THE COMILLA STRATEGY: A SYSTEMS ANALYSIS OF RURAL DEVELOPMENT ORGANIZATION

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ABSTRACT

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The Pakistan Academy for Rural Development in Comilla, East Pakistan was a center of international attention in the nineteen sixties. Experts in agricultural and rural development flocked there from around the world to find out how it was that the programs and institutions sponsored by the academy had succeeded, in one of the poorest regions on earth, in raising agricultural output, cutting birth rates, educating women, and generating employment in the villages. While the innovative tradition of the rural development academy at Comilla has been carried on under the government of independent Bangladesh, the golden era of the Comilla experiment was in the nineteen sixties. The author was privileged to spend a year at the Academy for Rural Development in Comilla in 1965-66, when he served there as an Africa-Asia Public Service Fellow.

Expanding upon information garnered in Comilla in 1965-66 about the economics of the rural credit cooperatives there, this study examines the rural development organizations in Comilla, and principally the cooperatives, from the standpoint of modern organization theory. Through a modification of an analytic paradigm proposed by Fremont Kast and James Rosenzweig, the cooperatives are regarded as a composite of several subsystems, each of which is examined in a separate chapter. A theoretical justification for this analytic approach is developed in the third chapter.

The utility of these system-analytic techniques is demonstrated by showing how they lead to a fuller understanding of the rural development organizations in Comilla than can be obtained from the best alternative schema: the model of effective organization for rural development proposed by Norman Uphoff and Milton Esman in their summary of a study of rural local government in Asia. Comparisons are also drawn with the paradigm of the Institution Building school, and with the model of rural organization elaborated by the National Front for the Liberation of South Vietnam.

Dedicated to

William Wirt Lockwood

1906 - 1978

Professor at the
Woodrow Wilson School of
Public and International Affairs
Princeton University

He was determined that I should write something of value.

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INTRODUCTION

Having grown up among the children of scientists in the posh, protected think tank of Princeton, New Jersey, I assimilated the antiquated assumption, which is more appropriate to the eighteenth than to the twentieth century, that the world is rational. In Castro's revolutionary Cuba, where I traveled with some Swarthmore college friends a few months before the Bay of Pigs invasion, the orderly social universe to which I was accustomed was thrown up into the bright Carribean sky, with liberated sugar cane workers and student radicals laughing as the cracked shards of my universe fell about them. Ever since that trip to Cuba I have been seeking to reconstruct the old verities in a new world of poverty, political passion, and civil war.

This book is an effort to bring order to the interpretation of two tours of inspection of that tumultuous other world. The first tour was to the country that is now called Bangladesh and was then called East Pakistan. As an Africa-Asia Public Service Fellow, I was stationed at the Academy for Rural Development in Comilla, East Pakistan, in 1965-66. Perhaps there are places on this planet where the people have less clothing, housing and food than they did in East Pakistan in the nineteen sixties, but nowhere else could the wretched earthlings be so proximate to one another across such a vast plain. Yet even there, amidst those tiny huts and farms, the rural people had hope of abundance. Their inspiration was in the feats of road building, canal dredging and crop improvement which they discovered they could accomplish with one another in the rural development organizations sponsored by the Academy for Rural Development at Comilla. It is those organizations -- mainly the structure of rural cooperatives -- which are at the center of attention in this book.

The second inspection tour was four times longer, lasting from 1967 to 1971. Its impact upon me was greater -- almost devastating -- yet its influence upon this book is more like that of a leitmotif than a central theme. The place where I lived on that second tour was also a part of rural Asia, and in my eyes there were commonalities in the methods employed there to organize and mobilize the rural masses. Yet I have already discovered, in defending this manuscript when it was submitted as a doctoral thesis at Michigan State University, that American experts on rural development resent analogies between their pet projects for uplifting the rural poor and the organizations for revolutionary change in Vietnam.

The intellectual window through which I have examined the Comilla cooperatives is that of organization theory. Through a theoretical interpretation, I have sought to generalize the explanation of the rural development organizations founded in Comilla. The significance of those organizations for rural development projects elsewhere, and for organizations in general, has thereby been demonstrated more clearly than would have been the case if a purely anecdotal exposition had been employed.

As if the mixture of Bengal, Vietnam, and organization theory were not complex enough, the third chapter of this book delves into other topics not generally thought to be germane to rural development. The second law of thermodynamics -- the so-called entropy law -- is discussed in the third chapter, as are arcane issues such as the difference between static and dynamic systems. Although the flights of theorizing in the third chapter do carry the discussion far from the agricultural cooperatives at Comilla, I contend that the third chapter makes the case for a new version of organization theory which is adaptable to the interpretation of rural development organizations, and to the interpretation of the corporate industrial organizations which are the more typical objects of discussion in contemporary essays in organization theory.

In the five chapters following the theoretical chapter I have applied the concepts elaborated in the third chapter to the explanation of the Comilla cooperatives. These chapters treat the cooperatives' structure (Chapter 4), their functioning (Chapter 5), their external linkages (Chapter 6), their ideological cohesion (Chapter 7) and their management (Chapter 8). In two of these chapters, those concerning structure and function, I have formalized the interpretation via mathematical models. The second of these models, that concerning the credit operations of the cooperatives, was translated into a computer program which tracked the long term solution of the simultation model under a range of assumptions about factors such as rates of interest and loan repayment.

I have laid out this roadmap so that the reader will be less confused when he takes unconventional intellectual routes through the subject matter of this book. If the reader is professionally concerned with agricultural modernization in the developing countries he will have heard of the Comilla experiments in rural uplift, but he may be unprepared to contemplate analogies between the National Liberation Front in Vietnam and the agricultural cooperatives in the villages of Comilla. Or if the reader is interested in the theory of formal organizations, he may be taken aback to find that theory applied here to organizations populated by Asian peasants rather than American executives. And no matter what the reader's professional training, I expect he will recognize that this is not a lean book. One of the members of my thesis advisory committee at Michigan State University, an educational psychologist named John Vinsonhaler, remarked that the manuscript was more appropriate as a life's work than as a thesis. Dr. Vinsonhaler's assessment may have been correct. I regard this book as a summary of the inner meaning of the bizarre combination of experiences and education which I have been privileged to enjoy in the last decade and a half. This is my mid-life memoir.

Those who assisted in the completion of this work are mostly associated with Michigan State University in East Lansing, with the government of Bangladesh, or with the Academy for Rural Development in Comilla. One man, who is quoted frequently in this volume, has been associated at various times with the faculty of Michigan State University and with the administration of the rural academy in Comilla. I am grateful to Akhter Hameed Khan for his inspiration, not only as an architect of rural development organizations but also as a monumental exemplar of ceaseless curiosity. The professor who served during the nineteen sixties as the head of Michigan State University's Pakistan Project, Richard Niehoff, guided me in factual research about the Academy for Rural Development at Comilla, especially in its relationship to Michigan State. I am grateful to Professor Vandel C. Johnson, chairman of the Department of Administration and Higher Education at MSU, for his liberality in allowing me to pursue such an unconventional topic for thesis research. And to John E. Hunter, Professor of Psychology at MSU and a member of my doctoral committee, I must say, with a wince, that I appreciate his straightforward criticisms. On the pages of an earlier draft of this manuscript, Professor Hunter penned remarks such

as "Unnecessary, uninformative, and irritating degression," or "More junk, out of place." Professor Hunter also had a hand in improving my statistical interpretations.

For their assistance in completing the questionnaire from which the information for the analysis of the structure of the thana cooperative associations was drawn, I am grateful to A. M. Abdul Mannan Bhuiya, formerly Director of the Integrated Rural Development Program of the Government of Bangladesh, and to M. Baset, Project Director of the Integrated Rural Development Program at Comilla. Within the Academy for Rural Development at Comilla, Zaker Hussain, Aziz Khan, Md. Solaiman, Badaruddin Ahmed, and Ali Akbar were especially helpful in providing data for this research project. For their labor in looking through organizational records of a decade ago so as to fill out my Cooperative Association Questionnaire, I am endebted to Rafiq ul Islam (Gaibandha Thana Central Cooperative Association), the project officer of the Gouripur Thana Central Cooperative Association, Mostafizur Rahman (Laksam T.C.C.A.), Md. Mosharat Hossain (Chandina T.C.C.A.), Md. Ali Akbar Sarkar (Sarail T.C.C.A.), Md. Abdur Rahim (Hajiganj T.C.C.A.), Md. Zahedul Islam (Brahman Baria T.C.C.A.), H. M. Abdul Mabud (Chandpur T.C.C.A.), Swapan Kumar Guha (Chouddagram T.C.C.A.), Ahmmed Ullah Khan (Barura T.C.C.A.), Abdul Motalib (Burichang T.C.C.A.), B. P. Barua (Bebidwar T.C.C.A.), Md. Manirul Haque Khandaker (Muradnagar T.C.C.A.), Md. Altaf Hossain (Daudkandi T.C.C.A.), M. A. Wadud (Homna T.C.C.A.), Md. Bahar-Ul-Islam (Kachua T.C.C.A.), Md. Delwar Hussain (Matlabganj T.C.C.A.), Kafil Uddin Ahmed (Faridganj T.C.C.A.), Niaz Mohammed Bhuiya (Bancharampur T.C.C.A.), Md. Zawadul Huque (Nabinagar T.C.C.A.), and to the project officer for the Nasirnagar T.C.C.A. These were busy officials in the Integrated Rural Development Program in Bangladesh, and their

willingness to contribute to my research on the structure of thana cooperative associations is deeply appreciated.

Finally, I should like to thank my wife and children for their patience. On many a night I returned from the Michigan State University computer center at two or three in the morning. Wakening, and trying her best to sound helpful, my wife Margo would ask, "Did the computer program run?" I would grunt "no" and pray that she would have faith in my incompetence a little longer. My young son, Anson, gave up waiting for the thesis to be done; as a birthday present, he gave me a small stapled book of blank white pages, titled in red crayon on the cover, "A Book of Thesis."

East Lansing, Michigan

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CHAPTER 1

The Comilla Experiment

> ...Small farmers and the landless have no weapon against the system but organization.[1]

In the Chilalo valley of Ethiopia the Swedish International Development agency and the Ethiopian government collaborated in the late nineteen sixties to create a model of intensive agricultural development, the Chilalo Agricultural Development Unit, or CADU. In a review of the accomplishments and failings of CADU, John M. Cohen explained some of the intellectual origins of the project. The Swedish and Ethiopian planners who designed CADU drew heavily on ideas about rural development organization that had originated in a pilot project which began five years earlier, in a place called Comilla, in East Pakistan. "In the history of international development," Cohen remarked, "the Comilla project...must be ranked as one of the most successful and influential agricultural development programs in the third world."[2]

Founding of the Comilla Academy

The town of Comilla, located midway between the major cities of Dacca and Chittagong, is a medium-sized commercial and governmental center for a large hinterland of rice-farming villages. In the wet season the fields surrounding the town appear to stretch in some places for miles, undulating in a green blanket of rice plants or sheeted with floodwaters. The winter dry season reveals those same fields as divided into miniscule diked paddies. Mudwalled thatch houses are scattered here and there among groves of cocoanut palms and bamboo. A westerner who stands on a roadbank to survey this idyllic scene may think himself virtually alone, but will soon be surrounded by banks upon banks of staring, brown-skinned villagers who would seem to have materialized out of the earth.

In this setting, which except for its extreme density of population appeared to be similar to the impoverished, tradition-bound rice growing areas of many other regions of Asia, the Pakistan Government and the Ford Foundation collaborated to found the Pakistan Academy for Village Development in 1959. A sister training institution was founded at Peshawar in what was then West Pakistan. The Comilla academy was later renamed the Pakistan Academy for Rural Development, and is now called the Bangladesh Academy for Rural Development, or BARD for short.

Planning for the 1959 opening of the Comilla academy had been underway since 1956, when a four man team from Michigan State University visited Pakistan, at the request of the prime minister, to draw up a plan for the creation of two rural development training institutions. Their idea was that public officials responsible for the implementation of rural development programs would come to the academies to study public administration and to learn about village life. The faculty of the academies were to be Pakistanis trained in western social science; the academy faculty would do field research in the villages in the vicinity of the academies, and would edify the government trainees by imparting to them the findings of their surveys. This original conception was pursued fairly strictly in the rural development academy at Peshawar, but in the Comilla academy it was to be substantially amplified.

In June of 1957 the Pakistan government accepted the plan for the establishment of the training academies. The Ford Foundation designated Michigan State University as a back up agency which would assist the academies in the initial recruitment and training of personnel, staff development, the purchase of library materials, and other such support services. Michigan State was also to provide a rotating staff of resident project advisors. For the technical assistance which Michigan State University provided to the two academies between 1956 and 1969, the Ford Foundation paid M.S.U. $1,935,082. To launch the Comilla academy, the foundation contributed a $210,000 grant for architects' fees and imported construction materials for the dormitory, cafeteria (the only one in East Pakistan at the time), library, classroom buildings, administration building, and faculty residences at the academy campus at Kotbari, seven miles from the town of Comilla. A later Ford Foundation grant of $810,000 to the Government of East Pakistan supported the foreign exchange costs of some of the academy-sponsored projects for agricultural modernization. Operational costs of the Comilla academy were born by the Pakistan government, and totalled somewhat more than five million rupees, or about a million dollars, from 1960 to 1968. The Pakistan government invested a similar amount for the construction of the academy facilities.[3] Compared to the funds that might have been expended over a comparable period by a new college in the United States, this level of support was modest. But by the standards of public institutions in East Pakistan, the funding provided by the Ford Foundation and the Pakistan government was extraordinary.

The Academy Director

The most important decision that was made in the period in the late fifties when the Comilla academy was being planned was the selection of the academy director. Akhter Hameed Khan, the principal of Comilla Victoria College, was chosen for this critical post. He brought to the job an exceptional knowledge of the administrative policies of Pakistan, gleaned from his participation in the Indian Civil Service in the late thirties, and from his leadership of the East Pakistan V-AID program in the mid fifties. He also had a deep compulsion toward innovation, and a compassion for the small farmers of the Comilla area.

Akhter Hameed Khan was born in 1914 in Agra, India. He was the eldest son of a police official of the government of British India. His parents were Pathans: the proud, tall Muslim people of India's northwest frontier. In comparison to most Muslims of that era, his parents were exceptionally well read and cultivated, and so they encouraged Akhter Hameed Khan's rampant intellectual curiosity. A younger brother recalls that when Akhter Hameed Khan was taking food at the dinner table with his right hand, a book would often be in his left hand. He explained to his younger brother that books were as essential to him as food.

He continued his non-conformist, syncretic search for truth in Meerut College, where he studied history, philosophy, and English literature, and at Agra University, from which he received his M.A. in English literature in 1934. He was fond of posing provocative questions such as "Why should I believe in the old dogmas of my religion if they are against logic?", and read widely in Arabic, Persian, and Sanskrit in his query into religious fundamentals.

In 1934 he competed successfully in the examinations for the Indian Civil Service, the most prestigous service in British India. The ICS sent him for two years study at Maudline College, Cambridge. Upon his return from England he showed himself to be as engrossed in religious studies as ever, and thereby disappointed his father, who had hoped that Akhter Hameed would assume the imperial bearing of an ICS officer. He also disappointed his British superiors in the ICS, who took exception to the simplicity of his dress and life style. A senior ICS officer once admonished Akhter Hameed Khan that "the other officers suffer by contrast."

His first posting in the ICS was to Comilla, where he was assistant Magistrate in 1938. He set about learning the Bengali language, which he later spoke fluently, but with a decided Urdu accent. His education in the rural problems of East Bengal began in the late thirties and was specially intensive when he served as the sub-divisional officer for Netrokana in Mymensingh, another locality in what was to become East Pakistan and then Bangladesh. As the result of the worldwide great depression, rural indebtedness had increased markedly in East Bengal, and the inability of farmers to repay their debts pulled the underpinnings from the cooperative movement which had flourished in the region in the period of the First World War. As sub-divisional officer, Akhter Hameed Khan was responsible for organizing Debt Settlement Boards for the scaling down of debts. He also served as the appellate court for debt settlement cases. In later years, Akhter Hameed Khan observed that his understanding of the problems of rural credit in East Pakistan derived from his personal experience with hundreds of debt settlement cases.

Akhter Hameed Khan resigned from the Indian Civil Service in 1944.

His disenchantment with the ICS derived from his perception of the inadequacy of the service, and of his participation in it, in the face of the poverty, injustice, and oppression of wartime India. The populace under his administration had been decimated by the great Bengal Famine of 1943, a catastrophe which must have been harrowing for anyone to witness. His restlessness in government service had been augmented by his marriage in 1939 to Hamida Mashraqui, the daughter of the founder and head of a semi-military political organization known as Khaksar.

Carrying out his resolution to lead the life of a poor man, Akhter Hameed Khan moved his family to Mamoola, a village near Aligarh. He rented a small house and acquired a goat and a buffalo cow. Finding that he couldn't make a living as a milkman, he apprenticed himself to a blacksmith to learn the art of lock making. When he had gained proficiency as a locksmith, he organized a cooperative workshop for lock manufacture.

When the Indian colonial era came to an end in 1947, Akhter Hameed Khan returned to public service in the role of an educator. He served as headmaster of a secondary school in Delhi, as a lecturer in Islamic history and English literature at Islamia College in Karachi, and in 1950 was appointed principal of Comilla Victoria College. His youthful interest in religious studies persisted; as principal, he sometimes requested the faculty to leave him unmolested in his office for weeks at a time so that he might pursue his readings of Islamic and Buddhist literature.

During his years in the Comilla principalship, Akhter Hameed Khan served for several terms as president of the East Pakistan Non-Government Teachers Association. In his presidential addresses he called for reform of the structure and curriculum of East Pakistan education so as to make it more germane to the needs of a rural society. His speeches often burst the bounds of educational issues, and pointed to the need for broader social change. In 1952, for instance, he observed:

> Look, for example, how the village is neglected. The village is a place without opportunities; there you have under-employment, sweat labour, uncertain produce, squalor, disease and boredom. Naturally as many as can want to leave the village. But unfortunately the village is the foundation of our national life. It is dangerous to weaken the foundation.[4]

An opportunity to test out his rural reconstructionist ideals would seem to have been presented to Akhter Hameed Khan in 1954, when he took leave of his college duties for a year to serve as the first director for East Pakistan of the Village Agricultural and Industrial Development (V-AID) program. His recollections about the experience, however, are generally negative. Understanding Akhter Hameed Khan's disagreements with the V-AID program is important, because many of the innovations which he introduced a decade or so later in the Comilla academy's rural development projects were justified, in his mind, as responses to the deficiencies of V-AID.

The Village Agricultural and Industrial Development program was a classic example of the community development fad which in the nineteen fifties swept through the less developed countries on the wings of American money and persuasion. The international prototype of a community development program of national scope was launched in India in 1952. The Ford Foundation had supported a plan to set up 15 community development projects covering 100 Indian villages each; the projects were to be built on the model of Albert Mayer's Etawah pilot project in the state of Uttar Pradesh. When the Indian government got wind of the possibility of massive funding for community development through United States foreign aid, the scheme was inflated to include 55 projects each covering 300 villages.[5] And so it went, in India, in Pakistan, and in many other countries. With the fertilization of American foreign aid, and with the blessings of several United Nations agencies, the community development movement grew phenomenally. By 1960 over sixty countries in Asia, Africa, and Latin America had initiated major programs for community development, constructed for the most part according to the Indian example.

The demise of the international community development movement was even speedier. By 1965 most countries, including India, had cut back or terminated their community development programs. The life cycle of this international movement, then, was about 13 years. In Pakistan the V-AID program was abandoned in 1961, nine years after it was started. The course of the precipitous decline of the community development movement was in large part the reverse of the cause for its meteorotic ascent: the United States government had lost interest, and was putting its foreign aid money elsewhere.[6]

Disillusionment had set in among national leaders in the developing countries as well. They had been led to expect that community development would yield a plenitude of happy consequences ranging from increased agricultural productivity to the political stabilization of rural areas. They observed, after a decade of utopian promises, that few of these benefits actually accrued. Within the national government, moreover, the community development programs occasioned unending jurisdictional and professional disputes, since the more established ministries, such as agriculture, generally viewed the community development ministry as a nest of technically incompetent intruders. In the absence of American funding or rural results, most national leaders were glad to be rid of the community development headache.

Although Akhter Hameed Khan has sharpened his hindsight with the aid of the many critiques of community development that have been published in recent years, it appears that he did perceive many of the inadequacies of the community development approach in the mid nineteen fifties, when the international community development movement was in the first stages of proliferation. As V-AID director, he was disturbed to find that the American backers of the program (field representatives of the International Cooperation Administration, a predecessor of the U.S. agency for International Development) believed that all of the methods of community development were known, and that the only task was to implement them. Akhter Hameed Khan requested, but was not granted, a small pilot project rural area in which to experiment with different approaches to community development. In the district of Khulna he did try out one experiment for which he was reprimanded by the community development authorities: he authorized the expenditure of 450,000 rupees for the construction of a flood control embankment. If the embankment had not been built, he contended, the Khulna villagers would not have bought fertilizer for their fields or installed the sanitation facilities and fishponds which the V-AID program promoted. Akhter Hameed Khan also decried the distrust with which the community development experts viewed the traditional civil administration. His American advisor, a sociologist named John Green, told Akhter Hameed Khan that community development work must be conducted independently of the government establishment. Lastly, Akhter Hameed Khan recognized that the economic content of the community development program was insufficient. In a speech which he gave to a conference at the Massachusetts Institute of Technology in 1964, he remarked, "So as I look back on these last ten years my own advice would be that nobody should be allowed to talk about community development unless he has passed a tough course in public administration and economic planning."[7]

Because he found himself disagreeing with so many of the precepts of the Village Agricultural and Industrial Development program, Akhter Hameed Khan left the job of provincial V-AID director in 1956, and returned to his principalship at Comilla Victoria College.

After his selection in 1958 as the first director of the Comilla Academy for Village Development, Akhter Hameed Khan and the newly recruited faculty of the academy (all of whom had M.A.s, and some of whom had Ph.D.s) were flown to Michigan State University for nine months of training, brainstorming, and planning for the job ahead. MSU faculty led discussions on community development, social change, public administration, and other aspects of the intellectual melange of American scholarship on problems of rural development in the post-colonial countries. Among the ideas which had the most lasting impact on the personnel of the Comilla academy were the concepts of the land grant college, an institution linking rural community involvement with academic investigation, and the idea of action research for problem solving. The thought of applying social science action research to issues in public administration seemed particularly intriguing.

The Rural Setting of the Academy

After their arrival in Comilla in May of 1959, the faculty of the newly founded academy set about studying the nearby villages. The setting of the academy, they discovered, was bleak. The rich rice land around Comilla town was desperately overcrowded, with a population density of over 1,500 per square mile in the rural areas. In proportion to cultivated area, the population density was over 2,000 persons per square mile.[8] The average farm per rural household was only 1.7 acres in area. These tiny holdings were further divided and scattered here and there in paddies, ponds, and houselots.

In the Comilla area, as elsewhere in East Pakistan, the difficulty of making a living on such a crowded landscape was compounded by the deterioration of earthworks which had traditionally protected the farm land. Flood embankments had been breached, and drainage channels had become choked with silt. During the colonial era, the maintenance of these earthworks had been mainly the responsibility of the _zamindars_, a peculiar class of hereditary tax collectors cum landlords. But the traditional arrangement for taxation and public works had been disrupted by the depression, the second world war, and independence, leaving the earthworks unrepaired for decades.

Economic conditions had grown so harsh in some of the most flood-prone villages near Comilla that farmers had had to sell their bullocks and were attempting to heave wooden plows through the soil with the force of their emaciated limbs. Wives had sold their jewelry, one of the most important liquid assets for a peasant family. Some families were contemplating migration to Burma as the only way to stay alive.

Social deterioration had proceeded apace with family economic decline. Beggars and thieves were numerous in the Comilla area in the ninteen fifties. Many farmers were unwilling to make investments for the improvement of their yields for fear their crops would be cut in the night and stolen. The folk method of preserving order and settling disputes via a council of elders known as samaj had become nearly impotent. Peter Bertocci, who conducted an intensive anthropological study of Comilla villages, reports that "...throughout my entire period of contact with these villages I heard continual lamenting of the fact that the sardari system of conflict resolution had 'broken down,' that it had 'gone bad' and that the samaj had been destroyed."[9]

The population was generally illiterate; 73 percent of all 15 year olds -- and 86 percent of all 15 year old females -- could not read in 1960. Poor health debilitated many villagers, the common afflictions being cholera, typhoid, tuberculosis, dysentery, and worm infections.

Economic status in the Comilla villages was determined mainly on the basis of the size of landholdings. At the bottom of the heap were landless laborers. Their numbers at the time the academy began have unfortunately not been recorded, but in 1967 Bertocci estimated them as about 10 percent of a sample of 102 Comilla thana cultivators.[10] The landless laborers lived hand to mouth, selling their services at planting or harvest time. They were so poor that they could not accumulate the wherewithal to rent land to cultivate. They were unemployed about half of each year. Their destitution was magnified by the coincidence of their dry-season unemployment, when there was no work to be done for hire in the fields, with the period of highest rice prices. As might be expected, many of these landless laborers deserted the villages in search of more stable employment in the towns.

The land poor were at the next level of economic stratification in the Comilla villages. In Bertocci's classification, these farmers owned less than the median landholding of 1.15 acres. They had only the most precarious toehold on the agricultural economy, and could not raise enough rice on their own plots to feed an average family of five. To sustain themselves, these land poor cultivators would have to sell their labor to other farmers. The land poor farmers constituted 34 percent of Bertocci's sample.

The next group in the economic scale, accounting for 47 percent of Bertocci's 1967 sample, was variously denoted as the middle farmers or the small farmers. Bertocci bracketted the landholdings of this group as between 1.15 acres (his sample median) and 4 acres. Akhter Hameed Khan has described the small farmers as owning between 1.5 and 5 acres.[11] When raising two crops of rice per year without an affliction of flood, drought, or pests, the small farmer could supply his family with rice and market a small surplus. With this little margin of cash, the small farmer could purchase agricultural supplies such as fertilizer, and meet a few of his family's consumption needs. Since he had so little reserve to fall back on, the small farmer usually sold his crop at harvest time, when the price of rice might be half the value it attained in the winter dry season. To meet his need for cash prior to the fall harvest of the amon rice crop, the small farmer frequently sought loans from rural moneylenders, and should things go badly for him in any season, the small farmer might have to turn over part of his tiny landholdings to the moneylender (in usufructory mortgage) in order to obtain a large enough loan to tide him over. The pressures of natural disaster, exploitation by rice merchants, high interest rates, and the division of landholdings among sons were constantly pressing the small farmer downward toward the category of land-poor cultivators, or even into the nether pool of landless laborers.

At the top of the lowly economic pyramid in the Bengali village was the class of surplus farmers or big farmers. Nine percent of the cultivators in the two Comilla villages in Bertocci's study were in this category. This small group of farmers were the lucky few with enough land to feed their families, meet their needs for agricultural supplies and consumption goods, and still have a margin of surplus to use as equity capital for moneylending and rice trading. In the Comilla villages of the nineteen fifties and early sixties these farmers had a vested interest in the status quo. They could invest in loans to land poor and small farmers, or in purchasing and stocking rice for resale at higher prices, and thereby make substantial profits with very small risk. If the small farmer or the land poor farmer could not repay the principal of his loan along with the 80-100 percent per year interest, the surplus farmer often retained the use of the mortgaged land. He might lease the mortgaged property pending repayment of the loan, and thereby accumulate still more wealth at little risk. When urged by village level extension workers to adopt better agricultural practices, these surplus farmers would gladly go along with the use of fertilizers or pesticides if these novel commodities were offered for free; after the subsidy for the demonstration ended, the surplus farmers would typically revert to the traditional practices which brought them such a relatively comfortable way of life. East Pakistani programs for rural uplift in the nineteen fifties, most notably V-AID, had been captured by this village elite; as a result the programs had neither boosted agricultural productivity nor arrested the downward economic spiral in which most villagers were caught.

Much of the preceding analysis of class structure in a Comilla village is drawn from a speech given by Akhter Hameed Khan to a conference of personnel of the United States agency for International Development, held in Comilla in June of 1963.[12] In this speech to the Americans, he described a vision of rural society that was close to that of Mao Tse Tung.[13] Many years later, after the collapse of the conservative East Pakistan regime and after his own retreat from the province because of the ethnic hatreds that boiled up during the war of independence, Akhter Hameed Khan admitted that he had been reading Mao's works in secret for many years. In his speeches to Pakistan government officials and to Comilla villagers during the nineteen sixties, Akhter Hameed Khan was less explicit about his vision of rural class conflict; for those domestic audiences he stressed the importance of vigorous administration or of community solidarity. Time has born out the accuracy of Akhter Hameed Khan's radical inner vision, the outline of which is taken for granted in most informed discussions of agrarian problems in contemporary Bangladesh.

Initiatives in Rural Development Organization

In August of 1959, three months after they had regrouped in Comilla after their training in Michigan, in England, and elsewhere abroad, the faculty of the Comilla academy faced their first class of trainees. These were all, as Akhter Hameed Khan recollects, "experienced government officers who had been connected with village life possibly for fifteen or twenty years.... It was interesting for me to watch how nervous the instructors were in facing these officers and how sure, on the other hand, the officers were that the instructors did not know anything about village life which was relevant to them."[14] The trainees were determinedly sceptical; they said that the odds against significant rural change were too great, that the instructors' foreign ideas had no chance of being implanted among the quarrelsome, downtrodden villagers of East Pakistan.

