lakhs |

Honours:

- 1) Indian Merchant Chamber's Silver Shield in 1971 for outstanding contribution towards Cost-Reduction in the textile industry.
- 2) Federation of Indian Chamber of Commerce and Industry award in 1971 for work on Energy Conservation.

Appendix - 3Physical Research Laboratory (PRL),
Ahmedabad

- Established : In 1947 as an autonomous scientific research institution.
- Objectives : To serve as a study and research centre for Physics in Western India and help to raise the standard of post-graduate education in Experimental and Theoretical Physics.
- Main initiators : Dr Vikram Sarabhai with the support of the Karmakshetra Educational Foundation, the Ahmedabad Education Society, the Government of Bombay and the Government of India through the Department of Atomic Energy.

Cumulative performance indicators (1954 - 1971)Academic:

- 1) Doctoral theses 65
- 2) Papers published 775

Application:

The Indian Space Programme was started as the result of the scientific research done at the PRL.

Staff

Total Staff in 1971 573

About the Authors

S R Ganesh is Professor, Public Systems Group and Organizational Behaviour at the Indian Institute of Management, Vastrapur, Ahmedabad 380 015, India. His interests and work are in the area of strategic management, institution building and organization development. He has a degree in Mechanical Engineering from I.I.T, Bombay; a masters degree in management from the Sloan School at M.I.T.; and a Ph.D. from the University of London. He has published papers in Business Horizons, Human Relations, Organization Studies and Higher Education, among others.

Padmanabh Joshi is a doctoral candidate at the Gujarat University and a project associate at the Indian Institute of Management, Vastrapur, Ahmedabad 380 015, India. His interests and work are in the areas of institution building and journalism. He has an M.A. in political science from the Gujarat University. He has worked closely with the various members of the Sarabhai family.

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