The upshot of this contretemps was that Akhter Hameed Khan obtained the backing of the academy faculty for the establishment of a working demonstration of rural development. He asked the East Pakistan government to allocate the rural region adjoining the academy, Comilla Kotwali Thana, as a laboratory and demonstration area to be attached to the academy. Obtaining approval for this unusual request required some lobbying, and Akhter Hameed Khan did not hesitate to make use of his connections with high government officials who had been his colleagues in the Indian Civil Service in the nineteen thirties. One old friend, the East Pakistan Chief Secretary, told him, "You are a fool, but a good fool, so I will let you go ahead."

When the request for a laboratory area was granted, the academy assumed the responsibility, which was (and still is) quite rare for an academic and training institution, of making many of the most crucial decisions as to how an administrative area was virtually to be governed. The academy did not assume full executive control over the thana, since representatives of the civil administration, police, and nation building departments still reported to their respective superiors above the thana level. The academy obtained, nonetheless, a very considerable latitude for rearranging administrative relationships and for launching pilot projects that were both rural and urban in nature. (The staff of the West Pakistan Academy, in Peshawar, did not take on comparable responsibility for the experimental development of a specific area. Not until Akhter Hameed Khan associated himself with the Peshawar academy in 1974 did it undertake to combine theory and practice in the demonstration development project in Daudzai thana.)

The size of a thana, according to Akhter Hameed Khan, was determined originally by the capacities of a horse; the borders of the thana were drawn in British imperial days by estimation of the distance that a man on horseback could travel from a police station and return in one day. In area, the thanas averaged 100 square miles. Comilla Kotwali Thana contained 107 square miles, a territory which the academy staff thought might be manageable for the purposes of development administration, just as it had proven manageable for police administration.

Explaining the selection of the thana as the experimental project area, Akhter Hameed Khan said, "The community development people had a kind of allergy to the existing administrative structure. We said don't create a new unit, but take the old law and order unit, and make it the basis of the reform. For over a hundred and fifty years the police station had been the symbol of the presence of the government as a maintainer of law and order. We said we would put the development center next to the police station, to show the new concern of the government."[15]

A still more important reason for seeking rural development models which were implementable on a thana scale was that the thana was the lowest level to which the civil administration -- the structure descended from the steel frame of government that had been manned by the Indian Civil Service in imperial days -- posted its officers. The thana-level administrative officer was the circle officer, and he was the man Akhter Hameed Khan had his eye on as the coordinator of local development projects. "Nobody except a captain can really coordinate from the public administration point of view," he commented. "Again, if I was talking the language of community development I could speak about human relations and tact and all that. But, in public administration, it really does not work. There must be a captain, and the captain is the coordinator. He is the chief."[16]

A second fundamental decision about the organization of rural development in Comilla was also related to the territorial hierarchy of administration, but was slower to crystallize. In the first years of trial and error experimentation, the academy staff organized farmer's cooperatives in more than 20 villages of Comilla Kotwali Thana. The aim of the cooperatives was to mobilize the small farmers, and to provide them with a means of group protection against rice merchants and moneylenders. It was realized during 1960 and 1961 that these independent village level cooperatives could not muster the resources, the technical expertise, or the bargaining strength to make breakthroughs in agricultural modernization on the one hand, or to deal with exploitative rice merchants and moneylenders on the other hand. Accordingly, the Kotwali Thana Central Cooperative Association (KTCCA) was organized and registered as a cooperative in 1962.

With the establishment of the KTCCA as a thana level umbrella organization, the two-tier administrative structure which was to become the hallmark of the Comilla cooperatives had been initiated. As will become apparent in later chapters of this book, the elements at each tier and the relationships between the tiers were successively transformed through the nineteen sixties. But the basic pattern of village level primary cooperatives and a thana level cooperative association remained fixed. The two-tiered structure is the aspect of the Comilla cooperatives which has been most widely imitated, as in the Integrated Rural Development Program in Bangladesh, and in the new cooperatives which Akhter Hameed Khan helped to bring into being in Daudzai thana of Peshawar, in Pakistan.

A third organizational decision was also closely related to the pattern of imperial administration via a territorial hierarchy. This was to create a Thana Training and Development Center in which local government, administrative services, and projects of non-formal education could be coordinated. Akhter Hameed Khan described the rationale for the creation of the center as follows:

> The Academy's first concern was to improve the quality of rural administration. In this field the Empire had left a poor legacy. The Imperial symbol was the Police Station. We erected a new symbol - the Thana Training and Development Center. Offices of the so-called nation building departments - Agriculture, Animal Husbandry, Fishery, Health, Education, etc. - were housed together in a spacious new building. For intensive planning and coordination a local government council was created at the thana level and also located at the Center. Chairmen of the next lower tier, the Union Councils, and the Departmental officers were the constituent members. The assumptions were that the people should be mobilized through their elected leaders; that the officers should coordinate departmental activities with each other as well as with the councillors. The Thana Center was to be the focus not only of planning and coordination but also of training. Special meeting halls and classrooms were added and officers were encouraged to teach. The Thana Center assumed that a good job requires a good tool.[17]

At about the time that the Thana Training and Development Center really started functioning, the academy staff itself removed to a new and far more spacious campus at Kotbari, five miles away from the operational center at Abhoy Ashram. The visual contrast between the two centers was striking: many of the one story buildings at the old Ghandian retreat of Abhoy Ashram were walled in the village manner with woven bamboo, whereas the multi-storied concrete structures at Kotbari had been designed, under Ford Foundation contract, by the Greek city planner Constantine Doxiadis. The social worlds of the two campuses were also distinct. The academy at Kotbari was the nexus of contact with government officers from Dacca and from other districts, who often flocked to the academy for in-service training in rural development. To the Abhoy Ashram campus came village cooperative managers dressed in shirt and wrap around lungi, bearded Muslim Imams, and shy rural women who might seldom have ventured from their houses before.

Although the Abhoy Ashram center appeared the more indigenous of the two institutions, the ideas behind the pilot projects which were headquartered there were of cosmopolitan origin. The village cooperatives, for example, were inspired by those which Friedrick Wilhelm Raiffeisen had organized in Germany in the mid nineteenth century. Raiffeisen had emphasized the need for a trade union type of joint action by the small German farmers, who had been grossly exploited by moneylenders and merchants.

To an extent which he was reluctant to admit while he served the conservative government of East Pakistan, Akhter Hameed Khan was also inspired by the example of communist China. In a speech which he gave to an International Seminar on Rural Development held at Michigan State University in 1975, he compared the Comilla peasant cooperatives to the Chinese mutual aid teams, and the Thana Training and Development Center to the commune. He averred that he and others at the academy had admired the extraordinary expertise of the Chinese communists in organizational and educational concepts and methods. "The Chinese leaders were veteran experts of rural organization. Their idealism and sincerity had survived fiery ordeals. Their long experience gave them superb insights."[18]

In the same speech on his lessons from China, Akhter Hameed Khan drew attention to one of the deep-seated contradictions in the development strategy which was devised at Comilla. The thrust of the Comilla movement derived from the hunger of the small farmers for protection against natural disaster and economic exploitation. The Comilla cooperatives were organized as instruments for the small farmers to use against the elites which had always dominated and squeezed them. Yet those very elites were in control of the Muslim League (the government political party), and an aristocratic psychology characterized those in control of the central government. "Since 1947 our rulers were aristocrats, civil servants and generals who felt more at home with landlords and industrialists than with peasants and laborers. Our parties in power were permeated with privilege. Government by bribery was as common as government by intimidation. There was little integrity and much corruption, few examples of discipline and much demagoguery. There was beggary and wasteful pomp instead of self-reliant austerity."[19]

If the government was in the hands of men such as those, was it possible to forge a reformist phalanx in which the circle officers were the captains and the small farmers were the men? Would not the officers of the civil administration, acting as agents of the ruling classes, assure the emasculation of any genuinely popular movement? The analysis is appealingly simple and partially true. The argument was sufficiently false, however, as to allow for the great strides taken in Comilla toward popular solidarity, rural welfare, and agricultural modernization.

Notes for Chapter 1

The Comilla Experiment

[1] Carl H. Gotsch, "Relationships between Technology, Prices, and Income Distribution in Pakistan's Agriculture: Some Lessons from the Green Revolution," In Robert D. Stevens, Hamza Alavi, and Peter J. Bertocci, eds., Rural Development in Bangladesh and Pakistan, The University of Hawaii, Honolulu, 1976, p. 262.

[2] John M. Cohen, "The Chilalo Agricultural Development Unit as a Program Intermediary for Foreign Assistance in Ethiopia," AID Spring Review of Small Farmer Credit, Vol. VIII, February 1973, p. 9.

[3] Arthur F. Raper, et al., Rural Development in Action: The Comprehensive Experiment at Comilla, East Pakistan, Cornell University Press, Ithica, 1970. Includes a more detailed discussion of the financing of the academy, and of its relationship to M.S.U.

[4] Akhter Hameed Khan, Presidential Address to the East Bengal Teachers' Conference, Comilla, 20 November 1952 (mimeographed).

[5] Sudhir Sen, A Richer Harvest: New Horizons for Developing Countries, Orbis Books, Maryknoll, New York, 1974, p. 113.

[6] Holdcroft, Lane E., "The Rise and Fall of Community Development," Department of Agricultural Economics, Michigan State University, 1976, p. 3.

[7] Akhter Hameed Khan, "The Essence of the Comilla Program," speech delivered at the MIT Conference on Productivity and Innovation in Agriculture in the Underdeveloped Countries, July, 1964 (mimeographed). Akhter Hameed Khan was amused at the anti-communist cold war ideology which impelled the American community development experts. He recalls that his American advisor was wont to drive him through the villages in a jeep; the advisor would wave his arm at the scene and say, "We have only ten more years before all this explodes."

[8] Peter J. Bertocci, Elusive Villages, Social Structure and Community Organization in Rural East Pakistan, Ph.D. thesis, Michigan State University, 1970, p. 150.

[9] Ibid., p. 150.

[10] Ibid., p. 71.

[11] Akhter Hameed Khan, "An Analysis of the East Bengal Village," a speech to the U.S.A.I.D. seminar held at Comilla in June, 1963. The speech is summarized in Comilla-USAID Conference Report, (mimeographed).

[12] Ibid.

[13] See, for example, "An Analysis of the Various Classes of the Chinese Peasantry and their Attitudes Toward Revolution," in Stuart R. Schram, The Political Thought of Mao Tse Tung, Frederick A. Praeger, New York, 1963, pp. 172-177. Mao divides the pre-revolutionary Chinese peasantry into eight economically-defined classes: the big landlords, small landlords, peasant landholders, semi-landholders, share croppers, poor peasants, farm laborers and rural artesans, and elements declasses. My own rough translation of Mao Tse Tung's classification into the scheme presented by Akhter Hameed Khan would equate the big landlords with zamindars, the small landlords with big farmers, and the peasant landholders of China with the small farmers of East Pakistan. For the rest, Mao's discrimination is much finer than Khan's.

[14] Akhter Hameed Khan, "The Essence of the Comilla Program," op cit, p. 2.

[15] Author's lecture notes from Agricultural Economics 865, "Rural Development Administration," Michigan State University, Winter term, 1975.

[16] Akhter Hameed Khan, "Principles of Rural Development," speech sponsored by the Asian Studies Center, Michigan State University, June 11, 1964 (mimeographed), p. 6.

[17] Akhter Hameed Khan, Reflections on the Comilla Rural Development Projects, Overseas Liaison Committee, American Council on Education, Washington, 1974, p. 11.

[18] Akhter Hameed Khan, "Learning from China, A Pakistani Experience," speech delivered at the International Seminar on Rural Development, Michigan State University, 1975, p. 2 (mimeographed).

[19] Ibid., pp. 2, 3.

CHAPTER 2

The Need for Models

> Many of us have seen the farmers of these lands. We have watched while they strained to guide clumsy wooden plows across meagre fields. We have seen them, clad in cotton drawers or breech clouts, thigh deep in paddy field mud, painstakingly tending young rice plants. Our arms and bodies have ached in sympathy as we observed the laborious efforts to break heavy clods with primitive hand tools. Perhaps some of us have wished we could somehow penetrate the minds that direct these bent, straining, fragile bodies through endless steaming days of toil. But unfortunately our efforts at understanding place us somewhere between guess and conjecture as we return to our desks - our papers and endless reports to satisfy those who understand less than we.[1]

The World Bank and the Rural Poor

The major issue which this book addresses was posed, hardly for the first time but perhaps more prominently than before, by Robert McNamara in a speech to the Board of Governors of the World Bank in Nairobi in 1973. McNamara said that the most difficult problem in fashioning a strategy for the world-wide development of small holder agriculture is the design of an appropriate organizational structure. He asserted the need, which he called the most critical of all, for "new forms of rural institutions and organizations that will give as much attention to promoting the inherent potential and productivity of the poor as is generally given to protecting the power of the privileged.... What is required is the organization of local farm groups which will service millions of farmers at low cost, and the creation of intermediate institutions through which governments and commercial institutions can provide the necessary technical assistance and financial resources for them."[2]

A year and a half after McNamara's pathbreaking Nairobi address, the World Bank published a sector policy paper on rural development.[3] The policy paper made mention of several examples of rural development projects, such as the Gezeira land settlement scheme in the Sudan, the Puebla project in Mexico, and the Comilla projects in Bangladesh. Yet anyone who reads the rural development policy paper in search of answers to the organizational problems posed by the bank president will be drawn to the conclusion that the World Bank staffers who prepared the paper have only the vaguest clues as to how an acceptable rural development organization might be put together.

The Rural Development Sector Policy Paper states that there is a growing consensus on the need for national planning for rural development, coordination at the central government level, decentralization at the regional and local level, and participation by the rural poor. Beyond these platitudes, the authors of the policy paper offer little concrete advice. They note that the minimum package program has worked in Ethiopia, that the Republic of China has done well with its Joint Commission on Rural Reconstruction, and that area development schemes have been successful in places such as Comilla. Among the few conclusions which they draw from these examples is a negative assessment of the potential dangers of area development schemes, which they say can unduly concentrate resources and "distort priorities in the allocation of resources among sectors."[4] Plaintive commentary of that sort achieves little. The intellectual road to which Robert McNamara pointed in Nairobi still lies open and untravelled.

The Deficiency of Present Theory

The road ahead is not, however, well mapped or even clearly perceivable. Only a few yards in front of us the verge is blurred by our essential ignorance of peasant society. And the road to rural development appears to divide, with one lane twisting through the thicket of land reform, another through the jungle of green revolution, and still another over the rough hills of cooperation. In the distance the route is lost in a shifting fog from which flash as disturbing beacons predictions of doubling world population, oil depletion and fertilizer shortage, Malthusian starvation, and cataclysmic retribution.

We might traverse the road to rural development more expeditiously if we could rely on some social or economic theory to guide our stumbling pace, much as the Chinese found guidance, or at least solace, in the thoughts of Mao Tse Tung. Unfortunately, the stock of theory on rural development, and especially on rural development organization, is meagre. Perceptive commentary on the subject is extremely rare. The intellectual situation is so bad that the late Frederick H. Harbison of Princeton University remarked that, "...for massive rural development, the skills are uncertain, the organizational structures are not developed, the leadership is unidentified, and the techniques for motivating change are largely unexplored. Both with respect to theory and practice, organization for rural transformation is probably the most underdeveloped area in the entire field of economic growth."[5]

If the subject of organization for rural development is virtually unexplored territory, the larger topic of rural development theory is only slightly better known. With the exception of a few economists, theoretically inclined academicians seldom write on the subject. There is a small literature of ideas that have been transplanted upon the wasteland from well-watered academic disciplines, but there are no oases of thriving thought.

As recently as the early nineteen seventies, when the International Council for Educational Development conducted their World Bank - sponsored research project on non-formal education and rural development, they found the field as intellectually arid as ever. "Although much attention has been given by scholars to evolving general theories of national development (mainly the economic elements)," they commented, "surprisingly little has been given to describing and explaining the nature and process of rural development. We were obliged, therefore, to improvise."[6]

The Cornell Rural Development Study

One of the few enlightened discussions of the genesis of rural development is contained in Norman T. Uphoff and Milton J. Esman's summary of the findings of a wide-ranging Cornell University study of 18 cases of rural local government in Asia. In that summary, Uphoff and Esman explain their empirical finding that "local organization is a necessary if not sufficient condition for accelerated rural development, especially development which emphasizes improvement in the productivity and welfare of the majority of rural people. Those cases in which there was more organization reaching down to the local level, accountable to the local people, and involved with rural development functions...have accomplished rural development objectives more successfully with respect to the available resource base than have those with less rural organization."[7]

The studies supervised by the Cornell Rural Development Committee, which was supported for the research project by the U.S. Agency for International Development, examined cases of rural local government from Japan to Egypt, including Bangladesh. Upon review of the case study reports, and of the discussions about them which had taken place among members of the rural development committee, Uphoff and Esman extracted seven general principles for successful organization for rural development. These seven principles comprise the closest analog of which I am aware to an operational theory of rural development organization.

To demonstrate the utility of theory in the design of rural development organizations, I have quoted Uphoff and Esman's seven principles below, and shown how each applies to the Comilla experience. Background information which will set the scene for later chapters is presented in the course of this exposition of the seven principles. These principles will be amplified, and linked to the larger literature of organization theory, in subsequent chapters. Because those chapters on organizational structure, technology, and so forth contain extensive reviews of the literature, and in two cases explanations of dynamic system models as well, the material on the Comilla experience in each chapter is necessarily compressed to an exclusive focus on the cooperatives. To give the reader a more comprehensive understanding of the experiment in rural development organization that began in Comilla, the illustrations in this chapter are drawn from two organizations which flourished there in the nineteen sixties: the Basic Democracies system of local self-government, and the Comilla cooperatives. Many more rural development programs were launched in Comilla Kotwali Thana -- as, for instance, the programs for family planning, tubewell irrigation, and milk processing -- but I have chosen to concentrate in this chapter on the two organizational innovations which best exemplify the seven design principles for rural development which Uphoff and Esman extracted from their field research.

1. "Local institutions should have more than one level of organization, probably a two-tier pattern, in which the lower tier performs functions at the neighborhood or small group level, while the other undertakes more complex business activities that require relatively large scale operations." (Uphoff and Esman, 1974, p. 99).

The multi-tiered approach to administrative organization has been characteristic of the governments of the Indian sub-continent for centuries past. In the sixteenth century the Moghul Emperor Akbar created the prototype of a territorial hierarchy of administration by inserting above the existing network of sarkars (which themselves resemble the districts of India, Pakistan, and Bangladesh) another level of provinces. Each province, or subah, was ruled by a senior imperial official called a subadar, who was responsible for security. The subadar's counterpart in the province was the diwan, who collected revenue.

The British rulers of Indian perpetuated the Moghul two-tiered administrative system of provinces and districts. The two administrative layers which the British added to the system -- the division between the province and the district, and the subdivisions below the district -- never attained the same bureaucratic status or popular legitimacy as the provinces and districts which were tracable to Emperor Akbar. The units of the territorial hierarchy of administration which was fashioned by the British, and retained by the government of Pakistan, is summarized in Figure 2-1.

Administrative Unit	Number of Units in East Pakistan	Principal Officer
Province	1	Governor
Division	4	Commissioner
District	17	Deputy Commissioner
Subdivision	54	Sub-divisional Officer
Thana	413	Civil Officer
Union	4,053	Union Council Chairman
Village	64,000	No legal head

Figure 2-1. The Territorial Hierarchy of Administration

In the British province of Bengal generally, and in its Muslim eastern hinterlands especially, the careful balance which Akbar had struck between revenue collection and other aspects of administration was upset. The British rulers of Bengal acquiesced in a pattern of indirect revenue collection which had been established early in the eighteenth century by the Moghul diwan of Bengal, Murshid Quli Khan.[9] In 1793 Lord Cornwallis, head of the British East India company, enacted what came to be called the Permanent Settlement. This arrangement formalized for the next century and a half the system of collecting land revenues in Bengal through a class of tax agents known as zamindars.

The _zamindars_ assumed some proprietary right to the lands in their tax estates. A consequence of this delegation of governmental tax collecting responsibility was that the formal institutions of the British administrative system, especially at the crucial district collectorate level, were truncated in Bengal.[10] The province of Bengal was characterized, according to the British rulers themselves, by administrative starvation. Elliot Tepper has described the administration of the Muslim districts of British Bengal as "a strong superstructure with weak underpinnings."[10]

After Pakistan obtained its independence of Britain, and of India, the abrogation of the 1793 permanent settlement was widely supported in East Pakistan. The popularity of the land reform measures of 1950-51 was enhanced by the fact that most of the _zamindars_ had been Hindu, whereas East Pakistan was newly launched as a wing of a Muslim nation. The demolition of the structure through which land revenue had been collected for a century and a half left an administrative void, nonetheless, since the hierarchies of agents established by each _zamindar_ had been among the few approximations of a link between the Bengali villagers and the exalted nexus of governmental power. In some areas of the province it seems that the _zamindars_ had at one time performed, albiet at the cost of exploitation, positive governmental functions such as the coordination of maintenance work on embankments and drainage canals. Rehman Sobhan remarks that these functions were progressively abandoned as the _zamindars_ left their country estates for a more comfortable city life, leaving the rural infrastructure of embankments and canals in a state of general decay.[11]

A signal attempt at filling in the administrative void below the district level was the multi-tiered system of Basic Democracies, promulgated by Field Marshall Ayub Khan, the Pakistan Chief of State in 1959. Basic Democracies were Ayub Khan's greatest and fondest innovation. He conceived of the layered system of councils, directly elected at the bottom, or union, level and increasingly appointed and bureaucratically controlled at higher levels, as a mechanism for the political socialization of the Pakistani populace, for their gradual education to the values and burdens of democracy and nationhood. A period of tutelage by the civil servants who dominated the higher level councils was anticipated, after which Ayub Khan averred that the Basic Democracies could become more democratic and less basic.[12] From Ayub Khan's perspective, one of the most valuable functions of the 80,000 basic democrats who were elected as members of union councils was the legitimation of his own rule; in 1962 and 1965, the basic democrats formed themselves into an electoral college, in accordance with the constitution which Ayub Khan had promulgated, and on each occasion selected him as president of Pakistan.

The form and philosophy of Basic Democracies were more of a novelty in West than in East Pakistan. So far as the rural populace of the eastern wing was concerned, Basic Democracies bore a resemblance to systems of local government through which they had, in a limited way, been resolving their affairs for three quarters of a century. In the late nineteenth century, which Elliot Tepper describes as "the earliest, and most paternalistic, period of British experimentation"[13] with local government in Bengal, the villages had been grouped into unions. The British imperial governors of Bengal sought to devolve upon committees and boards at the union level some of the governmental functions which the regular civil service and the _zamindars_ were so ill-prepared to handle.

The first imperial initiative in this direction was a flop. The Chaukidari Act of 1871 sought to have union committees tax the villagers to pay for a staff of chaukidars, or village policemen. The plan was abandoned following several violent protests from villagers who perceived the chaukidars and the union taxes as a new form of petty tyranny. The Local Self-Government Act of 1885 was more favorably received, since it gave local councils, in addition to the power of taxation and responsibility for the maintenance of rural order, a modest capability for carrying out more positive functions such as the building of roads. The three tiered system of councils created by the Local Self-Government Act prefigured Ayub Khan's Basic Democracies. Structurally, the major difference was that the intervening council in the 1885 arrangement was at the subdivisional level (the next level below the district in the British administrative hierarchy, and the lowest level to which members of the elite Indian Civil Service were posted), whereas Ayub Khan placed it one step lower down, at the thana level. Discussions about the powers and composition of the Union Committees, Sub-divisional Boards, and District Boards which preceeded the 1885 enactment also foreshadowed many of the controversies that were to be engendered by Basic Democracies.

William Gladstone, leader of the English liberal party in the late nineteenth century, expressed his opinion that "It is our weakness and our calamity that we have not been able to give to India the blessings of free institutions."[14] When he returned to the prime ministership in 1880, Gladstone sent out to India as Governor General his disciple Lord George Frederick Ripon. In his history of India, Percival Spear asserts that from Ripon's four year term of office, from 1880 to 1884, "dates the beginning of India-wide urban and rural self-government, which still follows in the main the original pattern."[15] Ripon advocated the establishment of a network of union and subdivisional councils, at least three fourths of the members of which were to be elected. The union councils in Ripon's plan were to have strong financial powers. In defense of his proposal Lord Ripon wrote:

> The task of administration is yearly becoming more onerous.... The cry is everywhere for increased establishments. The universal complaint in all departments is that of overwork. Under these circumstances it becomes imperatively necessary to look around for some means of relief; and the Governor-General in Council has no hesitation in stating his conviction, that the only reasonable plan open to the government is to induce the people themselves to undertake, as far as may be, the management of their own affairs; and to develop, or create if need be, a capacity for self-help in respect of all matters that have not, for imperial reasons, to be retained in the hands of representatives of the Government.[16]

Before it was officially enacted in 1885, after he had left office, Ripon's scheme was revised to suit the disposition of the imperial power elite. The strongest of the boards established by the Local Self-Government Act was at the district level, and it was chaired by the district officer, a member of the Indian Civil Service. The district officer was given the power to appoint members of the district board and of the lower boards. Financial and programatic powers of the union committees were severely restricted.

The same issues of bureaucracy versus democracy, of appointment versus election, and of the relative power of the union, district, and intermediate councils were to emerge in critiques of Ayub Khạn's system of Basic Democracies. The system as originally proposed by Ayub Khan resembled the conservative, bureaucratically-dominated structure of the 1885 Local Self-Government Act. Many Bengalis perceived the Basic Democracies system in the form in which it was first promulgated as a regression, since under the Local Self-Government Act of 1919 the democratic character and financial powers of the union committees (then renamed Union Boards) had been strengthened.

Akhter Hameed Khan played something of the role of the liberal Lord Ripon in urging, throughout the Ayub era and thereafter, the democratization and vitalization of the lowest levels of the Basic Democracies structure, the Union Councils and the Thana Councils.

The elaboration of rural administration over the centuries from Akbar to Ayub Khan has exhibited two themes consistently: the adherence to a territorial hierarchy of administrative power, and the descent of innovation to lower and lower levels of that hierarchy. For Akbar, the issue was the relationship between the <u>subah</u> and the <u>sarkar</u>, or, in modern analogy, between the province and the district. For Lord Ripon, who was ahead of the times, the issue was the relationship between the subdivision and the union; his successors, who actually enacted and implemented the Local Self-Government Act of 1885, put the emphasis on the relationship between district and subdivision. Ayub Khan's own thinking did not advance much beyond what the British imperialists had enacted in 1885. Akhter Hameed Khan emphasized the lowest dyad in the official hierarchy, the relationship between thana and union. Schematically, this evolutionary descent is summarized in Figure 2-2.

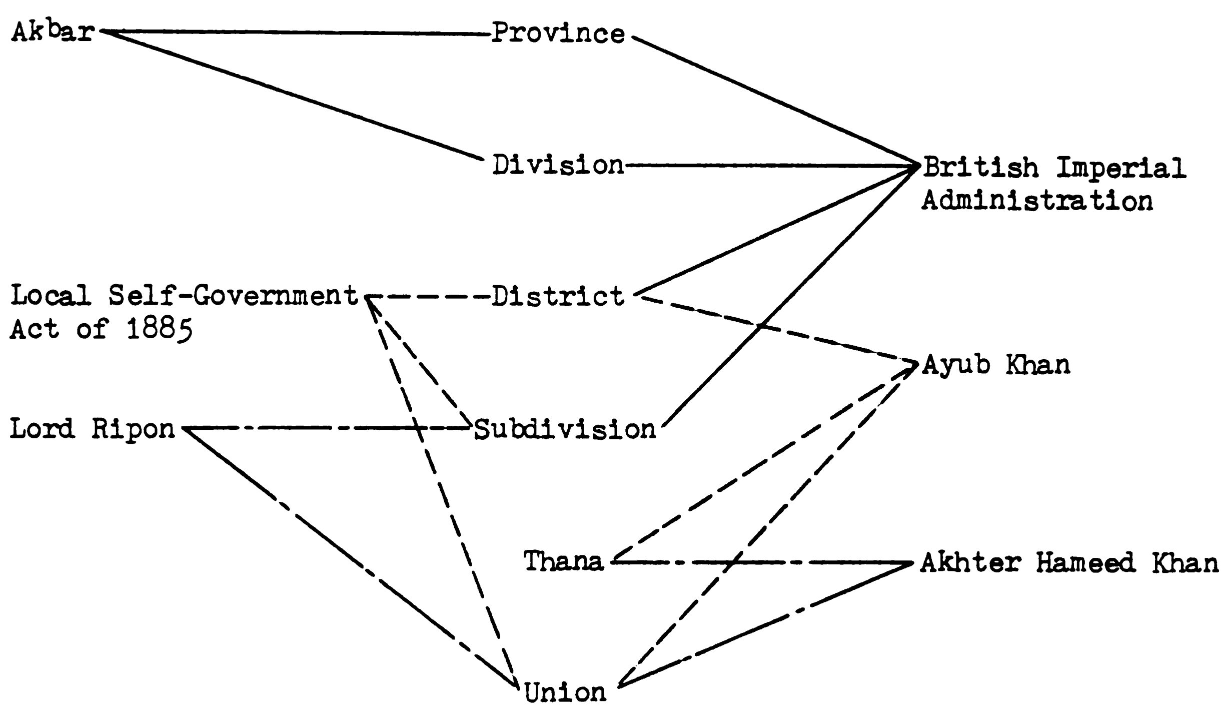

Figure 2-2. Levels of Administrative Interest

Even the thana-union dyad, however, does not match the recommendations of Uphoff and Esman for the proper scale of rural development organizations. The primary organizational unit for rural development, they suggest, should be the neighborhood, including from 30 to 100 households. The unions of East Pakistan, each of which included, on the average, between 12 and 13 thousand people, exceeded this ideal size by a very large margin. To attain the mobilization of the rural populace, organization on a more intimate scale was required. The Comilla village level primary cooperatives, which had an average of 34 members during the nineteen sixties, were of a more appropriate size. Since each cooperative member typically represented one household, the primary village cooperatives actually stood near the lower end of Uphoff and Esman's recommended scale of between 30 and 100 households for the primary organizational unit.

Peter Bertocci, who has examined the relationship of rural society to cooperative organization in Comilla more closely than anyone else, has asserted:

> The Comilla cooperative project has from its inception taken the "primary village community" as its grassroots organizational focus. Indeed, it seems fair to say that most development activities in Comilla Kotwali Thana have in effect bypassed the union level of political and administrative organization, with the single important exception of the Rural Public Works Program. Most cooperative societies in Comilla Thana would appear to be coterminous with the area's many "local villages." And where in the larger-sized villages cooperative societies are formed, it is common for such communities to have more than one cooperative, each of these established in parts of the village where neighborhood loyalties, as against those felt toward the larger collectivity, are strong. In a word, Comilla cooperatives tend to overlap with the project area's "natural" social groupings.[17]

2. "Local communities should be linked to higher level decision centers by <u>multiple channels</u>, both to achieve the benefits of specialization in communication and to enjoy alternative avenues of influence." (Uphoff and Esman, 1974, p. 100).

The best evidence for the satisfaction in Comilla Kotwali Thana of this second of Uphoff and Esman's criteria for rural development organization is provided in the appendices to their own report. In those appendices they describe the major methodological innovation of the Cornell Rural Development Committee's study as being the development of quantitative measures for the comparison of configurations of rural local organizations in different places. One of these quantitative measures dealt with the relative importance of different organizational channels in each of the 18 Asian cases studied. A standard matrix for each case was devised, with five categories of channels constituting the columns, and ten rural development functions forming the rows. The matrix for East Pakistan during the nineteen sixties, which was among the case studies in the Rural Development Committee's sample, is shown in Table 2-1.[18]

The 10 points alloted to each rural development function in the "Total" column are standard for each of the case study matrices. Entries in each row show how these 10 points were judged by the Cornell Rural Development Committee to have been divided among the five organizational channels of communication. For example, nearly all planning and goal setting in East Pakistan was performed by the state administration, which was given 9 out of the 10 points for this function. The sums for each column (44 for state administration) can be read as the percentage of rural development functions performed by each channel. The local government column in the matrix represents the system of Basic Democracies, which operated throughout Pakistan in this era. The column for associational organizations represents the otiose state-sponsored Union Multipurpose Cooperative system, plus miscellaneous farmers' organizations. Political organizations, it might be noted, were just about impotent at the local level in East Pakistan. It is important to recognize that the entries in the matrix indicate the proportional distribution of rural development functions in the place concerned (East Pakistan in this instance), and do not indicate the level or amount of activity that took place.

Because Comilla Kotwali Thana was such an exception in the area of rural development organization in East Pakistan in the nineteen sixties, the Cornell Rural Development Committee prepared a special matrix for the thana. (See Table 2-2.)

Table 2-1. Rural Development Channels in East Pakistan

	Local Organizations					
	Local Govt.	Assoc. Org's.	State Admin.	Private Sector	Pol. Org's.	Total
Planning and Goal Setting	1	0	9	0	0	10
Resource Mobilization	0	1	3	6	0	10
Provision of Services	1	8	19	22	0	50
Water	1	3	6	0	0	10
Fertilizer	0	2	3	5	0	10
Credit	0	1	2	7	0	10
Extension	0	2	8	0	0	10
Marketing	0	0	0	10	0	10
Integration of Services	3	1	6	0	0	10
Control Over Administration	1	0	5	3	1	10
Claim Making	1	1	2	4	2	10
	7	11	44	35	3	100
	18					

Table 2-2. Rural Development Channels in Comilla Kotwali Thana

	Local Organizations					
	Local Govt.	Assoc. Org's.	State Admin.	Private Sector	Pol. Org's.	Total
Planning and Goal Setting	2	3	5	0	0	10
Resource Mobilization	1	2	3	4	0	10
Provision of Services	4	21	9	16	0	50
Water	2	4	4	0	0	10
Fertilizer	1	3	2	4	0	10
Credit	0	4	2	4	0	10
Extension	1	8	1	0	0	10
Marketing	0	2	0	8	0	10
Integration of Services	3	5	2	0	0	10
Control Over Administration	1	2	5	1	1	10
Claim Making	1	3	2	3	1	10
	12	36	26	24	2	100

The major difference in the interpretation of the Kotwali Thana matrix is that the associational organizations column includes the Kotwali Thana Central Cooperative Association and its legions of local member cooperatives, an institutional innovation that was not present in most of the remainder of East Pakistan during the nineteen sixties. All in all, the channels of local organizations (local governments plus associational organizations) performed 48 percent of rural development functions in Comilla Kotwali Thana, as compared with 18 percent in East Pakistan as a whole. The proportionate influence of the state administration was cut down sharply in Kotwali Thana. With the continuing exception of political organizations, the distribution of functions among organizational channels was more even in Kotwali Thana than in East Pakistan, showing that the thana did indeed meet Uphoff and Esman's second criterion for successful rural development organization.

3. "Though specialization may be indicated for some activities, local institutions should ordinarily be vested with <u>multiple functions</u> in order to achieve the benefits of scale and to facilitate the local integration of services.... The organizational design for successful rural development is likely to be a limited number of local institutions which are multi-level and multifunctional and which communicate through multiple channels." (Uphoff and Esman, 1974, pp. 100, 101).

In Uphoff and Esman's conceptual framework, the important functions of rural development organizations are those which make up the rows of the matrices displayed in Tables 2-1 and 2-2, i.e. planning and goal setting, resource mobilization, the provision of services, the integration of services, control over administration, and claim making. A complete explanation of how these six types of functions were performed in Comilla Kotwali Thana by the basic democracies and by the agricultural cooperatives would be a voluminous undertaking. Rather than catalog all of the functions of these organizations in accordance with Uphoff and Esman's typology, I would call the reader's attention once more to the entries in the first two columns of Table 2-2. Read vertically, the distribution in both columns are fairly even, indicating that just about the whole gamut of rural development functions was performed by local government organizations and local associational organizations in Comilla Kotwali Thana during the nineteen sixties. The major examples of these organizations in the thana at the time were the basic democracies and the cooperatives.

The rural cooperatives at the village and thana level were especially distinctive for the diversity of their activities. Among their more salient activities were the disbursal and collection of loans; the installation of irrigation tubewells and the management of water distribution; projects in literacy, family planning, and women's uplift; agricultural demonstration and extension; processing and marketing of milk, rice, and other crops; and massive, unending training of all levels of personnel. These wide-ranging activities were fused at the level of the primary cooperative, which served as a single conduit into the village, but were divided out into specialized sections of the thana central cooperative association. Managerial talent, which was perhaps one of the scarcest attributes of the Comilla villagers, was thereby husbanded by the primary cooperatives. The thana cooperative association, which employed professionals who were not of the village mold, took full advantage of the efficiencies ensuing from organizational specialization. Like a modern corporation set up on functional lines, the thana cooperative association had organizational units for the creamery, for the cold storage plant, for tubewell sinking, for tractor driving and repair, and for other such functions.

A further issue that deserves comment is why so many activities should have been undertaken by the cooperative association, and pressed upon the villagers by means of the primary cooperatives. At the thana level also there were limits to management capabilities, and it might be argued that the cooperatives would have done better to concentrate on a few key projects -- such as tubewells, extension and credit -- rather than dissipating financial resources and executive energies in so many directions. The germ of a rejoinder to such a criticism is to be found in Arthur Raper's book about the comprehensive rural development experiment at Comilla. In his final chapter of reflections Raper observes that "the quality of intersupportiveness permeates the Comilla program as one activity leads to or strengthens another, and so each enhances the other."[19]

Lane Holdcroft, an officer of the Agency for International Development who took a sabbatical at M.S.U., has said that mutually reinforcing components or activities are characteristic of successful rural development programs around the world. He compared this characteristic complementarity to the interaction of factors of production in an economic production function. When such complementarities are present, "the application of two or more improved inputs, e.g. seed, fertilizer, and water, result in more total output than the sum of the increases which can be attributed to each individual input."[20] Mathematically, such interaction effects can be expressed as the multiplication of the factors of production one by another, causing the production function to be non-linear.

One of the complementary input relationships which Akhter Hameed Khan has come to believe in ever more firmly is that between land improvement and technological innovations in agriculture. For the peasants, he asserts, land protection and land improvement is the primary issue, and for them all else must follow after. In a speech which he gave in 1975 about lessons from China and their influence on the Comilla rural development projects, he said:

> During our investigations we had discovered that the losses caused by flood and drought were immense and frequent. The villagers themselves attributed their destitution primarily to these losses. Their first demands were always for roads, drains, embankments, canals and wells. Our agronomists, on the other hand, emphasized the use of "miracle" seeds and chemical fertilizers. Through intimate knowledge of our ecology, we comprehended why the Chinese were mobilizing millions of men, year after year, for land improvement, a priority which we had neglected. Learning from them we organized a rural works program which simultaneously built the infrastructure, provided gainful employment to otherwise idle agricultural laborers, and prepared the ground for a stable and progressive agriculture (including the miracle seeds and fertilizers).[21]

This expost facto interpretation of the intellectual origins of the Rural Public Works program turns the tables of history quite violently around. While it seems to be true that the Chinese example influenced the thinking of Akhter Hameed Khan as long ago as the early nineteen sixties, when the Comilla rural development projects were just getting started, American advisors have customarily been given much of the credit for initiating the Rural Works Program.

In October of 1960 Dr. Richard V. Gilbert, the chief of the Harvard Advisory Group to the Planning Commission of Pakistan, took a boat ride with Akhter Hameed Khan through flood-stricken regions of Comilla Kotwali Thana. Because of breaches in poorly maintained levees and the ensiltation of drainage canals, flooding in a 25 square mile area south of Comilla town had for four years damaged the spring rice crop, driving the villagers there to utter destitution. Akhter Hameed Khan explained the need for repairing the embankments and canals. Gilbert suggested that a leaf might be taken from Franklin D. Roosevelt's book, in that a dry season public works program could be organized similar to the Works Progress Administration of the depression years in the United States. As Gilbert put the case somewhat later: "Your villages are in a state of depression. There is a lack of employment, and there is a lack of local capital works. Why is it not possible, in the slack work season, to put your idle people to work building roads, drainage canals, and an irrigation system - the very things the villagers need so badly?"[22]

Gilbert took the idea of a rural works program for East Pakistan back to the headquarters of the planning commission, in Karachi. His proposal was to finance the works program with American surplus food commodities, donated under United States Public Law 480, which could be given to village laborers directly as wages, or which could be sold for rupees to be paid to the workers. To Gilbert's consternation, the proposal elicited a barrage of opposition. It was asserted, for example, that a massive works program would either overburden the civil service, or, if its implementation were entrusted to union councils, would lead to rampant corruption in the rural areas. Hearing such criticism, Gilbert fulminated, "A works program, in the context of the labor surplus which, in the East wing, as in India, is probably of the order of 25 percent, is so obvious a necessity that I find myself getting furious at the array of argument, pseudoanalytical or practical, that is thrown up."[23] Gilbert soon swung the Planning Commission, the cabinet, and the president to his side, however, and encouraged negotiations with the United States government for an expanded program of P.L. 480 assistance. In August of 1961 an agreement was completed for $621 million of U.S. surplus agricultural commodities, to be used, in part, for a works program in the rural areas.

In September of 1961 the Planning Commission formally inquired whether a pilot rural works program might be undertaken in Comilla Kotwali Thana. Akhter Hameed Khan replied affirmatively, and brought the idea before the Kotwali Thana council in October. Proposals for projects were solicited from the union councils, and were speedily consolidated into a rural works program for the thana. As it happened, delays in the implementation of the U.S.-Pakistan P.L. 480 agreement made it impossible to finance the pilot works plan from the intended source.[24] Through the intervention of Richard Patten, an East Pakistan advisor associated with the Harvard Advisory Group, financing was secured from the minor irrigation project fund of the provincial Agriculture Department. In Kotwali Thana, 44 project committees, each chaired by a union council member resident in the vicinity of the particular project, carried out the pilot works program during the dry season in the early months of 1962.

The results of even such a hastily assembled pilot scheme were impressive. Eight million cubic feet of earth were moved by hand labor. In keeping with a long-standing concern of the Comilla villagers for flood control and drainage, 34 miles of drainage canals were cleared and 14 miles of embankments were constructed. The three-month spurt of land-improvement activity in the pilot works program mobilized

46,000 man days of labor, at a total cost of 202,000 rupees, or about 42,000 dollars.

The Pakistan government and the American aid mission responded to these results enthusiastically, some have said too enthusiastically, and replicated the rural works program throughout East Pakistan in 1962-63, and throughout the country the following year. Annual works programs implemented through the Basic Democracies structure became a characteristic feature of rural life in Pakistan for the remainder of the Ayub Khan era. In modified form, the rural works program was perpetuated by Ayub Khan's successors, and by the government of Bangladesh.

Appraisals of the rural works program in East Pakistan during the nineteen sixties are quite varied. Edward S. Mason entered one of the strongest encomiums, calling the program "probably the most successful attempt to use effectively the services of underemployed agricultural workers that has been undertaken in any less developed country."[25] An astringent judgement has been rendered by Walter P. Falcon, who contends that the program was ineffective in producing rural employment except at the margin, since only 3.5 percent of the estimated rural unemployed were given jobs.[26]

A criticism of the works program which was at first stridently expressed -- that the rural councils were technically incapable of completing such a vast enterprise -- by and large subsided after 1963. On the basis of his field research in eight dispersed thanas in East Pakistan, Thomas concluded that works program rural roads were constructed in a logical pattern, coinciding with economic and administrative needs, and that 95 percent of them were maintained. About 10 percent of the works program bridges, in Thomas's estimation, were inadequate for their intended carrying capacity. Undeniably a tremendous quantity of earth was moved by hand labor, mostly for the purpose of building embankments to elevate dirt roads above the annual flood level. In 1963 East Pakistan had but 3,411 miles of useable roads. Over a hundred thousand miles of roads were built or repaired in the province between 1963 and 1967.[27]

A commoner's assessment of the impact of the new roads has been recorded by Mahamoodur Rahman, of the faculty of the Academy for Rural Development in Comilla. In 1966 he interviewed a cross section of East Pakistan citizens to ascertain their views of the works program. A group of rickshaw pullers told him that rickshaws had increased in number in recent years, and "were replacing the traditional time consuming and laborious palanquins which were used until recently for carrying women from one place to another. Outsiders can now easily reach the remote interior areas of the villages.... Some rickshaw pullers said that their incomes had also risen due to increased use of their rickshaws by the people. They added that the building of roads had brought about great changes in the villages."[28]

One of the criticisms of the Rural Works Program which has stood up better than many others is that it was at bottom an American give-away program, and did not require the commitment of indigenous resources. The works program funds which flowed to the union councils, thana councils, and district councils of the Basic Democracies structure were American, and not Pakistani, in origin. The works program did not require any reallocation of indigenous tax revenues away from the departments and personnel of the established administration. Nor did it evoke a financial commitment from the rural people who were its beneficiaries. Tax assessments and collections by the union councils did not increase during the years of the works program. Despite administrative directives placing the responsibility for maintenance of works projects upon the union councils and their local resources, maintenance was typically arranged through new works program allocation. In a conversation with the author in 1977, Akhter Hameed Khan observed that in East Pakistan only the people were mobilized for the reconstruction of the land, whereas in China land improvement schemes carried out by the commoners had mobilized both people and resources.

Even if it is granted that the union and thana councils mobilized no more than people and dirt for the Rural Public Works Program, that still stands as a considerable endeavor. I find it hard to understand, therefore, why the functional matrix in Table 2-1 shows zero for the mobilization of resources by local governments in East Pakistan during the nineteen sixties. Even in the Cornell committee's matrix for Comilla Kotwali Thana, shown as Table 2-2 above, local governments are credited with only one out of 10 points for resource mobilization. In the province of East Pakistan and in the special case of Comilla Kotwali Thana, local governments should have been given more recognition for their accomplishments.

4. "Politics, the competition among groups for influence and resources, must be accepted as inevitable and legitimate in rural local organization.... It is not required that all benefit equally -- nowhere is this achieved. What must be avoided is the politics of exclusion or monopoly, where practices of patronage cut certain persons or groups off from the benefits of government." (Uphoff and Esman, 1974, p. 101).

During the nineteen sixties, which were the golden years of worldwide admiration for the Comilla projects, little notice was given to the political competition underway in the union councils and village cooperatives. This inattention was to a large degree a reflection of the anti-political attitude of the Ayub Khan regime, in which it was considered proper to focus on overcoming the administrative problems and resolving the policy issues involved in economic development, but not to discuss the interplay of social classes and political factions.

In an occasional address, such as the 1963 speech to the U.S. agency for International Development conference referred to in the last chapter, Akhter Hameed Khan explained his vision of class conflict in the villages of East Pakistan. But his vision was seldom followed up in that era by empirical studies of the patterns of influence of farmers owning differing amounts of land. This is not to say that data on the landholdings of the leaders of the village cooperatives and union councils was not collected; but the information, once reported, was usually passed over without incisive commentary. An academy-sponsored evaluation of the rural public works program in East Pakistan during 1962-63, for example, found that five sixths of the rural works project committee chairmen and a little less than three quarters of the project committee secretaries owned five acres of land, or more. The academy faculty who wrote the evaluation report noted that "the amount of land owned ranges up to more than 35 acres, indicating a high correlation between land ownership and rural leadership."[29] And that was all they said on the matter.

Subsequent reviews, both by Bengalis and by Western scholars, have been less evasive and much more critical. Urban residents and intellectuals in East Pakistan were never fond of the system of Basic Democracies, since they correctly divined that Ayub Khan had engineered the system so as to reduce their share of national political power. It is not surprising, therefore, to find that a study of Basic Democracies originating in the Bureau of Economic Research of the University of Dacca presented a scathing characterization of the union councillors as venal representatives of a corrupt rural oligarchy. Yet the study, supervised and written up by Rehman Sobhan, cannot be easily dismissed. The empirical evidence about the rural works program which he amassed from interviews with 1,819 persons in 114 randomly chosen unions in East Pakistan in 1964-65 is compelling. Sobhan found, for example, that 64 percent of his respondents thought the union council members to be corrupt, and 63 percent thought that the union council chairmen misused funds from the public works program.[30] The slant of his discussion is intriguing; he devotes much of one chapter to a description of Akhter Hameed Khan's 1963 address to the U.S.A.I.D. conference in Comilla, and contends that the Basic Democracies, far from liberating the small farmers, increased the dependence of the small farmers on the surplus farmers who dominated the union councils. In his chapter on "The Politics of the Works Programme" Sobhan remarked:

> In the perhaps genuine belief that they were building up the infrastructure of the villages, the government poured money not into the hands of the villagers but into the hands of the 'surplus' farmers in their role as union council members. This served a mutually beneficial purpose. It bound the B.D.'s* more closely to the government both in general and more specifically in the machinery of local government. At the same time it greatly strengthened the hands of this class at the village level. It made them into direct dispensers of financial patronage.... Now not only were they the moneylenders and land leasers of the village but also the dispensers of jobs and fringe benefits. Here it

* Basic Democrats, another term for Union Council members.

> is important to note that their control over the landless or land poor labourer in particular must have increased even more than over the generality of villagers. It was this class of villager who was most dependent on the 'surplus' farmer for a bit of land to farm or for implements or for casual jobs during the harvest. Now his landlord and creditor also become the arbiter of whether he would work and hence eat in the winter months.[31]

Whether Sobhan's sweeping characterizations should be accepted *in toto* is open to question. He has the biases of an armchair socialist who relished a theoretical affinity with the rural proletariat, and who deeply resented the Ayub Khan regime. He tended to play up the derogatory findings of his field research, and neglected to remark upon those findings which were complimentary to the Basic Democracies. He found, for example, that 72 percent of his interviewees described union council members who were reelected in 1964 as honest and sincere, yet that information appears only in a table and not in the text of his book. His conclusions contradict, moreover, the assertions of many enthusiasts for Basic Democracies and the rural works program. John Thomas, in a monograph which he wrote for the Development Advisory Service of Harvard University, commented that the works program "has helped to create a new, modernizing leadership for the rural areas, and it has provided the framework for participation in the governmental process."[32]

Between the analyses of rural politics proposed by Sobhan and Thomas, my own reluctant inclination is to place greater credence on Sobhan's, since events subsequent to 1968, when both authors published their research, have tended to bear out the characterization of the union councillors during the Ayub era, and especially of the union council chairmen, as members and agents of the rural economic elite.

The implications of the events of late 1968 and early 1969, when a prolonged series of riots and demonstrations culminated in Ayub Khan's resignation, have been summarized by Akhter Hameed Khan in cutting terms:

> The Ayub model of rural local government was a failure: it did not mobilize the rural people, and it alienated the urban people. The result was a revolt of the urban people who with the help of the army overthrew Ayub Khan. There was not a ripple of protest in the rural areas, because the union councils had been captured anyway by the landlord class, who in any event were in league with the urban economic elite.[33]

Viewing the Basic Democracies experiment in retrospect, Akhter Hameed Khan noted in 1975 that local councils are no longer advocated with such enthusiasm by rural development planners, since it has become apparent that they promote neither mobilization nor stability in rural areas.[34]

Rehman Sobhan concluded his acidulous book with an affirmation of hope in village cooperatives of the Comilla variety as the potential guardians of the interests of the small farmers of East Pakistan. He conceded that the cooperatives neglected those at the bottom of the economic scale, the landless laborers, but he contended that with some reorientation, perhaps including land reform, cooperatives of the Comilla stripe might circumvent the oligarchical pitfalls of the union councils. This line of thinking accords very well with what Akhter Hameed Khan has argued for many years: that the village cooperatives should serve as a shield, or even as a trade union, for the small farmers to protect them against exploitation by the large farmer moneylenders and by the traders. And it is quite possibly true, as Akhter Hameed Khan has further argued, that the village cooperatives could serve as the training ground for a new corps of rural leaders who would eventually unseat the oligarchs on the union councils; such seemed to be the trend, at least, in the Union Council elections in Comilla Kotwali Thana in 1964.

Unfortunately for those utopians who foresaw the salvation of rural society as emerging from village cooperatives, the same critical attack which Rehman Sobhan made against the union councils has been made against the Comilla village cooperatives by Harry W. Blair, a political scientist from Bucknell University. The Cornell Rural Development Committee commissioned Blair to write one of their 18 case study reports on the topic of rural local government in Bangladesh. He visited Bangladesh in the summer of 1973 to do field research, and read widely on the many institutional approaches to rural development which have been attempted in the country. Since Bangladesh was at the time of his visit still reeling from the war for independence from Pakistan, most of Blair's material concerns the more stable decade of the nineteen sixties, and especially the agricultural cooperatives which then took shape in Comilla Kotwali Thana.

Blair's thesis is that many of the primary cooperatives in the thana were corrupted from about 1967 onwards when surplus farmers with landholdings of five acres or more muscled their way into the leadership of those cooperatives, and appropriated to themselves a major share of the cooperative loans. Blair concludes that after a promising start in the direction of assisting small farmers, the Comilla cooperatives went the way of almost every other experiment in institution-building for rural development in South Asia: toward local control by elite interests.[35]

I shall have more to say about the details of Blair's critique in later chapters. Suffice it to say for now that he has surfaced the question of whether the politics of the Comilla cooperatives remained open to and protective of the small farmers who comprised the largest bloc of the rural population of Comilla Kotwali Thana. He has thereby cast doubt on whether the fourth of Uphoff and Esman's criteria for successful rural development organization was fulfilled by the Comilla cooperatives.

5. "Sanctions to control the acts of leaders of local organizations should be applied from above and from below to get best performance." (Uphoff and Esman, 1974, p. 102).

The most significant sanction in both systems, Basic Democracies and the Comilla type cooperatives, was constituent pressure, which was encouraged by requirements for open meetings, publication of financial records, and periodic elections. Thomas reports, for instance, that each project undertaken in the rural works program was expected to be discussed beforehand in public meetings, that works program allocations to the union councils were supposed to be made public knowledge, and that signboards were to be put up at the site of each project to identify the scope of work, the amount to be spent, and the project committee chairman. He contends that these requirements, with the exception of the signboards, were generally fulfilled. His field research in a sample of eight thanas showed that 100 percent of his village respondents could identify at least one rural works project in their area, and 87.5 percent could identify four or more.[36] He asked a random sample of 227 villagers to indicate whether they thought that 1) demonstrated ability to serve the community, 2) age, 3) money, or

4) important family connections was the most important prerequisite for election to a union council. Demonstrated ability to serve the community garnered 45 percent of the responses. Money was the runner up, with 33 percent.[37]

Although publicity, constituent pressure for good performance, and the possibility of electoral defeat did control the union councils to a degree, these were about the only sanctions that were applied. There was an official requirement that rural works project committees maintain an accounts book, muster roll, measurements register and daily attendance register, and that these records be audited by the Circle Officer at thana headquarters. An evaluation survey of the operation of the rural works program in 62 unions of 19 thanas, conducted by the Comilla academy in 1964, revealed that the circle officers had found that these registers were improperly maintained in nine tenths of the cases. For the most part the circle officers threw up their hands at these irregularities, as did the academy evaluation team. The team excused the lapse in record keeping on the grounds that "(1) village people, who are completely ignorant about keeping registers, have been required for the first time to keep six different registers properly; and (2) no necessary correlation between improper maintenance of registers and misappropriation of funds can be established."[38]

A major cause of the laxity of administration in the rural works program was the breakneck pace of its expansion. After the completion of the pilot works program in Comilla Kotwali Thana in 1961-62, the Academy for Rural Development recommended that a works program be attempted the following year in the 54 thanas adjacent to sub-divisional headquarters, so that administrative supervision and assistance with technical engineering problems could be assured. The academy was also concerned that union councilors and thana officers receive sufficient training in the recommended procedures for project planning, the formation of project committees, the maintenance of records, and so forth. All of the union councilors and thana officers who had been involved in the pilot works program in Comilla were carefully trained at the academy. Project plans for the pilot project had been checked out for technical feasibility and integrated into a thana-wide scheme. As the result of such precautions, few irregularities of works construction or of record keeping had been detected in the pilot program. All in all, the deliberate expansion schedule for the rural works program which was proposed by the academy projected that the entire province of East Pakistan would be included in the program after eight years.

The decision taken by the East Pakistan government, instead, was to spread the rural works program across the whole province in one year.[39] Training of the participants, under such circumstances, was perfunctory. A crash three day orientation was arranged for 295 circle officers, while the circle officers from the 54 thanas included in the academy's earlier planning were treated to a two week course at Comilla. Sobhan comments sarcastically:

> The union council members, for their education, had to be content with invitations to Dacca and Rajshahi to the chairmen and three members from each union to hear a public address by the President and the Director of the academy. We are not told how these inspiring addresses were translated into the know-how necessary to carry out the programme in the 4053 unions of East Pakistan.[40]

The replication of the Comilla cooperative experiment, by contrast, proceeded at a pace which was much more restrained. Comilla-type cooperatives were organized in three new thanas outside of Comilla district in 1963-64, and seven more thanas within Comilla district established cooperatives in 1965-66. The balance of 13 thanas in Comilla district organized the two-tiered cooperatives three years later, in 1968-69. Only at the very end of the decade of the sixties, when the government of East Pakistan was itself on the verge of extinction, was a plan promulgated for spreading Comilla-type cooperatives to all the thanas of the province under the auspices of a scheme called the Integrated Rural Development Program, which was subsequently picked up by the government of Bangladesh.

The most important reason for the gingerly pace of the expansion of the Comilla cooperatives during the nineteen sixties was an alternating hesitancy on the part of Akhter Hameed Khan and the provincial government. On several occasions in the early sixties the academy was urged to duplicate its cooperatives widely, but Akhter Hameed Khan resisted because he was not confident that a good model for replication had yet been developed. In 1965, after encouraging reports had come in from the first three additional thanas, and after the organizational pattern in Comilla Kotwali Thana appeared to have clarified, he began to press for expansion. Three months after the next seven thanas in Comilla district were taken up, war broke out between Pakistan and India, throwing all planning into disarray. When the country settled down again in 1966, the governor of East Pakistan, Abdul Monem Khan, began to heed conservatives in the Muslim League who were hostile to the Academy for Rural Development and its organizational endeavors among the poor.

The requirements of recruiting, training, and supervising the project directors for the new Thana Central Cooperative Associations

(TCCA's) were also a cause for caution in the expansion program. For the cooperatives, with which he identified far more closely and personally than with Basic Democracies or the works program, Akhter Hameed Khan was determined to avoid the fiasco of lassitude and corruption which resulted in India when the community development program was spread at maximum speed throughout the country in the nineteen fifties. Young and relatively idealistic officers from the East Pakistan Civil Service were chosen for the TCCA project director posts. Each was trained for six months in Comilla, in classroom sessions at the academy and through observation of the many field activities of the cooperatives. Once the TCCA's were established, their key staff assembled monthly in Comilla to discuss problems and progress. Beyond the competence of the TCCA project directors, their probity was a matter of real concern. Because of the powers that were concentrated in the Thana Central Cooperative Associations, the Comilla-type cooperatives were very vulnerable to corruption at the upper echelon. The two officers who bore the major responsibility for building up the Kotwali Thana Central Cooperative Association, Zakir Hussain and Shamsul Huq, were tested and incorruptable veterans, Zakir Hussain from the police service and Shamsul Huq from the provincial cooperative department. But men of their ilk were exceedingly rare. It would be all too easy, Akhter Hameed Khan knew, for a project director to succumb to the blandishments of politically or economically powerful men in their thana. To guard against project directors being influenced unduly by relatives or old acquaintances, the directors were never sent to their home thana.

Although the control of the project directors themselves was a precarious business, the control mechanisms and sanctions employed by

TCCA's over the primary village cooperatives were explicit. Accurate and reasonably up-to-date accounts for each village cooperative society were maintained by staffs of village accountants paid by the central association. These accounts were annually, though typically rather tardily, audited by officers of the cooperative department of the provincial government. Village cooperatives could be denied loans if they were judged to be too far in arrears on loan repayment, or incompetent in their management. The TCCA could initiate legal proceedings to seize the land of individual members of the village cooperatives who were too deeply in default. Because of tight controls such as these, the village cooperatives in all the experimental thanas established a reputation for being less corrupt than the union councils.

The way of the cooperatives, as Akhter Hameed Khan stressed many times, was a hard way requiring group discipline and personal sacrifice on the part of the villagers, and the highest standards of integrity on the part of the project officers. The attitude of the government of Pakistan toward the union councils, by contrast, was strongly colored by Ayub Khan's desire to secure a base of political support among the council members, the basic democrats who comprised the electoral college for the presidency and for the legislatures. Many a Pakistani citizen has contended that Ayub Khan used the American P.L. 480 funds which financed the rural works program to buy his way to reelection in 1965. In actuality, the Pearsonian correlation between the distribution of rural works expenditures and of votes for Ayub Khan was statistically insignificant, but as Harry W. Blair points out, the important fact was that the regime believed in the political efficacy of rural works, and acted accordingly.[41] In such an atmosphere, discipline of corrupt union council members was hardly an urgent concern.

6. Decentralization of operating decisions within a system of centrally determined policies provides the best way of combining authority with the most relevant information and most informed judgement." (Uphoff and Esman, 1974, p. 102).

Both Basic Democracies and the Comilla-type cooperatives score well on this criterion. Integral to both systems was a real devolution of responsibilities to lower, more local levels of government and society. The reforms which gave rise to Basic Democracies and to the new cooperatives were all the more striking in the Pakistani context because the government which formed a backdrop for these experiments was centralized and elitist, and its connections with the rural populace were poorly developed.

Although Union Boards had been in existence in one form or another for three quarters of a century before the launching of Basic Democracies, their fiscal and administrative powers had been slim. The imperial administration made it clear to the Union Boards that their major responsibility was the maintenance of a local force of chaukidars, or village policemen. As a consequence, 60 percent of the taxes gathered by the Union Boards were spent for the salaries of these rural police.[42] The union councils brought into existence under Basic Democracies were financially stronger, being empowered to levy 23 kinds of taxes. Their officially sanctioned role was expanded, to include civil administrative functions, judicial functions, and the stimulation of economic development, in addition to the traditional function of maintaining the rural police.[43]

During the interval between the promulgation of the Basic Democracies order in 1959 and the launching of the province-wide rural works program in 1962-63, illusory expectations about the revamped local government institutions were widespread. The departments of the East Pakistan provincial government generated a flurry of directives for collaboration with the union councils. A goodly portion of this paperwork ended up in the hands of the union councils; in 1960-61 one union in Comilla thana, Kalirbazar, was the recipient of 206 letters from various officials and agencies. Much of this correspondence suggested that the union councils prepare plans for the amelioration of whatever condition the government department was charged with improving. With naive enthusiasm, many of the union councils forwarded ambitious schemes to the departmental officials, who, in the time honored manner of South Asian functionaries, filed them away and took no action.[44]

A discrepancy between organizational form and financial power was the major reason why the wheels of the provincial administration and of the Basic Democracies at first spun so rapidly and so infrequently engaged each other. The union councils on the one hand and the provincial departments and authorities on the other (as for agriculture, animal husbandry, water and power development, etc.) were sharply different kinds of organizations, and they operated at different levels of the territorial hierarchy. The thana was the lowest administrative level to which the departments posted their regular officers, though the agriculture department employed extension assistants at the union level as well.

The first response of the provincial government to this discrepancy was to distribute works program funds so as to reinforce the financial position of the union councils and of the district councils, giving them more bargaining power. Akhter Hameed Khan protested to

Musa Ahmed, the East Pakistan Secretary for Basic Democracies and Local Government, that the crucial intervening layer of the thana was being neglected. The share of works program funds expended by the thana councils thereafter rose steadily, from a low of 6 percent in 1962-63 to 58 percent in 1966-67. The union councils' share of public works expenditures held steady throughout most of this same period at around 20 percent. District councils and municipal and town committees were the losers.

The response proposed at Comilla for the organizational discrepancy between Basic Democracies and administrative departments was the Thana Training and Development Center, which was described briefly in the first chapter. When the shift of financial and organizational power to the thana level had been effected in Comilla Kotwali Thana, and in other thanas which copied the model organization there, the East Pakistan countryside was treated, quite unbeknownst to its inhabitants, to what the architect of many of these organizational innovations considered to be the South Asian administrative equivalent of a Communist Chinese commune. It was in the commune and not the production team, at the thana level and not the village level, that Akhter Hameed Khan believed that an organizational engine of rural progress could properly be constructed.

The predominence of the thana level organizations, both in the rural works program and in the Comilla-type cooperatives, is an instance of what Uphoff and Esman refer to as controlled decentralization. They assert that such a pattern is more effective in the Asian rural context than is complete decentralization. To restrain villagers from abusing their access to governmental resources, Uphoff and Esman contend that "...effective decentralization is usually best constrained by firm policy guidelines and centrally established standards enforced by regular inspections and other forms of audit and control, while leaving operations in the hands of local personnel."[45] They were referring, it seems, to relationships between central and local governments, but the same argument can be made within the microcosm of a thana.

The greatest accomplishments and the most prominent failings of Basic Democracies revolved around the issue of decentralization. The devolution of decision making power and the distribution of relevant resources to local bodies was in many cases dramatically efficacious. It is universally agreed, for example, that the earthworks and even the small concrete bridges put up by rural works project committees of the union councils cost a fraction of what would have been charged by private contractors working for the Department of Communication and Buildings. In many instances the villagers were demonstrably wiser than were the salaried civil engineers in agencies such as the Water and Power Development Authority, which once in Comilla Kotwali Thana built a drainage canal that brought in more water than it carried away. Villagers knew the lay of the local landscape more intimately, and were seldom caught making such glaring errors.[46] Despite the parochialism of so many of the decision makers in the works program, the overall pattern of roads which emerged was sensible, in that it connected small markets to larger markets, and government headquarters to one another. Transportation costs fell, commerce increased, and the rural sector of East Pakistan was finally involved in the market economy. Thomas estimated a benefit-cost ratio for the rural works program of 4.0, which is far above what can be claimed for highway or canal building schemes in developed countries.

One of the most widely noted innovations of the Comilla cooperatives, to take another example of decentralization, was the design of a new organizational system for agricultural extension. The community development program in India had promoted the model of a village level worker, or gramasavak, who would go to the village and act as a catalyst for change, including the improvement of agricultural practices; this was the model that was imitated in the ill-fated Pakistani program for Village Agricultural and Industrial Development, or V-AID. The American extensionists, who exerted a strong influence on the Agricultural Department, promoted the similar idea of the county extension agent. Neither of these designs for an extension officer who was a local appendage of a central bureaucracy proved successful in rural conditions such as those of East Pakistan. Villagers distrusted the sanctimonious outsiders, and the extension workers quickly learned that the way to personal success was to pay more attention to the office politics of bureaucratic advancement than to the needs of their clients.

In Comilla, each village cooperative society chose one of their members, on a rotating basis, to be the village model farmer. At the demonstration farm which Japanese agricultural experts had set up at Abhoy Ashram, the headquarters of the Kotwali Thana Central Cooperative Association, these model farmers were instructed in better ways of planting, irrigating, and fertilizing their rice crop, and in subjects such as pisiculture and the growing of vegetables. The model farmers returned to their villages, adopted some of these innovations on their own farms, and in turn instructed their fellow farmers in the local cooperative society. This decentralized method of agricultural education worked admirably, and was one of the elements of the Comilla experiment which was most widely imitated, as in the Chilalo Agricultural Development Unit in Ethiopia.

The reason that decentralization was a factor in the failings of the works program and of Basic Democracies is paradoxical. Unsupervised decentralization of decision making to the union councils had several undesirable consequences. Among them was the tendancy on the part of the local councils to favor road projects, which were technically simple (since what had to be done to build a road, for the most part, was to pile dirt in a long heap) and which favored the large farmers whose land values rose near the roads and who were involved to a greater extent in the market economy. Flood control, drainage and irrigation projects were often more difficult to execute without technical assistance and without coordination of planning among several union councils, or even among thana councils; although such projects were frequently felt by smaller farmers to be more important than the building of roads, they tended to be neglected by the union councils.

Yet it was the very centralization of power at the thana headquarters which led to the discrediting of the works program and of Basic Democracies in the eyes of the Bengali people. After the election of 1965, particularly, the conservative, elitist political coalition with which President Ayub Khan and Governor Abdul Monem Khan allied themselves attempted to bring into its fold the circle officers who chaired the thana councils, and with them the chairmen of the union councils, who all served concurrently as members of the thana councils. Once power had been concentrated at the thana level, the regime discovered there a ready made instrument for the corruption and manipulation of rural politics. The consequence was that the thana councils and the thana training and development centers are remembered only by the most visionary of commentators as bearing any resemblance to the Chinese communes.

7. "Distribution of assets and income poses a serious political issue whenever raised, but our studies indicate the importance of this issue and the need to address it in shaping rural development strategies and institutions. More equitable distribution appears to be a necessary if not sufficient condition for extensive rural development, though enclave development can occur in its absence." (Uphoff and Esman, 1974, p. 103).

The overwhelming impoverishment of the rural populace of what was East Pakistan, and is now Bangladesh, comes to the fore when the distribution of assets and income is considered. In rural East Pakistan almost everyone was poor. Once the zamindars had been swept from office in 1951, there remained no class of rural landlords who were rich by the standards of, say, the Latin American latifundistas. According to the 1960 Census of Agriculture, which sampled all farmers living in 10 percent of the revenue villages in East Pakistan, only 0.4 percent of landholdings in the province were over 25 acres, and less than five percent were over ten acres. The average landholding in 1960 was 3.5 acres. Many observers have remarked that institutional experiments such as Basic Democracies and the Comilla cooperatives were substantially assisted by the resultant egaliterianism of poverty. On what Thomas Jefferson would have considered a microscopic scale, it might appear that East Pakistan was a yeoman's democracy.

As I have sought to explain, the distinctions among farmers owning less than 10 acres of land were nonetheless strong enough as to set off the surplus farmers (owning, perhaps, 7.5 to 10 acres of land in 1960, and maybe as little as 5 acres by 1970, when productivity per acre had risen substantially due to the Green Revolution) into a category of villagers who were domineering, self-serving, conservative, and somewhat exploitative. It was upon the rock of these larger surplus farmers that Rehman Sobhan claimed the Basic Democracies foundered; Harry W. Blair said that the Comilla cooperatives did likewise.

If there had been no cooperatives in Comilla Kotwali Thana, however, it seems likely that the smaller farmers there would have fared much more poorly during the nineteen sixties. The agricultural technology of the Green Revolution, including especially improved seed varieties and dry season water supplies, was rapidly disseminated through the cooperatives in the second half of the decade. In an analysis of the agricultural transformation that took place in the thana from 1966 to 1970, Faidley and Esmay remarked that landless and near landless cooperative members (those owning no land or less than one acre of land) had engaged in the growing of high yielding varieties of irrigated dry season rice in about the same proportion as had cooperative members owning larger acreages. The landless and near landless farmers who were not members of cooperatives, by contrast, had found it difficult to obtain access to irrigation water, and had lagged dramatically in their participation in the Green Revolution. Among all the farmers in the thana, cooperative members owning between one and three acres led the pack in the percentage of land that was winter cropped.[47] It was precisely this latter group of small farmers whom the cooperative organizers had aimed to assist from the beginning.

In as much as the small farmers, and even some of the landless and near landless farmers, of Comilla Kotwali Thana did benefit from the cooperatives, these organizations were bucking the tide of change in rural Asia. From the perspective of the nineteen seventies, it has become commonplace for observers of the Green Revolution to complain that the new high yielding seeds and the new methods of cultivation were adopted mainly by the larger farmers. The Green Revolution in Asia, it has been charged, augmented the income of the rich farmers, and in some places actually diminished the abysmal standard of living of the rural poor. Rich farmers in most places had better access to agricultural credit, and to the expensive inputs (pumps, fertilizer, insecticides, and sometimes tractors) that were needed to grow the improved seeds. Tenant farmers were sometimes displaced by landowners who suddenly found it profitable to cultivate their own fields, and agricultural wages were depressed in some places due to the substitution of tractors for hand labor.[48]

Cooperatives of the Comilla variety gave the small farmers more equitable access to credit and to inputs of all types, as well as to processing and marketing services. Through the organizational vehicle, farmers in Comilla who owned as little as an acre of land were able to participate fully in the Green Revolution.

In a precient article written just before the collapse of East Pakistan, Princeton Lyman pointed out that it was no mean achievement for the Comilla cooperatives to have helped the small farmers to make real gains in their literacy, production, and standard of living, but that the cooperatives had nonetheless neglected the large block of landless and near landless residents of the thana. Forty-one percent of the farmers in Comilla Kotwali Thana owned less than 0.8 acres in 1969, whereas only fourteen percent of the cooperative members were in the same category.[49] Faidley and Esmay, while they demonstrate that those landless and near landless farmers who did join the cooperatives were able to benefit from their membership (especially by obtaining access to irrigation water), admit that it was nonetheless difficult for the most impoverished villagers to meet the standards of cooperative membership, as by making regular savings deposits. Cooperative loans, moreover, were issued to individuals on the basis of a guarantee of land which could be appropriated in case of a default; the landless, obviously, could not meet this requirement for credit worthiness, and so could not benefit from the most important service which the cooperatives provided.

Due to the inexorable pressure of a growing population against a fixed land base, there seems to have been a steady increase over the past decade or two in not only the number but the proportion of rural people who cannot claim title to even the tiniest plot of land. Exact statistics on the absolutely landless are hard to come by, because many of the standard rural surveys, such as the 1960 East Pakistan Census of Agriculture, covered only the landed farmers. In 1963, when Akhter Hameed Khan spoke to the USAID convention in Comilla, he estimated the landless laborers and near landless farmers as comprising from 15 to 25 percent of the rural population, and increasing. The majority element in the rural population was at that time the small farmers, the rural group on which the Comilla academy based its village cooperatives. By 1969, when Abdul Muyeed collected the data referred to by Princeton Lyman and by Faidley and Esmay, the landless and near landless sector of the rural population in Kotwali Thana had apparently swollen to 41 percent.

As the army of miserable landless and near landless paupers has grown from year to year, the spectre of a radicalized rural proletariat has flashed into many minds. A revolution by the utterly indigent may have been forestalled by the debility resulting from malnutrition. The egalitarianism of rural poverty has also served to defuse the revolutionary impulse; although there are many surplus farmers there is no prominent clique of large landlords which might serve as a radicalizing focus for political hostility.

One clear consequence of the proletarianization of the rural populace is that the Comilla model of cooperative organization has come under heavy fire as inappropriate to the requirements of Bangladesh in the nineteen seventies. Criticism of this sort first came to a head under the regime of Sheik Mujibur Rahman, who governed Bangladesh as prime minister and then as president from 1971 to 1975. In an absolutely contradictory manner, the political foundation of Mujibur Rahman's Awami League, and later of his single state party named Baksal (Bangladesh Krishak Awami League), rested on the vested interests of landlords and traders which had always controlled the Bengali villages, yet the ideology which the Mujib regime promoted was that of socialism. Armchair socialists who believed in the efficacy of administrative edicts as a means of restructuring the social order were especially influential.

Upon the advice of some members of his government who had recently visited Eastern Europe, Mujibur Rahman declared, at a mass rally in Dacca on March 26, 1975, that the 65,000 villages of Bangladesh should be organized within five years into compulsory multipurpose cooperatives in which the landless would have an important say. Very shortly thereafter, Mujibur Rahman's proposal was forced as a discussion topic upon an assembly of internationally prominent agriculturalists who had gathered at the Bangladesh Academy for Rural Development; they had come to Comilla to discuss "The Impact of High Yielding Varieties on Income Distribution." Mahbub Alam, who had assumed Akhter Hameed Khan's old job at the Comilla academy, stressed to the conference participants that the local institutions developed during the nineteen sixties, including the Comilla cooperatives, had been dominated by the large landowners. The landless and near landless villagers, who were burgeoning in numbers, had been ignored. A new cooperative system was called for, said Mahbub Alam and other governmental representatives, and would the gentlemen who were so conveniently gathered at the academy kindly assist in designing it? The ensuing hubub has been described by Robert Stevens:

> At the conference in Comilla there ensued a great deal of speculation about what the President planned or intended about the internal organizational form of the new village cooperatives.... With respect to speculation about the forms of the cooperatives, a large official committee including many appropriate ministry officials has been charged with making recommendations. However, in view of the fact that the committee had not been consulted about and was surprised by the March 26 announcement, many guess others are advising the president on these matters.... Some participants...insisted that the President's intention was clear - a pooling of all land and all other resources in each village. Others seemed to think the scope of internal cooperative organization remained much wider so as to include owner operatorship of certain amounts of land within the new cooperative structure.[50]

Given the frantic surrealism of its inception, it is just as well that nothing further came of Mujib's proposal for compulsory cooperatives. After his March speech he did not push the idea again. A few months later he was assasinated.

Critique of Uphoff and Esman's Approach

The foregoing analysis of East Pakistani experiments in rural development organization has revealed many points of importance. Uphoff and Esman's seven criteria touched upon critical issues which show up the comparative strengths and weaknesses of the Basic Democracies system and of the Comilla-type cooperatives. Yet there is something missing in the description of rural development organizations which emerges from the consideration of these seven criteria. Like Uphoff and Esman's book itself, these are summary measures of a macroscopic nature, generalizations derived from the study of a wide range of cases of rural development organizations in many countries. And although these generalizations from case study evidence comprise the closest existing approximation to a theory of rural development organization, they are not linked to other theoretical approaches to the social sciences. The seven criteria and the other generalizations in Uphoff and Esman's book seem to come at us out of thin air, as if they were reified out of the cross-talk above the Cornell Rural Development Committee's conference table.

To take these generalizations to the microscopic scale and really explain the workings of a specific rural development organization would be difficult. The difficulty arises from the lack of connection between Uphoff and Esman's observations and more established ways of looking at organizations. The disjuncture is hardly surprising. Organization theory, after all, has been built up in order to model, and to manage, entities like General Motors. The corporate executives who are usually at the center of concern in organization theory are at the opposite end of almost every sociological spectrum from the peasant farmers who were the concern of the Cornell Rural Development Committee. Organization theorists, it can safely be said, have not gone out of their way to think about peasants.

In most accounts of the history of organization theory, a French businessman named Henri Fayol is credited as being the father of the administrative management school. In a book which he wrote in 1916, Fayol asserted that administration is divisible into five primary functions: planning, organization, command, coordination, and control. He also laid down fourteen principles of sound management, among which were chestnuts such as: an employee should receive orders from one superior only; and the organization should provide an orderly place for every individual. Fayol's pronouncements have been criticized by subsequent writers as obiter dicta derived from a narrow, mechanistic, and highly centralized view of business organizations. They have had a profound influence on management thought nonetheless.

One good reason why Henri Fayol extracted his principles of management mainly from his own executive experience, rather than from the management literature, was that there was no management literature when he wrote his book. Norman Uphoff and Milton Esman, I would suggest, were in a comparable situation when they derived their set of six primary rural development functions, and their list of seven criteria for successful rural development organizations.

What I have sought to do in this book is to move the theory of rural development organization beyond the Fayol phase. At the beginning of each of the analytic chapters which follow the next I have referred to one or several of Uphoff and Esman's seven principles, and I have sought to set them within the context of modern organization theory. The relevant experience from the Comilla cooperatives is then reviewed in detail, and in some instances interpreted by means of a mathematical model. I confess that my own intellectual bent is more toward analysis than prescription, so the pattern that emerges from this mosaic is not an eight fold path to rural righteousness to replace the Cornell dogma. Some theoretical connections have instead been demonstrated, so that someone who is either evaluating or constructing a rural development organization could proceed with confidence.

My efforts at applying organization theory to rural development organization have by no means been a one way process. In attempting to extend organization theory into such alien territory, I have discovered many inadequacies in the state of organization theory itself. The result has been a thoroughgoing revision of organization theory, as is described in the next chapter.

Notes for Chapter 2

The Need for Models

[1] Lawrence Hewes, Rural Development, World Frontiers, The Iowa State University Press, Ames, Iowa, 1974, p. xviii. Reprinted with permission.

[2] Robert S. McNamara, Address to the Board of Governors, September 24, 1973, International Bank for Reconstruction and Development, Washington, 1973, p. 17, 18.

[3] Rural Development Sector Policy Paper, World Bank, February, 1975.

[4] Ibid., p. 47.

[5] Frederick H. Harbison, Human Resources as the Wealth of Nations, Oxford University Press, New York, 1973, p. 41. Reprinted with permission.

[6] Philip H. Coombs and Manzur Ahmed, Attacking Rural Poverty, How Non Formal Education Can Help, The John Hopkins University Press, Baltimore, 1974, p. 14.

[7] Norman T. Uphoff and Milton J. Esman, Local Organizations for Rural Development: Analysis of the Asian Experience, Rural Development Committee, Cornell University, Ithica, New York, 1974, p. xi.

[8] Ibid., pp. 99-103.

[9] Philip B. Calkins, "Stability and Change in Landholding and Revenue Systems in Bengal," in Robert D. Stevens, Hamza Alair, and Peter J. Bertocci, editors, Rural Development in Bangladesh and Pakistan, The University Press of Hawaii, Honolulu, 1976.

[10] Elliot L. Tepper, "The Administration of Rural Reform: Structural Constraints and Political Dilemmas," in Stevens, op cit, p. 38.

[11] Rehman Sobhan, Basic Democracies, Works Programme and Rural Development in East Pakistan, Oxford University Press, Dacca, 1968, p. 66. The embankment which protects the town of Comilla from innundation by the river Gumti, which runs by the town, was given over in 1845 by the government to the Raja of Hill Tippera, zamindar of the area, who assumed responsibility for its maintenance. See W. W. Hunter, A Statistical Account of Bengal, Trubuer and Company, London, 1876 (reprinted by Raj Bandhu Industrial Company, New Delhi, in 1973), p. 364. That the Gumti river maintained into the mid-twentieth century its reputation

as "Comilla's sorrow" does not speak well for the Raja's conscientiousness in repairwork.

[12] Lawrence Ziring, The Ayub Khan Era, Politics in Pakistan 1958-1969, Syracuse University Press, Syracuse, New York, 1971, p. 16.

[13] Tepper, op cit, p. 47.

[14] Quoted in Percival Spear, India, A Modern History, The University of Michigan Press, Ann Arbor, 1961, p. 305.

[15] Ibid., p. 305.

[16] Quoted in Tepper, op cit, pp. 38, 39.

[17] Peter J. Bertocci, "Social Organization and Agricultural Development in Bangladesh," in Stevens, op cit, p. 166. An East-West Center Book. Copyright 1976 by the University of Hawaii. Reprinted with permission.

[18] Tables 1 and 2 are from Uphoff and Esman, op cit, p. 122.

[19] Arthur F. Raper, et al., Rural Development in Action, the Comprehensive Experiment at Comilla, East Pakistan, Cornell University Press, Ithica, New York, 1970, p. 273.

[20] Lane F. Holdcroft, "Rural Development Today: A Practical Perspective," Department of Agricultural Economics, Michigan State University, 1976 (mimeographed), p. 7.

[21] Akhter Hameed Khan, "Learning from China - A Pakistan Experience," paper presented at the International Seminar on Rural Development, Michigan State University, 1975, p. 6.

[22] Quoted in A. T. R. Rahman, et al., An Evaluation of the Rural Public Works Programme, East Pakistan 1962-63, Pakistan Academy for Rural Development, Comilla, 1963, p. x.

[23] Quoted in John W. Thomas, Rural Public Works and East Pakistan's Development, Development Advisory Service, Harvard University, Cambridge, Mass., 1968, p. 20. The quotation is from a letter written to Gustav F. Papenek on December 29, 1960.

[24] Richard V. Gilbert, "The Works Program in East Pakistan," International Labor Review, V. 9, No. 3, March, 1964.

[25] Thomas, op cit, p. 3.

[26] Walter P. Falcon, "A Perspective on Rural Development and the Green Revolution in Asia," 1975 (mimeographed).

[27] Thomas, op cit, p. 48.

[28] Mahamoodur Rahman, "Works Programme and Peoples' Opinion," in The Works Programme in Comilla: A Case Study, Pakistan Academy for Rural Development, Comilla, 1966, p. 164.

[29] A. T. R. Rahman, et al., An Evaluation of the Rural Public Works Programme, East Pakistan 1962-63, Pakistan Academy for Rural Development, Comilla, East Pakistan, 1963, p. 46.

[30] Sobhan, op cit, p. 121, 123.

[31] Ibid., pp. 242, 243.

[32] Thomas, op cit, p. 39.

[33] Akhter Hameed Khan, Agricultural Economics 865, Rural Development Administration, Winter Term, 1975, Michigan State University. From author's class notes.

[34] Ibid.

[35] Harry W. Blair, The Elusiveness of Equity: Institutional Approaches to Rural Development in Bangladesh, Rural Development Committee, Cornell University, Ithica, New York, 1974.

[36] Thomas, op cit, p. 33. The number of respondents was in this case 112.

[37] Ibid., p. 40.

[38] A. T. Rafiqur Rahman, An Evaluation of the Rural Works Programme, East Pakistan, 1963-64, Pakistan Academy for Rural Development, Comilla, 1964, p. 73.

[39] In retrospect, Akhter Hameed Khan says that he does not regret, and in fact was persuaded to support, the government decision to spread the works program from one thana to 413 thanas in a single year. He recalled, in a 1977 conversation with the author, how Musa Ahmed, the East Pakistan Secretary for Basic Democracies and Local Government, and Richard Patten, East Pakistan advisor with the Harvard Advisory Group, explained to him that if the program were not expanded immediately to the whole province much of the year's allocation of 10 million rupees for public works from P.L. 480 sales would be lost. He accepted their advice, and helped to mount a crash effort for propogating, the works program.

[40] Sobhan, op cit, p. 110.

[41] Blair, op cit, p. 97.

[42] K. M. Tipu Sultan, "Workings of Local Councils in British Era," in The Works Programme in Comilla: A Case Study, Pakistan Academy for Rural Development, Comilla, 1966, p. 21.

[43] A. K. M. Mohsen, The Comilla Rural Administration Experiment, History and Annual Report 1962-63, Pakistan Academy for Rural Development, Comilla, 1963, p. 11.

[44] Ibid., p. 23.

[45] Uphoff and Esman, op cit, p. 76.

[46] Zakir Hussain, the project director of the Kotwali Thana Central Cooperative Association, told me in 1966 that government engineers working on the Sonaichari irrigation project in Comilla Kotwali Thana had predicted that water would flow one way in a new diversion channel, when in fact it flowed the opposite way. The villagers in the area had told the civil engineers what would happen, but the engineers would not listen.

[47] LaVern Faidley and Merle L. Esmay, "Introduction and Use of Improved Rice Varieties: Who Benefits?" in Stevens, op cit. In case the idea of landless farmers engaged in farming seems odd, it should be noted that there was some land available for rent. The major source of income for the landless, however, was the sale of their services as agricultural laborers.

[48] One of the best-documented arguments of this sort has been put together by Keith Griffin, of Oxford University, in The Political Economy of Agrarian Change, An Essay on the Green Revolution, Maxmillan, London, 1974.

[49] Princeton Lyman, "Issues in Rural Development in East Pakistan," Journal of Comparative Administration, May, 1971. A. Z. Obaidullah Khan, a civil servant who has held many important rural development posts in East Pakistan and in Bangladesh, plagarized Lyman's article extensively, and without attribution, in a monograph titled "Rural Development in Bangladesh: Problems and Prospects."

[50] Robert D. Stevens, "Whither Bangladesh in Agriculture - Cooperatives or Communes," mimeographed report of a conference held at BARD, Comilla on April 9-11, 1975.

CHAPTER 3

A Systems Approach to Organization Theory

> Modern organization theory and general systems theory are closely related, with organization theory a special element of general systems theory. Systems theory and organization theory are both concerned with the investigation and performance of the organization as an integrated whole.[1]

Overview

In the United States and Britain, at least, modern organization theory is closely linked to systems theory. Organization theorists draw many of their interpretative images, such as "input-output," "equilibrium," and "feedback," from one branch or another of systems theory. Some of the more enthusiastic writers, such as the trio of Johnson, Kast and Rosenzweig who penned the passage above, aspire to witness the ultimate mingling, in some Olympian grove of the intellect, of organization theory and general systems theory. Sceptics such as David Berlinski, on the other hand, would contend that whosoever mingles with general systems theory mingles with a fog. The more cautious advocates of a systems view of organizations, such as Cleland and King, note that management practitioners have resisted systems concepts because they are based on analogical reasoning rather than empirical research; the proponents of the middle way contend, nonetheless, that the application of some system concepts to organizational issues can be productive not only of aesthetically gratifying insights, but even of useful management techniques.

A balanced and sensible view of the two schools of thought should proceed from a recognition of their dominant failings. The general systems theorists are dreamers of the most grandiose, and oft times of the fuzziest, sort. Their aspiration is to create a science of theoretical universals, a set of laws about laws which would be applicable equally to the understanding of living organisms, mechanical and electronic apparatus, and human organizations.[2] The general systems theorists disdain the lower ground on which most citizens and researchers tread. They would build arches, instead, from mountaintop to mountaintop. The problem with the organization theorists, in a sense, is that they, too, have been attracted to heights. The summit toward which the organization theorists clamber is that of the office of the president or of the corporate boardroom. Organization theorists have flitted happily toward the source of corporate power like moths to a light. Ecological irresponsibility, corrupted connections with politics, price fixing -- none of these disagreeable attributes of the modern corporate behemoth are mentioned by the organization theorists. They are the faithful servants of bureaucrats, organizers, planners, and managers, criticizing only enough to draw attention to their wares, flashy baubles such as matrix management, computerized information systems, and program budgeting.

Basic Bertalanffy

"Shall I compare thee to a summer's day?" The question was Shakespeare's. Some of the academic cranks who have indulged in theorizing about systems in general have shown an analogical inventiveness nearly equal to the bards; they have not, unhappily, shown a comparable concern for intellectual discipline such as is inherent in the construction of a sonnet. Consider, for example, a passage of typically unrestrained comparisons posed (in the disguise of a definition) by James G. Miller:

> An artifact is an inclusion in some system, made by animals or man. Spider webs, bird nests, beaver dams, houses, books, machines, music, paintings, and language are artifacts.[3]

The man who coined the term "General Systems Theory," and who is widely regarded as the founding father of the general systems movement, Ludwig von Bertalanffy, felt compelled almost at the outset to defend his school of thought against the charge that general systems theory was nought but a package of analogies. In an article published in 1955 in Main Currents in Modern Thought, von Bertalanffy wrote:

> But general system theory is not a search for vague and superficial analogies. Analogies as such are of little value since besides similarities between phenomena, dissimilarities can always be found as well. The isomorphism under discussion is more than mere analogy. It is a consequence of the fact that, in certain respects, corresponding abstractions and conceptual models can be applied to different phenomena. Only in view of these aspects will system laws apply.[4]

What, then, are the conceptual models and system laws that have been discovered by the general system theorists? The substance of general system theory is a will o' the wisp. The chief preoccupations of Ludwig von Bertalanffy are exploring the intellectual antecedants of general system theory, and defending it against sceptics. He devotes pages to the description of developments which are closely connected with system theory, such as cybernetics, information theory, game theory, decision theory, graph theory, and factor analysis (his list). Seldom, though, does von Bertalanffy stand forth to state the ideas around which his expository web is woven.

In my opinion David Berlinski comes down too hard on von Bertalanffy and his school when he avers that the general system theorists have done no more than stumble on the modeling capabilities of simultaneous differential equations.[5] The evidence for Berlinski's contention is certainly there. In a key chapter on "Some System Concepts" von Bertalanffy nods to the thought that "a system can be defined mathematically in various ways," but proceeds to present as his major example of the representation of a system a set of equations of the form:

$$\frac{dQ_1}{dt} = f_1\ (Q_1,\ Q_2, \ldots Q_n)$$

$$\frac{dQ_2}{dt} = f_2\ (Q_1,\ Q_2, \ldots Q_n) \qquad (3.1)$$

$$\frac{dQ_n}{dt} = f_n\ (Q_1,\ Q_2, \ldots Q_n).$$

Solutions to linear versions of equations such as these; von Bertalanffy takes pains to demonstrate, can illustrate system characteristics such as stability, periodic fluctuations and growth.[6] Such an observation is not trivial. It is the basis, in fact, of a highly productive model-building movement whose practitioners range from mathematical purists such as Lotka and Volterra, who developed mathematical models of prey-predator relationships, to devotees of computer simulation such as Jay W. Forrester, who has written a book apiece about his respective simulations of industry, cities, and the world. In the interest of historical accuracy, nonetheless, it must be said that Ludwig von Bertalanffy did not discover the modeling potential of simultaneous linear differential equations. Forrester's ambitious books on system dynamics, for example, derive from a well-established body of theory in electrical engineering, where such equations have been the stuff of shop talk for half a century. And it might also be noted that laws of the differential calculus are, after all, laws of mathematics and not necessarily of systems in general. As David Berlinski puts it, in his critique of von Bertalanffy, "the passage from model to theory and back to model again is made with oleaginous ease."[7]

Yet these mathematico-theoretical fumblings are not the reason that Ludwig von Bertalanffy's name is celebrated by system theorists. He is remembered for a non-mathematical idea which he derived from his professional work as a biologist. The idea is that living organisms are open systems which import energy from their environment so as to sustain the internal organization required for productive work, and so as to carry on the tasks of the organism. While such an assertion might seem to the layman to be obviously true, its significance stands out clearly when the open system idea is contrasted with scientific views which prevailed until about the middle of the twentieth century. The dominant perspective outside of physics, which had moved on, was akin to that of Newtonian mechanics, in which the solar system, for example, could be modeled as a closed system containing all the variables required for explaining the movement of the planets about the sun. Within such closed systems, it was believed, the tendancy was toward ever greater disorganization, to conclude in the celestial case with the heat death of the universe, when the order represented by the regular orbits of the planets would have been broken down into random movement. By pointing to the openness and orderliness of the organism as a whole, as against the internal and degenerating interactions of its separate parts, von Bertalanffy pointed the way to a new conception of biology and, he insisted, of the social sciences.

In 1954 four men sat down around a luncheon table at the Center for Advanced Study in the Behavioral Sciences in Palo Alto, California. Out of that luncheon conversation between a biologist, a biomathematician, a physiologist, and an economist came the idea of founding a society for the furtherance of general system theory. The four originators of what came to be called the Society for General Systems Research were Ludwig von Bertalanffy, Anatol Rapoport, Ralph Gerard, and Kenneth Boulding. The society set itself the task of promoting the unity of science through the elaboration of general system concepts and through the improvement of communication among specialists. Unfortunately the first of these methods for attaining a unified world view has been crowded out by the second. The society's ponderous yearbook, General Systems, has been neatly described by David Berlinski as containing a great variety of articles which, while interesting, seldom have anything to do with general system theory.

Boulding's Typology of Systems

Kenneth Boulding, the only social scientist among the four originators of the Society for General Systems Research, made but a fleeting sally into the field as a serious author. His major contribution was published in 1956 as an article in Management Science.[8] In that essay, "General Systems Theory, the Skeleton of Science," Boulding delineated a nine-layered hierarchy of systems. It has since become *de rigeur* for authors of books on organizational systems to summarize the Boulding hierarchy as an example of the explanatory power of general system theory. The hierarchy is never criticized or expanded upon, and it's real value as a typology is very seldom tested by a comparison of categories with cases. Quoted below is one of the clearest of such summaries, contained in Kast and Rosenzweig's excellent text, Organization and Management: A Systems Approach. Like most such authors, Kast and Rosenzweig hold up the Boulding hierarchy as if it were an archeological artifact to be gasped at, discuss it in one following paragraph, and then reverently return it to its crystalline case.

> 1. The first level is that of static structure. It might be called the level of frameworks; for example, the anatomy of the universe.
>
> 2. The next level is that of the simple dynamic system with predetermined, necessary motions. This might be called the level of clockworks.
>
> 3. The control mechanism or cybernetic system, which might be nicknamed the level of the thermostat. The system is self-regulating in maintaining equilibrium.
>
> 4. The fourth level is that of the "open system," or self-maintaining structure. This is the level at which life begins to differentiate from not-life: it might be called the level of the cell.
>
> 5. The next level might be called the genetic-societal level; it is typified by the plant, and it dominates the empirical world of the botanist.

6. The animal system level is characterized by increased mobility, teleological behavior, and self-awareness.

7. The next level is the human level, that is, of the individual human being considered as a system with self-awareness and the ability to utilize language and symbolism.

8. The social system or systems of human organization constitute the next level, with the consideration of the content and meaning of messages, the nature and dimensions of value systems, the transcription of images into historical record, the subtle symbolizations of art, music, and poetry, and the complex gamut of human emotion.

9. Transcendental systems complete the classification of levels. These are the ultimates and absolutes and the inescapable unknowables, and they also exhibit systematic structure and relationship.[9]

Several things need to be said about this typology.

In the first place, it is a linear. The set of categories is appropriately displayed as a straight line on the printed page, in the same manner as the numbers 1 through 9 appear above. The typology has one structural dimension. Yet the most famous of all typologies, Mendeleyev's chemical table of the elements, is two dimensional (if the rare earths are excluded). What reason is there to believe that a typology of systems should be one dimensional? There is no inherent reason, of course, to suspect that such a typology <u>must</u> have the form of a two dimensional matrix like the table of the elements, or, for that matter, that it should have the form of a cube or of some n-dimensional figure. But raising the issue of dimensionality does open up possibilities for reconstructing the typology.

The second point which deserves to be made is that Boulding asserted that every level of his typology subsumed those below it. Interpretation of this remark leads one to recognize that the one dimensional hierarchy is printed upside down in the preceding quotation, but that defect is easily dismissed as a gesture of convenience in accordance with our European reading habits, inasmuch as our eyes are trained to trace a course from the top to the bottom of a page.

Another interesting aspect of this typology is that it shows a sharp break between the third and fourth levels. The first, second, and third levels, which represent closed systems of increasing complexity, are all mechanistic. From the fourth level upwards the references all involve living things. For Boulding, as for von Bertalanffy, the break between life and non-life was identical to the distinction between closed and open systems. Another break in the typology is evident between the seventh and eighth levels, in that the focus shifts from individual organisms to social systems. As Boulding himself admitted, the ninth level of the typology was added on as a final turret to the typology, which he included at the risk of being "accused at this point of having built Babel to the clouds."[10]

Study of these discontinuities in Boulding's typology is instructive. I am led to the suspicion that he pasted together two hierarchies, one for mechanistic systems and one for living systems, and to the result attached social systems and transcendental systems for the sake of decoration.

The most serious flaw in the Boulding schema is that it confuses the classification of theoretical models with the classification of actual objects. In discussing clockwork systems at the second level of his typology, for instance, Boulding cites examples of levers, pulleys, steam engines and dynamos in one sentence, and in the following sentence asserts that the theories of physics, chemistry and economics are also, for the most part, constructed as clockwork systems. Perpetuation of this confusion between the theoretical and the actual can lead to major fallacies. Since clockwork systems are the second of Boulding's categories, preceeding open systems which he places at the fourth level, one might be led to conclude from his presentation that steam engines -- which he places at the second level -- are closed systems. Yet in some respects such a classification is obviously erroneous. Steam engines must be provided with inputs of coal to burn and of water to boil, so they can also be regarded as open systems.

The most obvious sorts of errors that can result from the confusion between models and reality derive from the first level of the Boulding typology. Paintings, whether on cave walls or on canvases hung in a museum, are indisputably static. A painting of a woman's face looks much the same today as it did hundreds of years ago when it was created by Rubens. The painting is a static model. Yet no sensible observer would be led to conclude from the stillness of the painting that the Flemish women of the seventeenth century were incapable of motion. The static model may represent one aspect of reality, but it does not tell the whole story.

A virtue of Boulding's article is that he admits that the hierarchy he has sketched is largely heuristic, in that "it gives us some idea of the present gaps in both theoretical and empirical knowledge. Adequate theoretical models extend up to about the fourth level, and not much beyond."[11] The theoretical models of self maintaining structures at the fourth level to which Boulding refers are those of open system theory, which was, at the time that Boulding wrote his article, pretty much limited to the writings of Ludwig von Bertalanffy. "Beyond the fourth level," Boulding wrote, "it may be doubted whether we have even the rudiments of theoretical systems....Up to now, whatever the future may hold, only God can make a tree."[12]

If theoretical reference points are indeed so scarce at the higher levels of Boulding's typology, then perhaps those higher levels should be discarded. What we should be seeking, after all, is something more than an arbitrarily designed, cut and paste typology. Every category of a typology of systems should be theoretically justifiable and logically distinct. And the relationship between the categories, ideally, should itself be orderly, much as the transition from one category to the next in the chemical table of the elements is governed by explicit rules.

Boulding's Typology Revised

As a first approximation of a replacement for Boulding's hierarchy, I would propose a simple four level schema.

1. Static structures
2. Simple machines

\- - - - - - - - - - - - - - -

3. Machines with input
4. Organic systems

Figure 3-1: A simplified system typology

Systems above the dotted line in Figure 3-1 are closed; those below are open. Systems at the first level are static, those at the second, third and fourth levels are dynamic.

To avert the sort of confusion about the classification of models versus actual objects which permeates the original Boulding typology, let me assert at the outset that the first three levels of static structure, simple machines, and machines with input shown in Figure 3-1 represent categories of models. These are classifications of theoretical constructs, not of items from the real world. The fourth level of the simplified system typology, organic systems, occupies an ambiguous position between theory and reality. This level of classification is intended to correspond to the fourth level of Kenneth Boulding's typology, which he stated was the level at which life begins to be differentiated from non-life, and at which systems are first capable of self-maintenance and reproduction. Boulding contended, in the passage quoted above, that adequate theoretical models extend up to about this level and not much beyond. In the absence of adequate theoretical models of self maintaining, reproductive systems it is difficult to define a classification for theoretical models of real world living systems. However, the concept of organic systems should not be thought of as limited to biological examples. As I shall attempt to demonstrate, human organizations belong in this classification as well.

The third level in Figure 3-1, machines with input, represents a theoretical construct which is omitted entirely from Boulding's typology. In company with many writers in the fields of system theory and organization theory, Kenneth Boulding seemed to presume that open system models can be applied only to living organisms. Yet the classic examples of open system models were developed to explain electrical circuits such as those that are found in a radio. A radio has inputs of electricity and radio waves, internal transformational processes, and an output of sound. A radio is an open system, and it is most appropriately modeled as such. Yet a radio is assuredly not alive.

The name which I have applied to the first of these four levels of systems, static structures, is used by Boulding, and the content of that category I see as identical to Boulding's level of frameworks. The names of the second and third levels in Figure 3-1, simple machines and machines with input, are taken from John Hunter, a mathematical psychologist at Michigan State University whose views of systems are strongly influenced by the writings of W. Ross Ashby. The term "organic systems," which I have applied to the fourth level of the typology, is a throwback to nineteenth century writers such as Auguste Comte, who described human organizations through a biological, organismic analogy.

Static Structures

Static structures, or frameworks, form the intellectual home of Copernicus. This level of system includes, in Boulding's words, "the geography and anatomy of the universe -- the patterns of electrons around a nucleus, the pattern of atoms in a molecular formula, the arrangement of atoms in a crystal, the anatomy of the gene, the cell, the plant, the animal, the mapping of the earth, the solar system, the astronomical universe. The accurate description of these frameworks is the beginning of organized theoretical knowledge in any field, for without accuracy in this description of static relationships no accurate functional or dynamic theory is possible."[13]

A little thought should make it plain that for any one of Boulding's own examples the static description is only a partial representation of reality. The orbits of electrons around a nucleus may be immovably displayed on a printed page, yet we know that the atom in actuality is a blur of motion. The point of this observation is well made by Boulding himself in the passage above. Theoretical constructs of static structures preceed the more comprehensive models of dynamic systems. Copernicus preceeded Newton.

Time is not an issue in the fixed universe of static structures. Relationships among variables can be expressed in algebraic equations, such as the economists' production functions, or the regression equations which are so fascinating to empirical social scientists. For the linear case, the general form of a system of such algebraic equations can be written in matrix notation as:

$$AX = K, \tag{3.2}$$

in which A is a matrix of coefficients, X is a vector of variables, and K is a vector of numbers.

Simple Machines

Sir Isaac Newton and the eighteenth century deists would have felt intellectually at home among system constructs at Boulding's second level of clockworks, containing dynamic systems with predetermined, necessary motions. According to Boulding: "Simple machines such as the lever and pulley, even quite complicated machines like steam engines and dynamos fall mostly under this category."[14] I have appropriated the term "simple machines" to describe this category, because it matches Boulding's meaning just as well as "clockworks," and because it carries a definite (and identical) meaning for cybernetic theorists.[15]

Just because simple machines are at such a lowly level in the systems hierarchy, or just because they are called "simple," models of this sort should not be regarded with contempt. As Boulding himself points out, most of the theoretical constructs in physics, chemistry, and economics fit into this category of the typology. Moreover, the comparison between statics and dynamics -- which corresponds to the comparison between static structures and simple machines -- has been an extremely important one in the history of social thought. Auguste Comte, the French philosopher who is considered the founder of sociology, divided his new science of social relationships into static sociology and dynamic sociology, a categorization which he based on the established division of biology into anatomy and physiology. A century after Comte published his treatises in the 1850's, sociologists were still absorbed in the static-dynamic comparison, posing the question as a debate on the relative importance of structure versus function.

Following the usage of economics, Boulding contends that simple dynamic systems may be analyzed via the method of comparative statics, in which "we compare two equilibrium positions of the system under different values for the basic parameters. These equilibrium positions are usually expressed as the solution of a set of simultaneous equations. The method of comparative statics is to compare the solutions when the parameters of the equations are changed."[16] But this is really a slight of hand. If there is any coherence to the behavior of the simple machine over time, then some underlying time function must describe the changes in the system parameters. A more comprehensive way to describe a simple machine mathematically is to display the relationships among system variables as a set of differential or difference equations. A set of such equations would be of the form of 3.1, which was Ludwig von Bertalanffy's mathematical example of a system. The solutions to such equations are written as time functions for each system variable. This is, as Boulding says, the method of true dynamics.

If the functions referred to in 3.1 are all linear, then the mathematical representation of a simple machine operating in continuous time can be written as:

$$\dot{X} = AX, \tag{3.3}$$

in which $\dot{X}$ signifies a vector of time derivatives of the system variables $(\frac{dX_1}{dt}, \frac{dX_2}{dt}, \frac{dX_3}{dt}, \ldots \frac{dX_n}{dt})^T$; A is a matrix of coefficients; and X is a vector of system variables. For discrete time, the same system can be represented as

$$\Delta X = AX, \tag{3.4}$$

in which ΔX is a vector of discrete changes in system variables $(\Delta X_1, \Delta X_2, \Delta X_3, \ldots \Delta X_n)$.

In a dynamic system the function describing the rates of change or the changes in the system variables need not be linear. I have used the illustration of linear functions mainly because of the brevity of notation provided by matrix algebra. The vector-matrix notation also leads to a symbolically simple comparison between static structures, simple machines, and machines with input.

A more general, set theoretic definition of a simple machine has been formulated by John Hunter. His definition, which I would take to be the overall description of systems at the second level of the Figure 3-1 typology, does not imply that the functional relationships in a simple machine must be restricted to the mathematically tractable linear case. According to Hunter:

> M is a simple machine with states S governed by T if and only if:
>
> 1. S is the set of all possible descriptions of M;
>
> 2. T is a function whose domain is S and whose values are in S, i.e. for each s in S, T(s) is an element in S.[17]

For an illustration of a social science theory built according to the principles of the simple machine, or closed dynamic system, I turn again to John Hunter, who has developed many mathematical models of this type. He refers to them as cybernetic models. The model of dyadic interaction is about the simplest conceivable two variable dynamic mathematical model, and Hunter frequently employs it as an example in his lectures and mimeographed class notes.

Suppose two people interact in a closed room. The only stimuli they receive emanate from each other. Suppose that neither person masks his feelings, so the messages that each person sends about the other are directly proportional to his feelings about that other person: if he hates the other person he will send a hateful message, and if he loves him he will send a loving message. According to the reinforcement theory of attitude change, positive messages will move the attitude of the receiver in a positive direction. A positive message, in this case, will result from a positive feeling on the part of the sender.

If x is the attitude of the first person toward the second, and y is the attitude of the second person toward the first, a mathematical model of the mutual changes in these attitudes can be stated as:

$$\begin{aligned} \dot{x} &= \alpha y \\ \dot{y} &= \alpha x. \end{aligned} \qquad (3.5)$$

In this excruciatingly elementary model, the coefficient α represents the relationship of changes in each person's attitude to the messages he receives from the other person, which are in turn related to the other person's attitude; all of these relationships are compressed into the single coefficient α, which is taken to be the same for both parties.

In terms of the notation of the matrix equation 3.3, in which a linear continuous time simple machine was symbolized as $\dot{X} = AX$, the vector X for the dyadic interaction model consists of the elements $(x, y)^T$, the vector $\dot{X}$ of time derivatives is $(\dot{x}, \dot{y})^T$, and the differential matrix A is $\begin{bmatrix} 0 & \alpha \\ \alpha & 0 \end{bmatrix}$.

$$\begin{bmatrix} \dot{x} \\ \dot{y} \end{bmatrix} = \begin{bmatrix} 0 & \alpha \\ \alpha & 0 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} \qquad (3.6)$$

The time functions which are the solutions to this system of differential equations are:

$$x = \frac{x_o + y_o}{2} e^{\alpha t} + \frac{x_o - y_o}{2} e^{-\alpha t}$$
$$y = \frac{x_o + y_o}{2} e^{\alpha t} + \frac{y_o - x_o}{2} e^{-\alpha t} . \qquad (3.7)$$

The simplicity of the matrix notation is even more apparent for this set of solutions, which can be summarized as

$$X = e^{At} X_o. \qquad (3.8)$$

X_o in the above equation is a vector of the initial values of the two variables, x_o and y_o, which in the dyadic interaction model indicate the attitudes which the two persons held toward one another when they entered the experimental chamber. The expression e^{At} is a wonderous entity, representing a potentially huge amount of information in a few symbols. Deriving the exact content of e^{At} can be a devilishly difficult process in complicated models with many variables and coefficients. For the dyadic interaction model,

$$e^{At} = \begin{bmatrix} \frac{e^{\alpha t} + e^{-\alpha t}}{2} & \frac{e^{\alpha t} - e^{-\alpha t}}{2} \\ \frac{e^{\alpha t} - e^{-\alpha t}}{2} & \frac{e^{\alpha t} + e^{-\alpha t}}{2} \end{bmatrix} . \qquad (3.9)$$

Just what do equations such as 3.7 or 3.8 imply about the behavior of this mathematical model of the attitudes of person number one and person number two? That can be a tricky question to answer for even such an elementary mathematical model. For any given set of initial attitudes, x_o and y_o, it is a simple matter to plot the ensuing trajectories of the attitudes of the two parties. The form of those trajectories varies considerably, though, with changes in the values

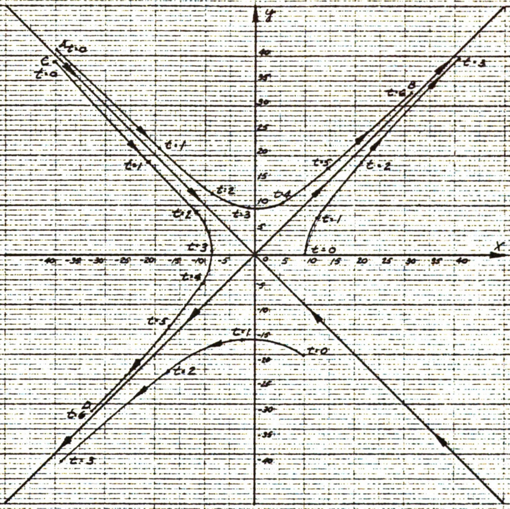

FIGURE 3-2 PHASE PLANE FOR A CLOSED SYSTEM DYADIC INTERACTION MODEL.

of the initial attitudes. A way out of this dilemma is provided by the device of the phase plane, in which the values of the system variables x and y are plotted against each other, rather than separately against time. For a cybernetic or closed system mathematical model the phase plane summarizes all the trajectories that can result from all the different sets of initial conditions. A phase plane for the dyadic interaction model of attitude change is shown in Figure 3-2. (In order to plot a phase plane for the model, a value had to be assigned to the parameter α. Following Hunter's example, I chose the value $\alpha = \ln 2$, or the natural logarithm of 2. This value simplifies the calculations which are involved in the plotting of the phase plane.)

For the sake of visual clarity, only a few sample curves have been drawn in Figure 3-2. It should be understood, though, that the complete phase plane for the dyadic interaction model would consist of an infinite family of curves (hyperbolas, in this case) nested one inside the other.

One of the most striking implications of the dyadic interaction phase plane is that the two participants in the psychological experiment end up loving or hating each other with infinite intensity. If the initial attitudes (x_o, y_o) of the participants are similar to those at point A, they will eventually zoom off past point B toward Nirvana. From a slightly different combination of initial attitudes such as is to be found at point C, the miserable experimental subjects will plunge past point D toward the depths of limitless hatred. Although it is often the case that intimate two-person relationships such as marriage tend toward emotional extremes, the evidence for infinite sentiments is scanty outside of the realm of poetry.

Empirical psychological studies lend more support to another implication of the dyadic interaction model, which is that the attitudes of the two parties will tend toward equality with one another. Graphically, this is indicated by the asymptotic approach of all the phase plane trajectories toward the line $y = x$. The tendancy toward reciprocity of attitude among interacting individuals is a well-established psychological finding.

From the perspective of system theory, an important aspect of most closed system mathematical models such as $\dot{X} = AX$ is that the directionality of time is immaterial to their functioning. The models would run just as well if time were reversed. They are like a movie film, which can be run through the projector backwards as easily as forwards. To predict the sequence of action in the motion picture, no matter which way the film runs through the projector, all that must be known is the frame at which the movie starts. For systems which are simple machines, similarly, the state variables of the system, the transformational relationship, and the starting position are all that need be known to project the behavior of the system either forwards or backwards in time. The arrowheads indicating the orientation of the trajectories on the phase plane in Figure 3-2 are in this respect misleading. So long as time goes forwards, the arrowheads point the direction in which the system will proceed along each trajectory. Yet there is nothing inherent in the mathematical model represented by the phase plane that indicates time must go forwards.[18]

Sir Isaac Newton and Pierce Simon de Laplace were the most brilliant and persistently influential mathematical designers of simple machines. In the great clockwork systems of equations which they constructed, the directionality of time was irrelevant. "In Laplace's world," David Layser has remarked, "there is nothing that corresponds to the passage of time.... The past and future coexist on equal terms, like the two rays into which an arbitrarily chosen point divides a straight line."[19]

Machines With Input

In the simplified systems typology presented above in Figure 3-1, machines with input were presented as the least sophisticated type of open system. For a definition of this category of systems, I rely once again on John Hunter.

> M is a machine with input E governed by T if and only if:
>
> 1. S is the set of all possible descriptions of M;
> 2. E is the set of all possible environments of M;
> 3. T is a function which maps S x E into S, i.e. for each s in S and for each e in E, T (s, e) is an element in S.[20]

As with simple machines, there are many ways to model systems of this sort mathematically. For the sake of simplicity and clarity, I will continue to resort to the linear, continuous time case for examples. A mathematical model of such a system can be put in the general form:

$$\dot{X}(t) = AX(t) + GU(t). \qquad (3.10)$$

The meaning of equation 3.10 is that the vector of time derivatives of the system state variables at time t, $\dot{X}(t)$, is equal to a coefficient matrix A times the value of the state variables at time t, X (t), plus a coefficient matrix G times an input vector in the form of a function of time U (t). To simplify notation, this general matrix equation for a linear machine with input may be written as

$$\dot{X} = AX + GU, \tag{3.11}$$

which is the form that will be used hereafter in this book. It should be understood, though, that if the system represented by 3.11 is to have a deterministic solution, as will all the examples discussed in this chapter and in Chapters 4 and 5, then the input vector U has prescribed values for all t from t = 0 to the end of the time interval over which the mathematical model is being tested.

To illustrate the application of equation 3.11, let us imagine that the two participants in the dyadic interaction experiment are subjected to various stimuli, or inputs, which influence their attitudes toward one another. The simplest such input would be a constant signal, let us say pleasant background music. The music constitutes a stream of positive messages to which the two subjects will respond. As before, the subjects will also respond to messages from each other. If the stream of incoming messages is at a constant value β, an open system model of dyadic interaction could be expressed as:

$$\begin{aligned} \dot{X} &= \alpha y + \beta u\,(t - a) \\ \dot{Y} &= \alpha y + \beta u\,(t - a) \end{aligned} \tag{3.12}$$

Since the input is identical for the two subjects, the input coefficient matrix G becomes a (2 x 1) vector,

$$g = \begin{bmatrix} \beta \\ \beta \end{bmatrix}, \tag{3.12}$$

which premultiplies the input vector $U(t) = u(t - a)$. In this expression, $u(t - a)$ is the standard notation for a step input in which the steady input signal commences at time a, as is shown graphically below.

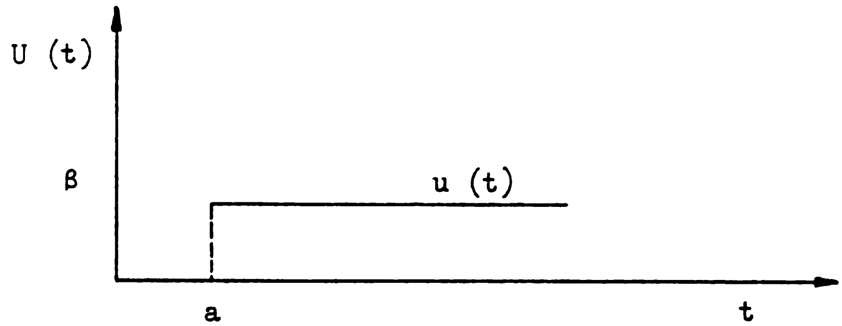

Figure 3-3. A step function with amplitude β .

To simplify the presentation as much as possible, let us assume that a = 0, which implies that the pleasant background music is switched on at the instant when the open system dyadic interaction experiment begins.

The general form for a solution of the matrix equation $\dot{X} = AX + GU$, which is commonly referred to in control system literature as the state equation for the system, can be written as:

$$X = e^{At}X_o + \int_o^t e^{A(t - \tau)} GU(\tau)\, d\tau , \qquad (3.13)$$

in which τ is a dummy variable of integration, and in which the initial values of the system (state) variables are assumed to have been measured at time t = 0. This is a formidable mathematical expression. The second term on the right hand side, which is a convolution integral, is particularly imposing.

The first term on the right hand side of 3.13 is recognizable as the solution to the linear continuous time model of a simple machine,

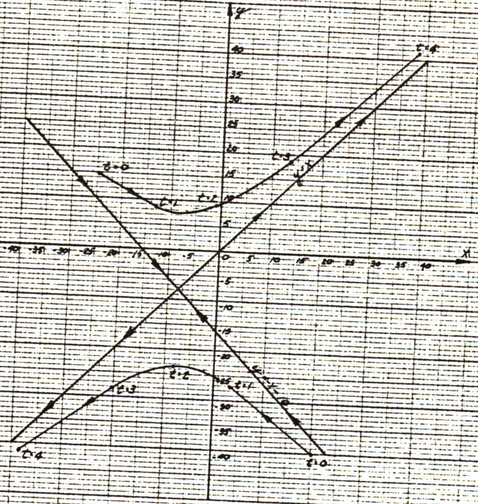

FIGURE 3-4 PHASE PLANE FOR AN OPEN SYSTEM DYADIC INTERACTION MODEL, WITH $U(t) = \beta = 8\alpha$.

$\dot{X} = AX$. In the context of a machine with input, this first term of the total solution is called the free response of the system. It represents the trajectory which the system would follow if there were no input, which is to say if the elements of the input vector U were always zero.

A look at the convolution integral comprising the second term on the right hand side of 3.13 reveals that the matrix A, which is the differential coefficient matrix for the closed system model $\dot{X} = AX$, plays a role in that term as well. This second term of the total solution is called the forced response of the system; it indicates how the system would behave if the values of all the system variables were zero at time $t = 0$, so the system would be responding only to input signals. Even the forced response of the system, it appears, is strongly influenced by the closed system characteristics of the system, as summarized in the coefficient matrix A.[21] The linkage between closed and open systems is strong indeed.

For the open system dyadic interaction model presented above, the general solution given in 3.13 can be simplified to the expression:[22]

$$X = e^{At}X_o + \frac{\beta}{\alpha}C, \tag{3.14}$$

$$\text{where } C = \begin{bmatrix} e^{\alpha t} - 1 \\ e^{\alpha t} - 1 \end{bmatrix}. \tag{3.15}$$

For this two variable, constant input model, the easiest way to grasp the implications of the solution set given by 3.14 is to plot representative trajectories once again on a phase plane. This is what has been done in Figure 3-4. Again, the value of α has been taken to be ln 2. Additionally, it was assumed that $\beta = 8\alpha$.

The influence of the closed system upon the open system is apparent from a comparison of Figures 3-2 and 3-4. For this special case in which the input to the open system dyadic interaction model is a constant, and influences both parties in the psychological experiment equally, the solution of the open system model is a shifted version of the solution to the closed system model.[22] The intersection of the axes of the hyperbolas on which the phase plane trajectory is traced has been shifted from the origin to the point $(-\frac{\beta}{\alpha}, -\frac{\beta}{\alpha})$. Since it was assumed that $\beta = 8\alpha$, the point of intersection of the axes is at (-8, -8).

What happens if the input signal to the dyadic interaction system has a form other than that of a step beginning at t = 0? There is no end to the possible forms of alternative input signals, and I will illustrate only two cases: a delayed step input and a ramp. The delayed step corresponds to the case in which the parameter a in Figure 3-3 has a value greater than zero. An undelayed ramp input is shown in Figure 3-4.

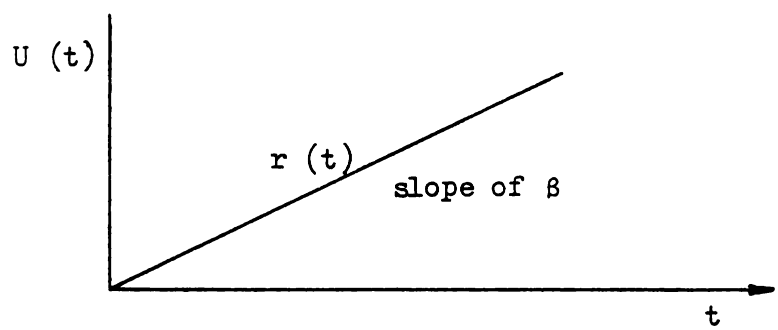

Figure 3-5. A ramp function with slope β .

From the general solution of a linear open system model given by 3.13, it is evident that no matter what the form of the input signal, the first term of the overall solution will be $e^{At}X_o$. When $X_o = 0$ (indicating that the trajectory under consideration starts at the origin of the phase space) this first term disappears and we are left

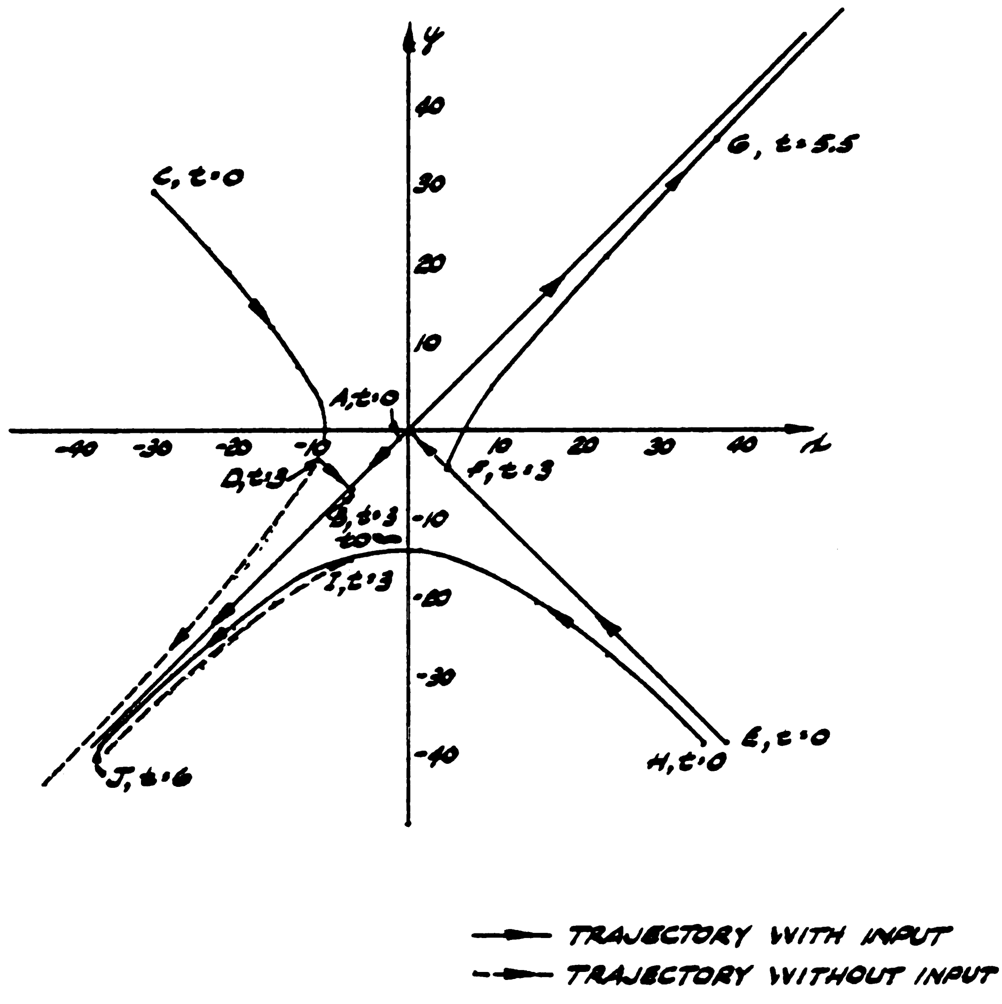

FIGURE 3-6 PHASE PLANE FOR AN OPEN SYSTEM MODEL OF DYADIC INTERACTION WITH A DELAYED STEP INPUT.

with the forced solution of the model. Forced solutions for the step, delayed step and ramp input signals are tabulated below. Derivations of these solutions are given in Appendix A.

Table 3-1. Forced solutions for three input signals to the reinforcement model of dyadic interaction.

Input Signal	Model	Forced Solution
Step	$\dot{X} = \alpha y + \beta\, u\,(t)$ $\dot{Y} = \alpha x + \beta\, u\,(t)$	$\frac{\beta}{\alpha}\begin{bmatrix} e^{\alpha t} - 1 \\ e^{\alpha t} - 1 \end{bmatrix}$
Delayed Step	$\dot{X} = \alpha y + \beta\, u\,(t - a)$ $\dot{Y} = \alpha x + \beta\, u\,(t - a)$	$\frac{\beta}{\alpha}\begin{bmatrix} e^{\alpha(t - a)} - 1 \\ e^{\alpha(t - a)} - 1 \end{bmatrix}$
Ramp	$\dot{X} = \alpha y + \beta\, r\,(t)$ $\dot{Y} = \alpha x + \beta\, r\,(t)$	$\frac{\beta}{\alpha^2}\begin{bmatrix} e^{\alpha t} - \alpha t - 1 \\ e^{\alpha t} - \alpha t - 1 \end{bmatrix}$

Phase planes showing the response of the dyadic interaction system to the delayed step and ramp inputs are shown in Figures 3-6 and 3-7. The inherent logic of the delayed step phase plane, Figure 3-6, is more readily apprehended than is that of the ramp phase plane, Figure 3-7. Trajectories in Figure 3-6 behave as if they were in a closed system dyadic interaction model, such as was shown in Figure 3-2, between $t = 0$ and $t = a$. In this example, $a = 3$. Thereafter, the trajectories behave as do those of Figure 3-3, the open system model with the undelayed step input. For example, a trajectory which starts at (-1, -1), which is point A in Figure 3-6, reaches (-8, -8) at $t = 3$ and stays at that equilibrium point, designated B in the figure, forever after. If it had not been for the application of the step input at $t = 3$, the trajectory would have continued down the line $y = x$ toward negative infinity. Another such special trajectory is CDB, which at $t = 3$ turns a corner and heads in a straight line toward the equilibrium point at B = (-8, -8). It should be noted that the three trajectories AB, CDB and EFG in Figure 3-6 are all special cases, since

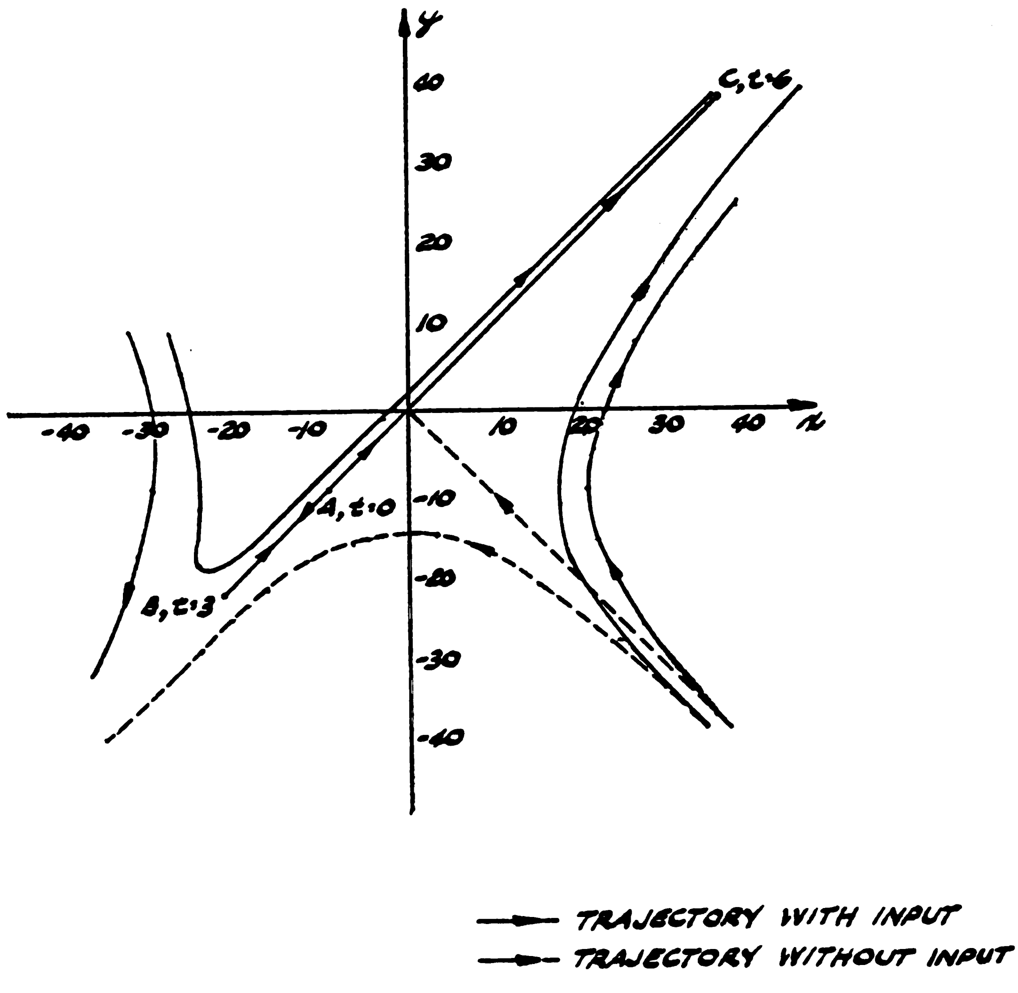

FIGURE 3-7 PHASE PLANE FOR AN OPEN SYSTEM MODEL OF DYADIC INTERACTION WITH A RAMP INPUT.

they begin or end on straight line paths. A more typical trajectory is HIJ, whose hyperboloid curvature is only slightly distorted (or, more exactly, shifted) by the application of the input signal after $t = 3$.

Trajectories resulting from a ramp input, shown in Figure 3-7, are no longer recognizable as hyperbolas, or as any other members of the classic set of conic section curves. The geometry of the closed system dyadic interaction model is obliterated, at least in the vicinity of the origin, by the ramp input. Only one line, $y = x$, remains unaltered. And even on that line the model can behave in unfamiliar ways. A trajectory commencing at A, where $(X_o, Y_o) = (-10, -10)$, goes down the line $y = x$ to point B and then reverses itself, so by the time $t = 6$ it has gone up to C at (39.1, 39.1). There is no point on the phase plane at which the system remains at rest, as it did at the origin in the closed system phase plane, and at (-8, -8) in the phase plane for a step input.

In contrast to simple machines, which are in most cases completely time reversible, machines with input can run backwards only over a restricted range: the range of time in which the input signal is explicitly defined. In accordance with standard conventions, the step and ramp functions in Figures 3-3 and 3-5 are defined only for positive values of time. A system with such functions as inputs cannot run backwards beyond $t = 0$, since the input signals are undefined for negative time.

The phase plane itself has a different meaning for closed system and for open system models. For a closed system model such as the one represented by the phase plane in Figure 3-2, the starting point for time $(t = 0)$ along any trajectory is arbitrary. No matter where the system starts along any trajectory in a closed system phase plane, the system will follow that same trajectory forever. Except in special cases, this is not true for a phase plane of a machine with input. For example, in the phase plane for the dyadic interaction model with a delayed step input, Figure 3-6, if the system starts at point A (-1, -1) it will proceed to point B (-8, -8), and stay there. However, if the system starts at point B, it will march on down the line y = x toward infinitely negative values for both variables. To take another example from the same phase plane, the system will not pursue the straight trajectory DB in Figure 3-6 if it starts at any point other than C (-32, 30) along the trajectory segment CD. From these examples it is apparent that for a machine with input a phase plane trajectory has a definite beginning, and indicates the course the system will follow from that defined starting point. In a closed system phase plane, the location along any trajectory of the point where t = 0 is fixed rather than arbitrary.[23]

Organic Systems

At the fourth level of the simplified systems hierarchy presented in Figure 3-1 are organic systems. The label "organic" for this category of systems is drawn from the nineteenth century French sociologist Auguste Comte, who described human societies as organisms. Like machines with input, organic systems are open systems: that is, they receive and respond to inputs from their environment. That is not to say, however, that all open systems have the characteristics of organic systems.

An amazing number of prominent social theorists have used the term "open systems" as a label for a category of systems which corresponds more or less to what I have called organic systems. Their terminology is misleading, to say the least. Walter F. Buckley, for example, has written:

> The transition from mechanical systems to adaptive, information processing systems is closely related to the transition from the relatively <u>closed</u> to the <u>open</u> type of system. That a system is <u>open</u> means, not simply that it engages in interchanges with its environment, but that this interchange is <u>an</u> <u>essential</u> <u>factor</u> underlying the system's viability, its reproductive ability or continuity, and its ability to change.[24]

The originator of this pervasive and egregiously improper terminology is the grandfather of general systems theory himself, Ludwig von Bertalanffy. Since his professional training was as a biologist, it was natural for von Bertalanffy to have the image of living organisms in mind when he wrote of open systems. The major advances in the mathematical theory of open systems, however, have been made by electrical engineers. The electronic circuits of resistors and capacitors which are their mental referants for open systems can be adequately modeled as machines with input. (The mathematical examples given by von Bertalanffy, curiously enough, are all models of closed systems of the form $\dot{X} = AX$.) Unfortunately, the social theorists who have sought to apply open system ideas to topics such as human organization have lacked the mathematical training to be responsive to the contributions of the electrical engineers, and so has been propagated the misconception that open systems are to be found only in biology and in the social sciences. Fremont Kast and James Rosenzweig, for instance, wrote in this ill-informed tradition when they asserted that:

> Bertalanffy made another major contribution in setting forth a distinction between closed systems and open systems. Physical and mechanical systems can be considered as closed in relationship to their environment. Thus, the first three levels in Boulding's hierarchy are closed systems. On the other hand, biological and social systems are not closed but are in constant interaction with their environment. This view of biological and social phenomena as open systems has profound importance for the social sciences and organization theory. Traditional theory assumed the organization to be a closed system, whereas the modern approach considers it an open system in interaction with its environment.[25]

Each of the categories in Boulding's hierarchy, and in the simplified typology presented in Figure 3-1, is more comprehensive than the one before it, and in a sense includes the category before it plus something else. The static structure of a still photograph may be one frame in a movie film, a closed dynamic system. And as we have seen in the preceding discussion of the dyadic interaction model, the solution of a mathematical model of an open dynamic system, or machine with input, may contain and be strongly influenced by the solution to a closed system model of the same phenomenon. In very simple terms, a simple machine is like a static structure plus motion. A machine with input is like a simple machine plus input. What, then, is the additional something which distinguishes an organic system from a machine with input?

The distinguishing additional feature is, I would contend, the capacity of an organic system to maintain and reproduce itself. So an organic system is like a machine with input plus maintenance and reproduction. This assertion is easily misunderstood, and deserves amplification.

First of all, adherents of what has been called the reductionist view of science might object that self maintenance and reproduction can be modelled as processes behaving like simple machines or machines with input. I would disagree with that contention, but since it springs from a common line of argument, it is probably best to fend off this objection at an early stage of the exposition of organic systems.

In September of 1972, an international group of eighteen geneticists, zoologists and philosophers gathered at the Rockefeller Foundation Conference Center at Villa Serbelloni in Italy to deliberate on Problems of Reduction in Biology. The papers they delivered there were later reproduced as a volume titled Studies in the Philosophy of Biology, Reduction and Related Problems.[26] The issue which the conferees discussed was whether the laws of biology were entirely reducible to the laws of chemistry, or, in a still more basic reduction, to the principles of physics. That issue is similar to the challenge posed above to the special identity of organic systems. For if biology is in fact no more than applied chemistry and physics, then its legitimacy as a distinct realm of inquiry is open to question. And if all that is true of organic systems can be studied through the modelling techniques of simple machines or machines with input, then there would be no need to present organic systems as a distinctive category in our typology of systems.

The conference participant who presented the clearest resolution of this problem of reduction was Peter Medawar of the Clinical Research Centre in Harrow, Middlesex, England. Without any thanks to Auguste Comte, who had advanced much the same proposition a century earlier, Medawar asserted that the sciences could be ranked in the following hierarchy:

1. Physics
2. Chemistry
3. Biology
4. Ecology/Sociology.

All of the laws of physics apply in chemistry, in biology, and in ecology and sociology, just as all the laws of chemistry apply in the sciences at levels 3 and 4, and so forth. Yet at each level of this hierarchy, Medawar asserts, new principles emerge which do not apply at the lower levels.

For an analogic illustration of this proposition, Medawar presented a hierarchy of four geometries.

1. Topology
2. Projective geometry
3. Affine geometry
4. Euclidian geometry.

As the most general, or fundamental, of all geometries topology includes properties such as "inside" and "outside" which still apply in the more specialized geometries at levels 2, 3 and 4. The property of linearity emerges in projective geometry, while in affine geometry it becomes meaningful to refer to a rectangle or an ellipse. The full ponoply of familiar geometric figures are definable in Euclidian geometry.[27]

The transition from the second to the third level of Medawar's hierarchy of the sciences, the transition from chemistry to biology, is more or less equivalent to the transition from the study of non-living to the study of living things. (True enough, one can study the chemistry of organisms, but in doing so one would only be demonstrating the inclusion in each level of the hierarchy of the sciences below it.) The participants in the Serbelloni conference on Reduction in Biology did not reach a consensus on which are the special qualities that distinguish life from non-life, or biology from chemistry. Speakers noted that it used to be thought that the capability of reproduction was unique to living organisms, but that this dividing line between the living and the non-living had been cast aside when it was discovered that some otherwise inert molecules can reproduce themselves. Giuseppe Montalenti of the Instito di Genetica in Rome asserted that individuality is the distinguishing characteristic of life. Natural selection and life itself begin, Montalenti said, when a self-reproducing molecule mutates to an individual different from others of the same sort.[28]

This brings us to the second way in which misunderstandings can arise about the assertion that organic systems are distinguished by the capacity for self maintenance and reproduction. It is quite possible that Kenneth Boulding was wrong when he claimed, in his article on general systems theory published in 1956, that self-maintenance and self-reproduction are the principal and critical features which set life apart from not-life. His assertion was in tune with biological thought in the nineteen fifties, but it may be out of date. Or else, indeed, biologists may never settle upon a definitive set of criteria to discriminate the living from the non-living. That is my impression after reviewing the material from the Serbelloni conference, plus a few additional works such as those of Jacques Monod[29] and of S. E. Luria.[30] Instead of perpetually readjusting the definition of organic systems to accord with the most recent fads in biological thought, it seems more sensible to stick with one set of standards. Boulding's standards seem as good as any.

If the point at issue were to distinguish actual organic systems from actual inorganic systems, then the Boulding standard might be less easily defended. But that is not the issue. The problem in defining organic systems is to set them apart from other sorts of theoretical models, and especially from machines with input. Some kinds of actual systems can be described by models having the form of machines with input, but machines with input are not actual systems. Living things, likewise, can be interpreted by organic system models, yet the actual and the theoretical realms remain apart.

The form which an organic system model would assume is not clearly definable, since as Kenneth Boulding observed adequate theoretical models peter out at the level of complexity of living things. Some characteristics which such a theory might possess can be inferred by analogy with the other sorts of models which we have described previously. In the model of a linear simple machine given by $\dot{X} = AX$, for example, the structure of the systemic relations is given by the coefficient matrix A. The properties of self maintenance and self reproduction, I would suggest, have a lot to do with the stability of that coefficient matrix.

For the reinforcement model of dyadic interaction, for instance, we might ask for how long a period of time we could expect the matrix $A = \begin{bmatrix} 0 & \alpha \\ \alpha & 0 \end{bmatrix}$ to govern the alteration of the attitudes of the experimental subjects. Returning to the assumptions underlying the construction of the model, we recall that the parameter α was taken to symbolize two factors concurrently: 1) the relationship of the attitude of one of the subjects to the messages which he sends to the other subject, and b) the relationship between the messages a subject receives and the changes in his attitudes toward the sender. To cap off the model-building simplification, the parameter α was taken to be the same for both experimental subjects. There is reason to question the stability of this all-embracing parameter. If the subjects' attitudes traced a trajectory toward unmitigated hatred, for example, they might reflect upon their increasingly unpleasant experience and spontaneously alter the psychological principles governing their relationship.

In other kinds of simple machines, likewise, internal forces of disorganization will inevitably come into play. Gears will start to wobble on their bearings, pistons will wear unevenly from abrasion, and in multitudinous ways the machine would start to break down. As the mechanism wore out, its internal operating parameters would change. The coefficient matrix A in the model $\dot{X} = AX$ would reflect the relationship of the system variables to one another with ever-diminishing accuracy.

Exactly the same line of argument can be applied to a machine with input modelled by the matrix equation $\dot{X} = AX + GU$. There also the stability of the matrix A is open to question. Even resistors and capacitors deteriorate, so the real response of an electrical network will drift away from model predictions.

It is important to keep clearly in mind here the distinction between a real world entity or process about which we are conceptualizing, and a model of that reality. It is the models, the intellectual constructs, which have been categorized as static structures, simple machines, and machines with input. Those models are never inclusive of all aspects of reality. The models may hold over a certain range, but in the end they can be expected to fail. Predictability will give way to uncertainty.

In a short section of his treatise on the geometrical interpretation of differential equations, Solomon Lefschetz discusses the concept of structural stability. A structurally stable system, he says, is one for which the portrait of trajectories in phase space is invariant under small changes in the system coefficients.[31] To the best of my knowledge, that is about as far as the mathematical discussion has been carried.

For all his faults of overstatement and imprecision, Ludwig von Bertalanffy must be given credit for perceiving the importance of ordering influences in the biological and social sciences. He paraphrases approvingly, for instance, a comment made by Warren Weaver, one of the founders of mathematical information theory.

> Classical physics, Weaver said, was highly successful in developing the theory of unorganized complexity. Thus, for example, the behavior of a gas is the result of the unorganized and individually untraceable movements of innumerable molecules; as a whole it is governed by the laws of thermodynamics. The theory of unorganized complexity is ultimately rooted in the laws of thermodynamics. In contrast, the fundamental problem of today is that of organized complexity. Concepts like those of organization, wholeness, directiveness, teleology, and differentiation are alien to conventional physics. However, they pop up everywhere in the biological, behavioral and social sciences, and are, in fact, indispensible for dealing with living organisms or social groups. Thus a basic problem posed to modern science is a general theory of organization.[32]

Ludwig von Bertalanffy did not get very far on his own in the formulation of a general theory of organization. But at least he pointed to the need for one. His call for such a theory has been heeded, it seems, more by the social than by the natural scientists. Indeed, among members of the profession to which he himself belonged, the biologists, Bertalanffy is regarded these days as something of an irresponsible mystic. He was characterized as such by some of the participants in the Serbelloni conference on Reductionism in Biology.

At the root of the theory of unorganized complexity is the second law of thermodynamics, the entropy law of physics whose implications for biology and for the social sciences have puzzled so many philosophers. And the implications of the entropy law for organic systems pose the third major source of misunderstanding about our simplified typology of systems.

According to the second law of thermodynamics, which was discovered by the French engineer Sadi Carnot in 1824 (and later refined and restated by Rudolf Clausius, Lord Kelvin, and Ludwig Boltzmann), the entropy of closed systems tends toward a maximum. In the statistical form of the law which was formulated by Boltzmann, the assertion is that particles in a closed system tend toward their most likely distribution, which is one of randomness.

Paul Chambodal has remarked that "No other quantity has given rise to so much argument as has entropy. Likewise, of all physical quantities, entropy is the one most productive of paradoxes."[33] The concept of entropy is exceedingly slippery. Explanations of the second law of thermodynamics seem sensible enough at first. Yet upon reflection these explanations dissolve into ambiguities. Following, for instance, is a concise explanation of the entropy law by a staff writer for Science magazine, Nicolas Wade. Note that soon after he explains the law Wade calls its logic into question.

> The law is a broad, almost philosophical, concept which has had many formulations in its 110 year history. Central to all of them is the notion of irreversibility, that certain processes go in one direction only and can never be repeated except at far greater cost on the whole. A given lump of coal, for example, can be burned only once. There is of course the same amount of energy in the heat, smoke, and ashes as there was in the lump of coal (that is stipulated by the first law

> of thermodynamics governing the conservation of matter-energy), but the energy bound up in the combustion products is so dissipated that it is unavailable for use, unlike the "free" energy in the coal, and the process cannot be reversed.
>
> Entropy is a measure of this bound or dissipated energy. The entropy law says that the entropy of a closed system always increases, the change being from free energy to bound, not the other way around. Entropy is also a measure of disorderliness (dissipated energy represents a more chaotic situation than that before the lump of coal was burned). So the entropy law is also saying that the natural state of things is to pass always from order to disorder. Whence the notion of entropy as time's arrow....
>
> For a deep law of physics, the entropy law's distinction between free and bound, available and unavailable energy may sound strangely anthropomorphic. And indeed it is anthropomorphic. A pure intellect would not comprehend the distinction: it would just see energy shifting about. The difference is important only to living organisms, because they exist on the slope between low entropy and high. They absorb low entropy by feeding, directly or indirectly, on sunlight, and they give out high entropy in the form of waste and heat.[34]

Our subjective experience informs us that lumps of coal do not regenerate themselves from ashes, smoke, and heat, but why is such a recombination so very unlikely as never to have been observed? The process of combustion, after all, can be interpreted as a reversible chemical reaction. Why does not our subjective experience include instances in which heat energy flowed into the combustion chamber so that water, carbon dioxide, and other residues could recombine to form coal? This is the conundrum of entropy. Ludwig Boltzmann's answer to the riddle was that a lump of coal is a highly ordered and therefore highly improbably state of matter, and that the tendency of events is toward a state of maximum probability, or randomness. If that assertion smacks of tautology or teleology, so be it. Such is the status of entropy theory.

Ludwig Boltzmann's critics pointed out that he had postulated a law of irreversibility on the basis of fully time-reversible physical laws. In all the laws of mechanics which govern the motion of the gas molecules which Boltzmann was discussing, the sign of the expression for time, t, can be changed from positive to negative without affecting the validity of the mechanical laws. In response to these strenuous objections to his entropy theory, Ludwig Boltzmann commited suicide. The expression $S = k \log W$, which was his formulation of the statistical value of entropy, S, is inscribed on his grave in the Central Cemetery in Vienna. A century later, Boltzmann is regarded as one of the great physicists of the nineteenth century, and as one of the founders of the field of statistical mechanics.

The inexorability of increasing entropy is a profoundly discouraging idea. The human mind seems to relish order in the universe. The thought that the cosmos is slowly, inevitably coming apart at the seams is disheartening. I recall that my roommate during my freshman year in college, Frans van der Bogert, had read about the ascendancy of entropy and the disintegration of order in Norbert Weiner's book Cybernetics and Society. During the required weekly physical education class, at Swarthmore, we freshmen were told to run across a field, around a tree at the far end, and back again. Frans asked everybody in the P.E. class to run around the tree in the same direction, so as to preserve for a little while longer the sum of order in the universe. He said it was a gesture of existential defiance.

Herbert Spencer, the highly influential social philosopher, was taken aback when he was informed of the implications of the second law of thermodynamics. Spencer formulated his basic ideas about the inevitability of progress in the early nineteenth century, when the first law of thermodynamics dealing with the conservation of energy was known. In Spencer's sociological interpretation of physical ideas, the first law together with processes of biological evolution led inevitably to the establishment of perfection, order and universal happiness. During the period in which Spencer was elaborating his ideas in his major opus, First Principles, Rudolf Clausius and Lord Kelvin announced their discoveries of the second law of thermodynamics, the entropy law. When it was pointed out to Spencer that the second law implies that the ultimate state of the universe will be one of omnipresent disorder and death, he replied, in a letter, "Regarding, as I have done, equilibrium as the ultimate and highest state of society, I have assumed it to be not only the ultimate but also the highest state of the universe. And your assertion that when equilibrium was reached life must cease staggered me.... I still feel unsettled about the matter."[35] Spencer resolved the contradiction, in the end, by brushing the second law under the rug. Like the British and American industrial expansionists who lionized him for his theoretical justification of laissez faire, Spencer was unprepared to observe any malignancy in the social organism.

The existence of biological organisms and of human organizations would seem to contradict the implications of the second law of thermodynamics. Both organisms and organizations are highly complex entities, and they often evolve towards states of higher order, or less randomness. How can the evidence for increasing order in the biological and organizational spheres be reconciled with the predictions of the entropy law?

The paradox of order in the midst of entropy is one of the deepest enigmas of modern science. Astrophysicists ask themselves why stars group themselves into galaxies. Biologists inquire how protoplasm, the stuff of life, could coalesce out of the primordial soup in the early oceans of the earth. I do not pretend to offer a full resolution of this paradox. I can only point to the ways in which some outstanding contemporary scientists have addressed the problem, and draw some rough inferences from their thought.

Following up on Sir Arthur Eddington's remark that the increase of entropy shows which way time's arrow is pointing, a Harvard astrophysicist named David Layzer has made a distinction between two arrows of time: the historical arrow and the thermodynamic arrow.[36] Historical processes in the evolution of the universe, such as the formation of galaxies, have transformed simple states into more complex states, and have thereby generated order. The thermodynamic arrow is the one which Ludwig Boltzmann described. Layzer's illustration of the thermodynamic arrow is less than galactic in scale. He remarks that as a lump of sugar dropped into a cup of tea dissolves, the macroscopic information, or order, represented by the aggregation of the sugar molecules gradually disappears; entropy increases.

These two arrows would seem to point in opposite directions; the historical arrow toward increasing order, and the thermodynamic arrow toward increasing randomness. How can these two arrows of time coexist in the same universe? Through a complex argument centered on what he terms the "strong cosmological principle," David Layzer argues that as the universe has evolved from a hypothetical state of local thermodynamic equilibrium both macroscopic information (the historical arrow) and entropy (the thermodynamic arrow) could be generated simultaneously. According to Layzer's estimate, the universe was in a state of local thermodynamic equilibrium during the first fraction of a microsecond after the big bang, the cosmological singularity.

In 1977 the Nobel Prize in Chemistry was won by a Belgian scientist, Illya Prigogine, in recognition of his path-breaking contributions to the theory of chemical thermodynamics. Prigogine has been misinterpreted by some reporters as having disproved the second law of thermodynamics.[37] Anyone who has read the lecture which Prigogine gave upon the acceptance of the Nobel Prize would realize that that assertion is erroneous. Prigogine actually professed an exceptional reverence for the second law. He compared it with Einstein's theory of relativity, since both theories set absolute limits on physical experiments. The relativity theory asserts that it is impossible to propagate a signal that travels faster than light, and the second law proves that a perpetual motion machine cannot be constructed.

The misconception that Prigogine has thrown over the traces of the entropy law arises from his contention that open systems which are not in a state of thermodynamic equilibrium can generate order. The fundamental assertion of the second law, by contrast, is that as closed systems move toward a condition of thermodynamic equilibrium they generate entropy, or randomness. Most of Prigogine's examples of such non-equilibrium thermodynamics involve chemical reactions, but he is cognizant of the possible application of his ideas to the explanation of order in biological systems, and even in human organizations.[38] The prevalence of open system non-equilibrium thermodynamics, Prigogine suggests, is so widespread that nature seems more prone to developing order than disorder.

Another Nobel Prize winner, the French biochemist Jacques Monod, describes how biological systems evade the degenerative implications of the entropy law in transferring large amounts of genetic information at the expenditure of miniscule amounts of energy. Energy, after all, is what thermodynamics is all about. If energy expenditure can be conserved, then thermodynamic dissipation can be minimized.[39]

While there are suggestive commonalities in the theories of Layzer, Prigogine, and Monod (both Layzer and Prigogine, for instance, explain how order arises in the context of non-equilibrium thermodynamic processes), it is beyond my capability to integrate their ideas. What I would suggest, though, is that the root of a general theory of organization -- such as Warren Weaver and Ludwig von Bertalanffy called for several decades ago -- will be found in a new and more general formulation of the second law of thermodynamics. Illya Prigogine has advanced farther toward such a reformulation of the entropy law than has anyone else. But it appears that his ideas have yet to be tested and refined by application to the ultimate intricacies of the macromolecular chemistry of genetics and biological regulation. Once a general thermodynamic theory of organization is discovered and verified in the biological case, I would expect that the theory will have utility in the interpretation of human organizations as well.

One of the subtler implications of the theories advanced by Prigogine and by Layzer is that they both result in the specification of the direction of time. In mathematical models of simple machines, time is simply a geometric parameter. In a simple machine, time can run backwards just as well as forwards (-t can be substituted for t), and like a reversed movie the model will still yield internally consistent results. We saw that in a machine with input some limitations are imposed on the reversal of time. In the non-equilibrium thermodynamic theories of Layzer and Prigogine, the directionality of time's unfolding through history becomes an essential property of their models. David Layzer's article on "The Arrow of Time" concludes with the observation that "the intuitive perception of the world as unfolding in time captures one of the most deep-seated properties of the universe."

According to Jacques Monod, the directionality of time has a special significance for biological organisms. Drawing upon his studies of the molecular theory of the genetic code, Monod posits three properties which he says are essential and distinctive characteristics of all living things. The unfolding of the organism through time is integral to all three of these closely interlinked properties.

- <u>Teleonomy</u>: the property of an object's being endowed with a purpose or project. In their structure and in their performances living things act projectively, even if their behavior is directed toward no more than the most basic of biological projects: to mature and multiply.

- <u>Autonomous morphogenisis</u>: like crystals, living things take on a form which is internally determined, rather than being shaped by outside forces.

- <u>Invariant reproduction</u>: the egg of a frog grows up to become another frog, and not a bull.

Unlike the other two authors cited, Layzer and Prigogine, Jacques Monod does not seek to explain the direction of time, thermodynamics, and the creation of order and disorder within one overarching theory. I suspect that these three concepts -- time, thermodynamics, and order -- will come to be united in a general theory of organization, when such a theory is formulated.

In the absence of a general theory of organization, the distinction in our typology between machines with input and organic systems will have to remain imprecise. It is conceivable that from the general theory of organization could be derived attributes of organic systems which would be more fundamental than those proposed by Kenneth Boulding in 1956. For example, it might be possible, in light of the general theory, to stipulate that organic system models are characterized by qualities such as the irreversibility of time. I cannot defend that proposition, since it is no more than a non-scientist's wild guess at the intellectual future. Yet even a layman can see the exciting prospects for a great intellectual breakthrough. Whoever it is that formulates a general theory of organization would attain the same lasting prominence in the biological sciences and in the study of human organizations as have Newton and Einstein in physics.

The Boulding criteria, in the meantime, are a fair stand-in for a theoretically rigorous definition of organic systems. Among the virtues of the Boulding criteria (the capacities for self-maintenance and self-reproduction) is their direct applicability to the social realm. Talcott Parsons, for instance, has stated that the property of pattern maintenance is a prerequisite to the functioning of all social systems. The match between Boulding's self-maintenance and Parson's pattern maintenance is close, perhaps because both writers had the biological example in mind.

System Control

If we turn our attention to problems of information and control, it becomes apparent that the simplified systems typology of static structures, simple machines, machines with input, and organic systems is inadequate. The distinction which Kenneth Boulding made, for example, between clockwork and thermostatic closed systems is lost in the simplified four level typology. What is needed is a way of amplifying the typology so as to allow for the categorization of different kinds of systems control.

The control and direction of complex systems is a long-standing concern in the field of organizational management. In the literature in this field, the best classification scheme of which I am aware is the one which was developed by Robert N. Anthony of the Harvard Business School. Anthony and his research team read through the literature on management and administration, extracted several hundred statements about the nature of management, and sought to sort them out into various typologies of management functions. He experimented with, and rejected, several standard methods of classification such as long range-short range, top management-middle management, and planning-control. The categories and definitions which he finally settled upon are:

> _Operational control_ is the process of assuring that specific tasks are carried out effectively and efficiently.
>
> _Management control_ is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives....
>
> _Strategic planning_ is the process of deciding on objectives of the organization, on changes in those objectives, on the resources used to obtain those objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources.[40]

An instructive comparison can be made between Anthony's hierarchy of management functions and the organizational stratification proposed by Talcott Parsons. In a chapter on "Some Ingredients of a General Theory of Formal Organization,"[41] Parsons proposed that there typically are three levels in the hierarchical structure of organizations: the technical level, the managerial level, and the institutional level. The primary function of the technical level is usually productive activity; this is the level at which students are taught or automobiles assembled. The acquisition of resources and the disposal of products, plus the management of personnel, are the major functions of the managerial level. At the institutional level, internal policies are set and relationships of the organization to society at large are determined. Parsons cites school boards and corporate boards of directors as examples of subsystems at the institutional level.

The two uppermost levels of Parson's organizational classification (the managerial level and the institutional level) bear a close resemblance to the top two categories in Anthony's typology (management control and strategic planning). There is no distinct place in the Parsonian scheme, however, for the lowest level of management, which Anthony labelled the level of operational control. In adopting Anthony's, rather than Parson's, typology I am implicitly emphasizing the importance of operational control, the sort of management exercised by foremen in factories and by sergeants and lieutenants in the army.

A Complete Typology of Systems

By laying out the four system levels of Figure 3-1 on the vertical dimension, and Robert Anthony's categories of control as the horizontal dimension, a complete typological matrix of systems can be created, as is shown below:

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static Structures				
Simple Machines				
Machines with Input				
Organic Systems				

Figure 3-8: A complete systems typology.

To test the validity of this typology, let us see how it matches up with other prominent schemes for systems classification. First, the Boulding typology. I have already mentioned the omission of machines with input from Boulding's scheme; the oversight shows up clearly as a blank row in Figure 3-9.

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static Structures	Frameworks			
Simple Machines	Clockworks	Thermostats		
Machines with Input				
Organic Systems	Cells	Plants	Animals	Humans

Figure 3-9: Comparison with the Boulding typology.

The distinctions among cells, plants and animals implied by Figure 3-9 are not entirely realistic. Even organisms as simple as cells exhibit some of the attributes of operational control, inasmuch as they are capable of regulating their own metabolism. Plants, similarly, can exercise some control over the inflow and outflow of resources (management control) through mechanisms such as the rolling up of their leaves to reduce transpiration. Part of the awkwardness of the match between Boulding's typology and my own derives from the off-handed way in which Boulding labelled his systemic categories.[42] He indicates briefly, for example, that a distinguishing mark of the type of system which he calls "plants" is a division of labor among the parts. A more appropriate label for this level of systemic organization would be "organs." The emergent significance of operational control at this level of systemic complexity would then be more apparent, since the separate tasks of different organs (leaves and roots, for example) must be integrated into a purposeful whole. Such is the function of hormones in living systems, and of sergeants and lieutenants in an army.

When it comes to his animal and human categories, Boulding's criteria for classification focus on the information-handling capabilities of the organism. Nervous systems are not found in plants and reach their highest development (on this planet, at least) in man. Boulding describes animals as responding to an image structure which intervenes between stimulus and response, and he notes that man is capable of using language and symbolism. While these distinctions are valid in their own right, Figure 3-9 suggests that animals may be distinguished from plants (or from organs) and that man may be distinguished from the other animals according to a different set of criteria. What sets animals apart is their ability to control their internal environments and their ability to control their interactions, particularly in regards to the acquisition of food, with their external environments. These are functions of management control. By virtue of the refinement of his brain, man alone is capable of strategic planning.

Another instructive comparison can be made between the typological matrix and different types of mathematical system models. For the sake of simplicity I have used linear continuous time examples in Figure 3-10, as in most of this chapter.

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static Structures	$AX = K$			
Simple Machines	$\dot{X} = AX$	Feedback Control		
- - - - - - - - - -	- - - - - -	- - - - - -	- - - - - -	- - - - - -
Machines with Input	$\dot{X} = AX + GU$	Feedback Control		
Organic Systems				

Figure 3-10: Comparison with mathematical models.

The absence of any entries in the last row of Figure 3-10 may be more the consequence of my own ignorance than of a deficiency in mathematics. In his Nobel Prize lecture, Illya Prigogine develops his ideas of non-equilibrium thermodynamics in mathematical terms (such as Lyapounov functions, partial differential equations, and systemic bifurcations) which are beyond my comprehension. Prigogine makes a tantalizing reference to applications of the theory of catastrophes which has been developed by Rene Thom, a professor of mathematics at the Paris Institute for Higher Scientific Studies. Perhaps all this does indeed constitute a mathematical language sufficient for the description of organic systems. My impression, though, is that the mathematical techniques employed by Prigogine do not fall together as one mathematical language, but are more nearly analogous to isolated sentences. To an outsider, at least, it looks as if the mathematical methodology for modelling organic systems is still disjointed.

Feedback and Operational Control

Kenneth Boulding distinguished his two categories of closed dynamic systems, clockworks and thermostats, by the absence or presence of regulatory feedback. Because they make use of feedback, simple machines of the thermostatic type can adjust system variables toward an established standard. The same sort of distinction applies at the level of machines with input, although feedback for systems of this order is usually in reference to an input signal rather than to a fixed internal standard.

In the field of systems science as it has been elaborated by electrical engineers, control systems are typically divided into two categories: open loop and closed loop. Open loop systems would fall in the first column of Figure 3-10, and closed loop systems in the second column. Feedback is a characteristic of closed loop control. For definitions of these terms, I rely upon Di Steffano et al:

> -- An open loop control system is one in which the control action is independent of the output.
>
> -- A closed loop control system is one in which the control action is somehow dependent on the output.
>
> -- Feedback is that property of a closed loop system which permits the output (or some controlled variable of the system) to be compared with the input of the system (or an input to some other internally situated component or subsystem of the system) so that the appropriate control action may be formed as some function of the output and input. 43

The idea of controlling a system without reference to its behavior or output may seem odd. Control in open loop systems, according to Di Steffano, is accomplished by calibrating the system so that the desired input-output relationships obtain. System instructions are all pre-programmed, and cannot vary with changes in the systems environment. A vivid example of how self-destructive pre-programmed instructions can be has been provided by Henry A. Kissinger, who described the centralization of decision making in the Soviet armies in World War II.

> Field regulations prescribed the exact location of company commanders in the rear of their troops. Field orders determined not only the direction of the attack but the precise form it was to take. The sphere of initiative of division commanders could not have been more restricted. Divisions were prohibited from crossing divisional

> boundaries, and commanders carried out this order even if it meant the destruction of a neighboring unit before their eyes. Regiments advanced on prescribed lines even into their own artillery fire. To deviate from orders was an offense punishable by court-martial if it did not succeed. To carry out even suicidal orders did not involve any stigma.[44]

Elementary Subsystems

At the beginning of this chapter I commented on the comparison between Boulding's system typology and Mendeleyev's chemical table of the elements. As it happens, the typological matrix I have constructed does bear a resemblance to Mendeleyev's chart. I would now like to pursue that analogy further, and inquire whether there are some elementary system components whose number and arrangement determine the placement of a system in the cells of the typological matrix. In atoms, the number of protons in the nucleus controls this placement: one more proton in the nucleus, and the element fits into the next cell in Mendeleyev's table.

Several theorists have sought to analyze social systems into a fundamental set of subsystems -- building blocks from which all social systems are composed. Talcott Parsons wrote of subsystems for adaptation, integration, goal attainment, and pattern maintenance. Shrode and Voich have suggested that human organizations can be broken down into five basic components: structure, techniques and information, people, purposes and objectives, and management.[45] A similar paradigm for the analysis of complex organizations has been proposed by Kast and Rosenzweig,[46] who propose that organizations can be viewed as composed of a structural subsystem, a technical subsystem, a psychosocial subsystem, a goals and values subsystem, and a managerial

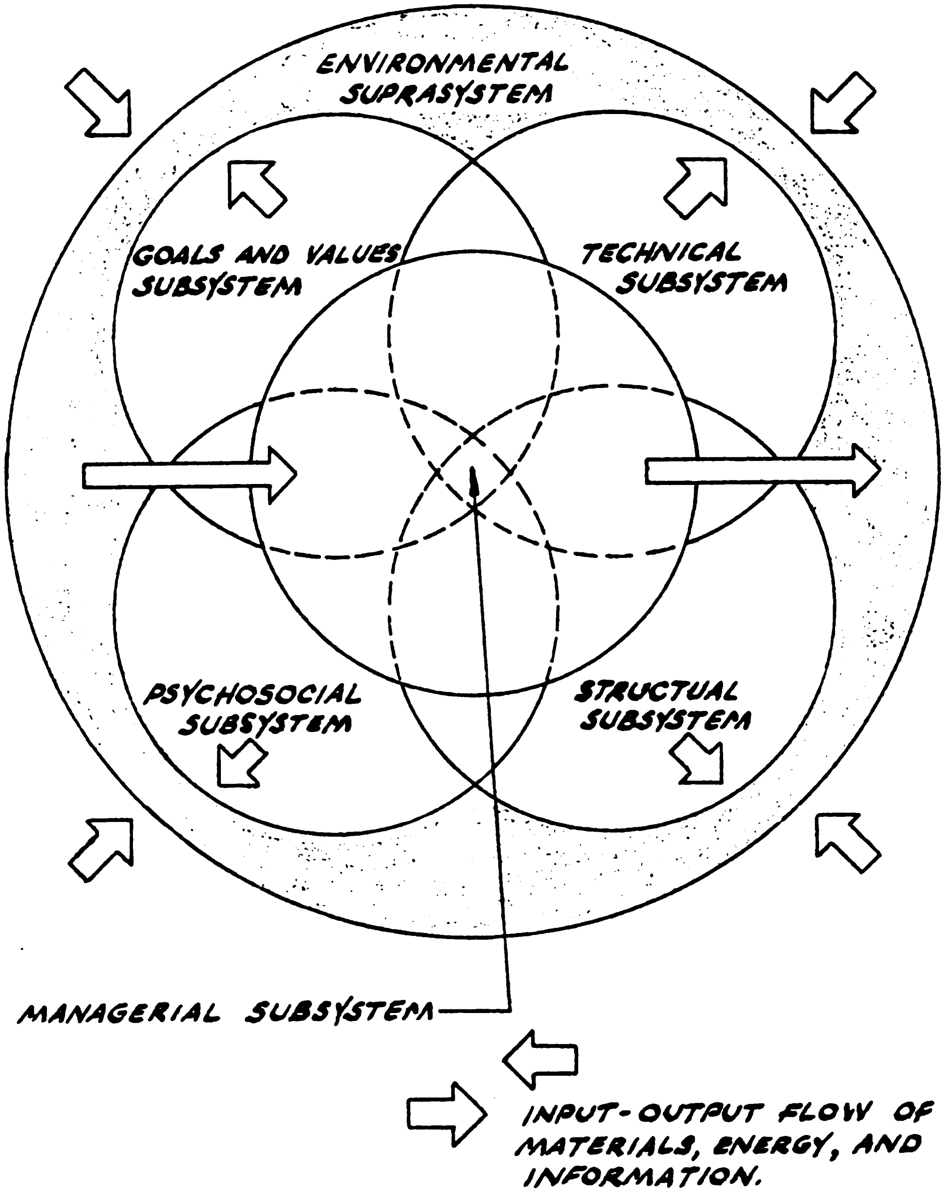

FIGURE 3-11 KAST AND ROSENZWEIG'S PARADIGM OF ORGANIZATIONAL SUBSYSTEMS.

subsystem. The diagram in which they present their paradigm is reproduced in Figure 3-11. The diagram bears an eerie resemblance to a science textbook portrait of an atomic nucleus.

The diagram of interlocking circles in Figure 3-11 is a simple one, and excepting the arrows, might have been produced at random by a child playing with a compass. The virtue of the diagram, however, is twofold: a) each of the circles (subsystems) can be separately linked to a distinct school of thought in organization theory; and b) the circles taken together allow for a fairly complete description of an open organizational system. There is cause for confidence, therefore, that the five organizational subsystems in Kast and Rosenzweig's scheme include a place for the consideration of most factors of importance in organizational analysis.

The multi-circled paradigm can be used, as Kast and Rosenzweig put it, as

> an aid to understanding the evolution of organization theory. Traditional management theory emphasized the structural and managerial subsystems and was concerned with developing principles. The human relationists and behavioral scientists emphasized the psychosocial subsystem and focused their attention on motivation, group dynamics, and other related factors. The management science school emphasized the technical subsystem and methods for quantifying decision-making and control processes. Thus each approach to organization and management has tended to emphasize particular subsystems, with little recognition of the importance of the others. The modern approach views the organization as an open, sociotechnical system and considers _all_ the primary subsystems _and_ their interactions.[47]

Notable for its omission from this passage is reference to the goals and values subsystem, which was shown in Figure 3-11 as a basic component of the organizational system. Indeed, throughout their text

Kast and Rosenzweig show an ambivalent attitude toward organizational goals and values. They sometimes lean toward the idea that organizational goals are established by management, and then hastily chastise themselves with references to the work of Etzioni, Perrow, and other modern writers who have asserted that official top-level organizational goals may have little bearing on the actual behavior of an organization.

My inclination is to eliminate the circle representing the goals and values subsystem from the paradigm shown in Figure 3-11. Those organizational goals which are in truth established by management could then be reviewed in the context of the managerial subsystem. Kast and Rosenzweig themselves incline toward this analytic methodology, in that they write of strategic, coordinative, and operating organizational goals, each set at a different level of management. Some of the actual goals of an organization may well arise from the orientation of the rank and file, and it seems to me that such goals could be studied within the framework of the psychosocial subsystem. The values of organizational participants, which Kast and Rosenzweig lump together with goals, would fit quite readily into the psychosocial classification.

The cavalier manner in which I have subtracted a subsystem from the Kast and Rosenzweig paradigm may trouble the thoughtful reader. If goals and values were so important to Kast and Rosenzweig as to merit the status of a separate subsystem, then how can such a significant classification be abolished? And is that all that a subsystem is, anyway: just a classification? Then why not call it a group or a family, in the manner of biological classification, rather than a subsystem?

I define a subsystem as a set of two or more interdependent elements of a system that interact according to definable rules. A

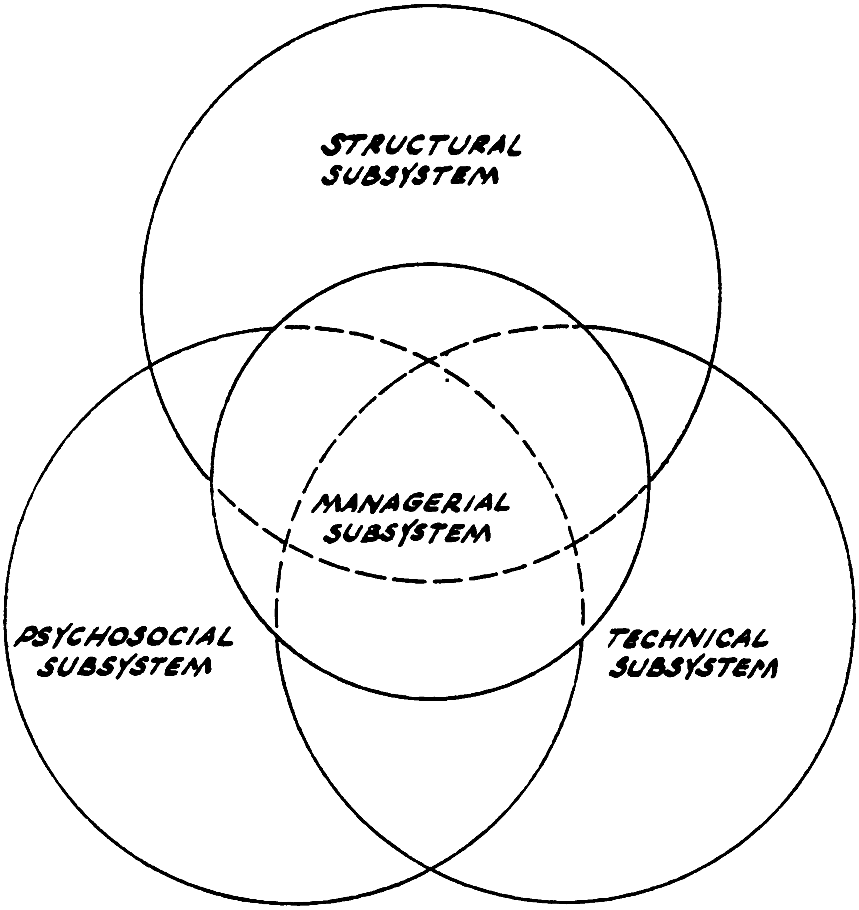

FIGURE 3-12 A SECOND VIEW OF THE ORGANIZATION AS COMPRISED OF SUBSYSTEMS.

system, similarly, is an organized, unitary whole consisting of two or more interdependent parts, components, or subsystems that interact according to definable rules, and which can be delineated by identifiable boundaries from its environment. With the addition of the phrase "that interact according to definable rules" this is the same definition of a system as is offered by Kast and Rosenzweig.[48]

It was with these definitions in mind that I removed the goals and values subsystem from Kast and Rosenzweig's five-circled paradigm. From a reading of their text, it is not clear to me which are the interdependent elements in what they describe as the goals and values subsystem. For that matter, Kast and Rosenzweig never explain what they mean by the term "subsystem." They use the word, apparently, more for the sake of trendy embellishment than for clarification. I shall try to be more precise.

What, then, is the systemic substance of Kast and Rosenzweig's psychosocial subsystem? It turns out that the psychosocial subsystem is as much a chimera as the goals and values subsystem. Kast and Rosenzweig describe the psychosocial subsystem in these terms:

> Every organization has a <u>psychosocial</u> subsystem which is composed of individuals and groups in interaction. It consists of individual behavior and motivation, status and role relationships, group dynamics, and influence systems. It is also affected by sentiments, values, attitudes, expectations and aspirations of the people in the organization. Obviously, the psychosocial subsystem is affected by external environmental forces as well as by the tasks, technology, and structure of the internal organization.[49]

It appears that the psychosocial subsystem in Kast and Rosenzweig's book serves the function of a theoretical attic in which they stash all of the factors which they could not place elsewhere in their schema for organizational analysis. If Kast and Rosenzweig's definition of the psychosocial subsystem were accepted, it would be next to impossible to formulate the rules which govern the behavior of this heterogeneous array. In the absence of such rules, the concept of a subsystem does not apply.

A more coherent definition of this subsystem can be derived from the theory of organic systems which was introduced earlier. The unique ordering capabilities of organic systems, it was argued, lie in their ability to sustain their systemic integrity and to reproduce themselves. If that integrity were indeed reflected in a mathematical model such as $X = AX + GU$, then the ordering ability of the system would be indicated by its capacity to keep its internal processes in step with that model. The system would sustain order and resist entropy.

Many organization theorists have been misled by the classical formulation of the August second law of thermodynamics, and have therefore contended that human organizations resist entropy simply by importing energy, or some relevant equivalent. Kast and Rosenzweig, for instance, assert that "...in the open biological or social system, entropy can be arrested and may even be transformed to negative entropy -- a process of more complete organization and ability to transform resources. This is possible because in open systems the resources (material, energy and information) utilized to arrest the entropy process are imported from the external environment."[50]

Many of the ordering processes in biological systems and in human organizations have little to do with system inputs. Genetic instructions encoded in molecules of DNA are quite internal to the organism. Status and doctrine, which are two common ordering factors in organizations, can be independent of inputs. There is no doubt that organizations can use a portion of their throughput for the maintenance of order -- the distribution of salaries being a good example. But inputs are not the sole source of order.

In the biological case order is indeed purchased through the consumption of inputs of energy in the form of food. Through the transformation of food, which involves the dissipation of heat and a net <u>increase</u> in entropy, the organism can construct new macromolecules, cells, and organs to replace those which have been worn down, and can thereby resist the tendancy toward degeneration. Local entropy within the organism is controlled at the expense of increasing entropy in the organism plus its environment. All of this is true, but it represents only a small part of the story, not including the part which is most relevant to the theory of human organizations.

The mechanisms which <u>regulate</u> the thermodynamic processes of biological organisms are themselves almost independent of thermodynamics. Complex proteins such as enzymes or DNA alter their own energy states only to a miniscule degree when they serve as catalysts or templates for metabolic or reproductive reactions. The change in thermodynamic potential in the chemical process governed by an enzyme may be large, despite the small expenditure of energy by the enzyme itself. Jacques Monod has compared this situation to that of an electronic relay which with a tiny throughput of energy can fire a ballistic missile.

The ultimate instance of the independance of regulatory processes from systemic inputs is that of the genetic code inscribed in molecules of deoxyribonucleic acid (DNA). The code is completely, hermitically isolated from outside influences. Information is always transmitted from DNA to the recipient protein, never in the opposite direction. The sequence of nucleotides in a segment of DNA is utterly impervious to external forces. In this one-way system for the transmission of genetic information -- which works entirely from the "inside" out, and never from the "outside" in -- we see the explanation for the extraordinary stability of species which have unalterably reproduced themselves for hundreds of millions of years.[51]

When it comes to the mechanisms for maintaining internal order, there is a close analogy between biological organisms and human organizations. Organizations can maintain themselves through ideologies and status systems which may be largely internal and independent of inputs. An organization with a well-articulated and widely-shared system of beliefs and expectations is like an organism with its genetic code. The ideology can shape and control the behavior of the organization's members and can be (although it does not have to be) pretty much impervious to influences external to the organization. And a system of beliefs about the nature and purpose of an organization, like a genetic code, can be the key to organizational reproduction.

The psychosocial subsystem as described by Kast and Rosenzweig would seem to contribute to the order of interpersonal relationships in an organization. They assert that the forces involved in the psychosocial subsystem "set the 'organizational climate' within which the human participants perform their roles and activities."[52] In organizations where that climate is uniform, we might anticipate greater uniformity, or order, in the behavior of the participants. Yet here we come upon a paradox. For many of the attributes of the psychosocial subsystem which are mentioned by Kast and Rosenzweig, such as status and role relationships, can exert a destabilizing influence as much as a stabilizing one. We saw in the last chapter, for instance, that the status of the big farmers in Comilla thana, and their traditional roles as moneylenders, were both incompatible with the purposes of the cooperatives.

Although the procedure is not entirely satisfactory, I will resolve this dilemma by means of a definition. In this volume; the psychosocial subsystem will be defined as _that set of beliefs and practices which sustain functional order in the working relationships of the organization's participants_. This may appear to be an excessively restricted, almost a militaristic, definition. Where in this construct is there room for all the idiosyncracies of motivation and behavior which make organizational psychology such an intriguing field of study? Where, indeed, is there room for the individual variations, from greed to altruism, which can be identified in all people, and which are sometimes accentuated in organizations?

By adopting a narrower view of the psychosocial subsystem than that which Kast and Rosenzweig allow, we have effected a trade-off between scope and rigor. The finer the brush, the less canvas can be painted. The precise definition accords well with the general theory of systems which has been advanced in this chapter. The ordering function of the psychosocial subsystem can readily be compared with the metabolic regulation accomplished by enzymes. On the other hand, there is a great deal of obstructionism and maneuvering in any organization which no longer seems to have a place in our paradigm.

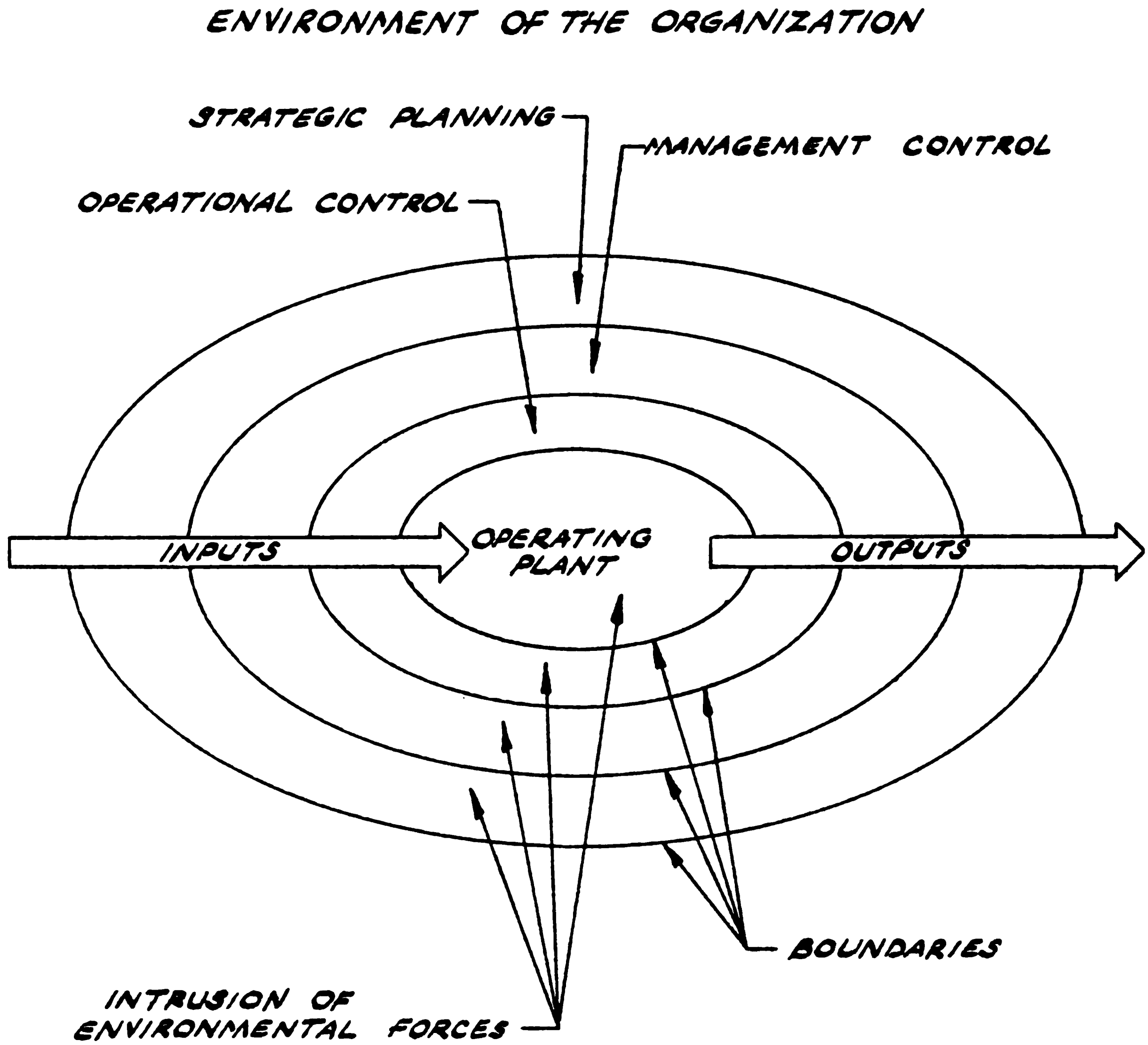

FIGURE 3-13 THE ORGANIZATION AS A COMPOSITE OF LEVELS OF CONTROL

Another intriguing diagram presented by Kast and Rosenzweig shows the management of an organization as consisting of concentric layers through which inputs and outputs pass.[53] A modified version of that diagram is shown in Figure 3-13. Pursuing, for a while, the atomic analogy, I would remark that Figure 3-13 shows a distant resemblance to a science textbook drawing of the orbits of electrons about an atomic nucleus.

In explanation of the similar diagram in their book, which they say is an extension of the work of Talcott Parsons, Thomas A. Petit, and James D. Thompson, Kast and Rosenzweig comment on the differences in the orientation of management at the different levels of their onion-like structure. The innermost layers of the organization are protected from the vagaries of the environment so that the core productive technology of the organization can function in a stable, rational, programable setting. Management at the outermost layer, that of strategic planning, has a perspective that is flexible, judgemental, and non-programable. Strategic management has a long run view of time; operational control a short run view. Strategic managers emphasize satisficing, while operational controllers concentrate on optimizing.

A superior paradigm for organizational analysis can be constructed by combining Figures 3-12 and 3-13. The explanatory power inherent in both diagrams can thereby be compressed into one diagram. The result of such a combination is displayed in Figure 3-14.

Because the paradigm shown in Figure 3-14 is so inclusive -- incorporating as it does most of the ideas displayed by Kast and Rosenzweig in two diagrams -- the gain in explanatory power is offset by an increase in complexity. The paradigm may be more readily understood if it is seen in an exploded view, such as Figure 3-15. As much for the

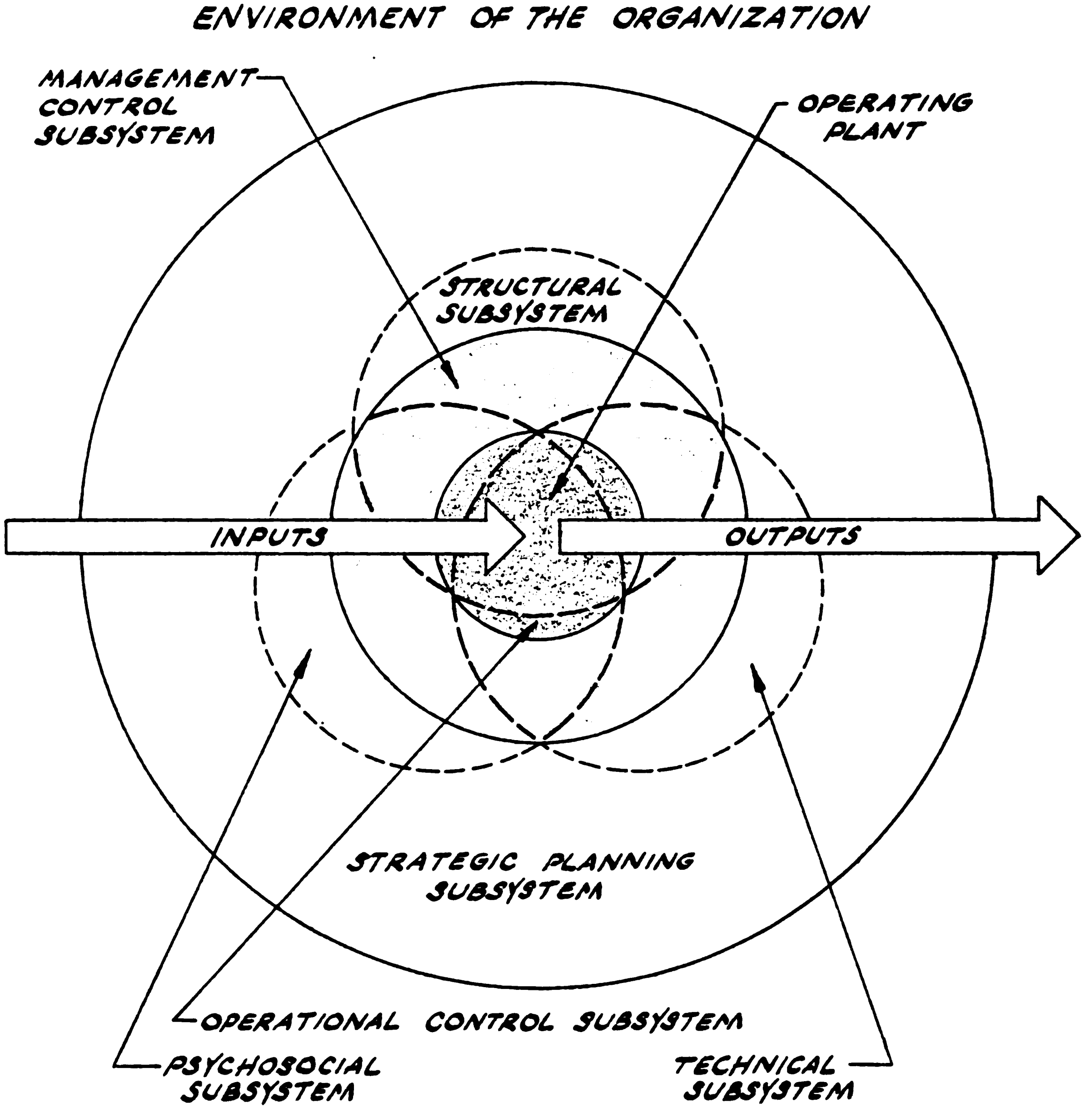

FIGURE 3-14 THE ORGANIZATION AS A COMPOSITE OF SUBSYSTEMS

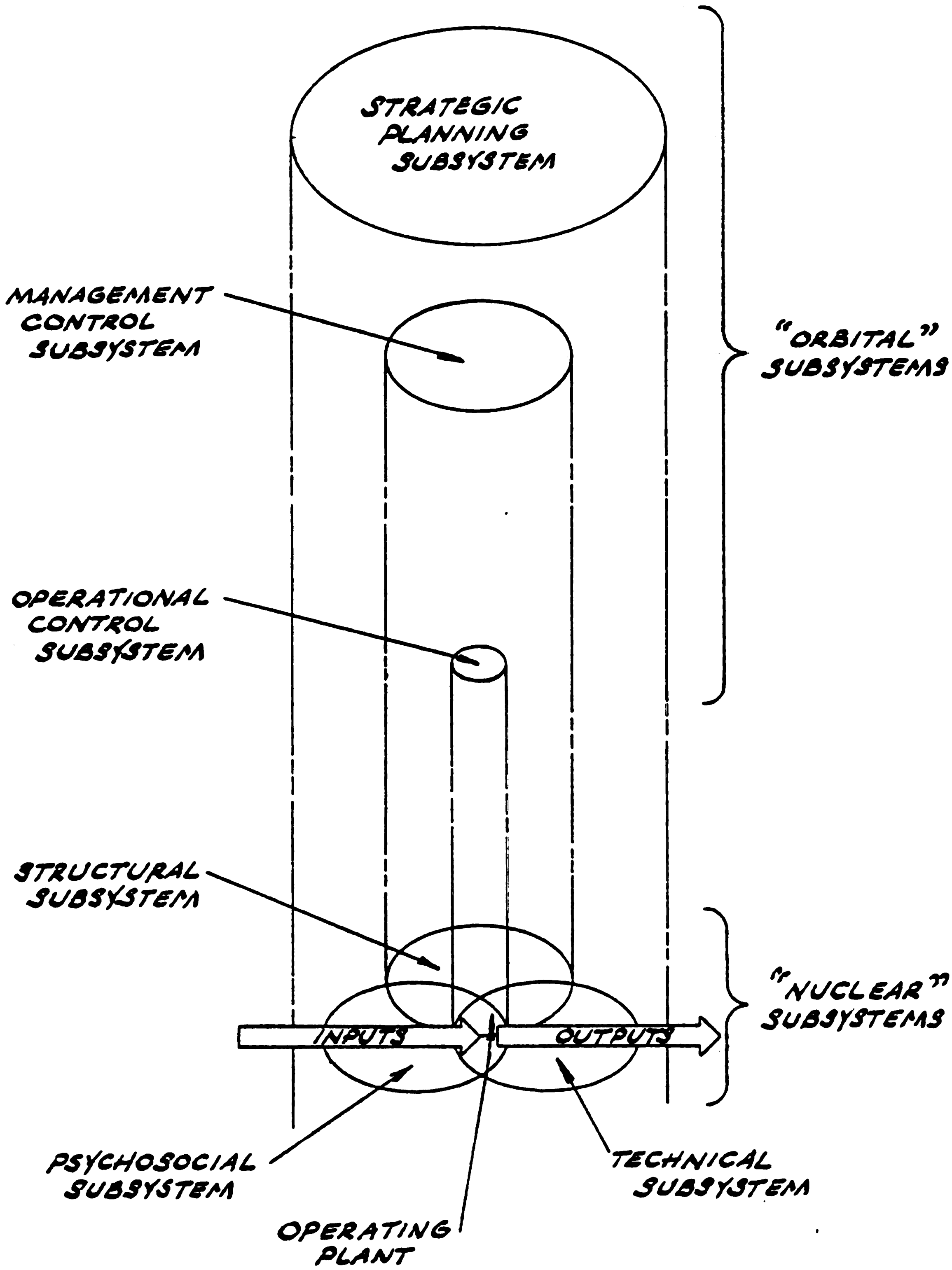

FIGURE 3-15 EXPLODED VIEW OF THE ORGANIZATIONAL PARADIGM.

sake of amusement as of edification, I have carried the atomic analogy forward in Figure 3-15, and have labeled the structural subsystem, the technical subsystem, and the psychosocial subsystem as "nuclear" subsystems, and the control subsystems as "orbital" subsystems. The significance of this analogy should not be exaggerated. Yet it does suggest -- and I think correctly -- that the core components of an organization are its structural, technical, and psychosocial subsystems. And the very core of the core -- the operating plant of the organization -- is to be found in the region where these three nuclear subsystems interact. A conceptualization of the operating plant would be incomplete if it did not take all three nuclear subsystems into account.

In Figure 3-16 I have indicated what I conceive to be the relationship between these multi-circled analytic paradigms and the general typology of systems. "S" in Figure 3-16 stands for structural subsystem, "T" for technical subsystem, "E" for environmental subsystem, "P" for psychosocial subsystem, "O" for operational control subsystem, "M" for management control subsystem, and "R" for strategic planning subsystem.

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static Systems	S			
Simple Machines	ST	STO		
Machines with Input	STE	STEO	STEOM	
Organic Systems	STEP	STEPO	STEPOM	STEPOMR

Figure 3-16: Subsystem components of organizational systems.

Here at last is a firm link between organization theory and general systems theory. Like the chemical table of the elements, Figure 3-16 indicates that different kinds of systems are built up out of different combinations of elementary components. (The analogy which I drew above between nuclear and orbital subsystems does not carry through in this instance.) I very much doubt that computers, for example, will ever exhibit the characteristics of true strategic planning. The farthest that computers can go, I suspect, is to the STEOM classification. So the last column of the row for machines with input is blank. On similar grounds, I would doubt that any of the other blank cells in Figure 3-16 could be filled in with actual examples.

Different combinations of elementary organizational subsystems create different kinds of organizations. The most complex and sophisticated organizations, such as large industrial corporations or modern governments, contain all of the elementary subsystems; they would fit the STEPOMR classification. I would venture to say that no collection of human beings could be called an organization, however, if it were not an open system, and if it did not include the basic nucleus of structural, technical, and psychosocial subsystems. To put the matter another way, I would posit that all human organizations are organic systems, and are appropriately classified in one of the four cells in the bottom row of Figure 3-16.

For the purposes of this book, the utility of Figure 3-16 is in the order which it lends to organizational analysis. Just as Kast and Rosenzweig's book is structured around the paradigm shown in Figure 3-11, the remaining chapters of this book are structured around Figure 3-16. As an ordering device, the typological matrix of Figure 3-16 is superior to the multi-circled paradigm shown in Figures 3-14 and 3-15. An appropriate sequence of presentation, building up from simple to complex, can be inferred from the matrix. Choosing which circle (subsystem) in

Figure 3-14 to describe first, on the other hand, is quite arbitrary. In terms of the systems typology, the fourth through eighth chapters of this book can be related to one another as in Figure 3-17.

	Operational Plant	Operational Control	Management Control	Strategic Planning
Static Systems	4			
Simple Machines	5			
Machines with Input	6			
Organic Systems	7	8	8	8

Figure 3-17: Chapters in the context of the systems typology.

I remarked in Chapter 2 that the territorial hierarchy of administration has been of fundamental importance in the design and operation of rural organizations in South Asia, including those intended for administration and those intended for development. Whereas in complex industrial organizations in developed countries geography is often used as a basis for horizontal departmentalization -- the west coast branch or the European division, for example--in rural organizations in developing countries, and especially in South Asia, geography is used as the basis for the establishment of a vertical hierarchy of authority. In defference to the significance of the territorial hierarchy, in my analysis of the Comilla cooperatives I will portray the three nuclear subsystems shown in Figure 3-15 at the village and at the thana level. When it comes to describing the three orbital subsystems, those for operational control, management control, and strategic planning, I will modify the strict division of the text into village level and thana level aspects of the cooperative organization.

One further modification needs to be introduced so as to make the

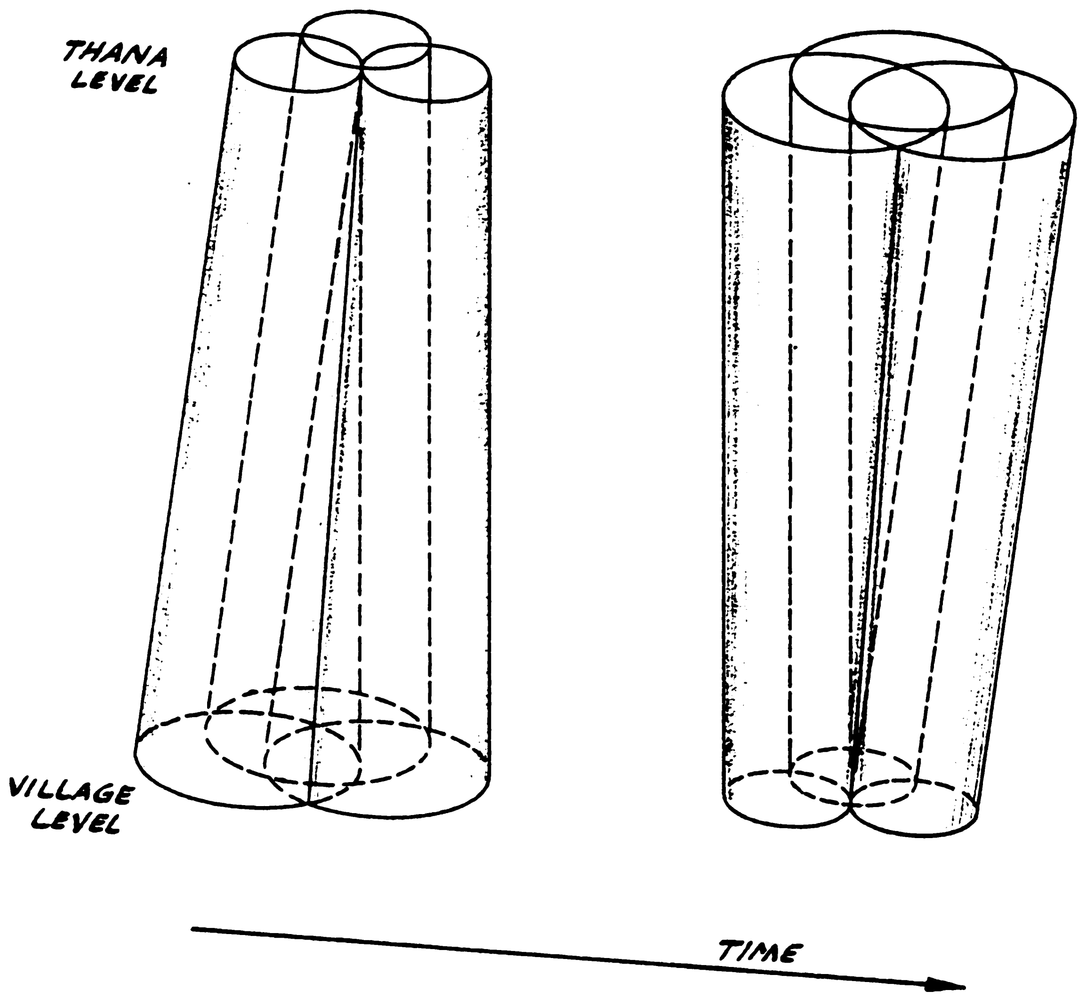

FIGURE 3-18 SYSTEMIC DEVELOPMENT

systems analytic framework suitable for the purposes of this book. I remarked in Chapter 1 that I had set out to discuss the evolution of the rural development organizations in Comilla, and especially of the rural cooperatives, during the decade of the nineteen sixties. Yet the analytic paradigm displayed in Figures 3-13 and 3-14 is obviously inadequate for such a purpose, because it is static. Figure 3-14 resembles a cross-section of the trunk of a many-boled cypress tree. For an historical study, what is needed is a way of representing how the tree has grown and changed its shape and proportions over time.

By introducing the territorial hierarchy as a vertical dimension of analysis, I have already added a third dimension to the two-dimensional organizational cross-section of Figure 3-14. To show changes in the model over time, a fourth dimension would have to be embodied in the model. While a true four dimensional representation is of course impossible on a two dimensional page, the influence of time can be shown schematically as in Figure 3-18, which portrays the three dimensional organizational model moving along a time line.

The processes of institution-building for rural development typically takes many years to unfold. In a speech at Michigan State University in 1966, Akhter Hameed Khan described the significance of time.

> ...building institutions is not like erecting a building where you just have a plan, raise the walls, and then put the roof on. Actually, nothing goes according to the plan. The analogy would be much nearer to the planting of an orchard, where the seed is put in and watered, and then you just wait. You can't do a thing. You can't push the germination process, and you can't push the growth of the trees. Sometimes the seed may not germinate at all; or the plant may be killed by disease, insects, and so on. So there is a great deal of waste, and a great deal of

> patience is required to see these institutions grow up. Building institutions is not simply a matter of writing a constitution or by-laws. It's really a question of creating loyalty, and loyalty is created only by time and testing. We cannot claim loyalty, but it will come after these institutions have been tested. We have to wait; we have to be very patient. There has been some progress in the last five or six years, but what we really need is sixty years, not just five or six years.[54]

A half century might, as Akhter Hameed Khan suggests, approximate the appropriate span of time in which to evaluate a rural development organization. This study of the Comilla rural development organizations is nonetheless limited to a much shorter period, to the ten years from 1960 to 1970. The decade of the nineteen sixties included the golden era of the Comilla cooperatives (the period 1964-67), but that is not the reason for the selection of the sixties as the period for investigation. As we shall see, several unfavorable trends came to light in the late sixties, so the period balances the bad with the good. The reason for limiting this study to the first decade of the Comilla experiment is that during those ten years the background economic and political conditions in East Pakistan were relatively stable, whereas they changed markedly during and after the upheavals which created Bangladesh.

Notes for Chapter 3

A Systems Approach to Organization Theory

1 Richard A. Johnson, Fremont E. Kast and James F. Rosenzweig, The Theory and Management of Systems, McGraw Hill, New York, 1967, p. 64. Copyright 1974. Used with permission of McGraw Hill Book Company.

2 William G. Scott, "Organization theory: an overview and an appraisal," in Frank Baker, ed., Organizational Systems, General Systems Approaches to Complex Organizations, Richard D. Irwin, Homewood, Illinois, 1973, p. 113.

3 James G. Miller, "The Nature of Living Systems," in Frank Baker, ed., Organizational Systems, General Systems Approaches to Complex Organizations, Richard D. Irwin, Homewood, Illinois, 1973, p. 48. Reprinted with permission.

4 Ludwig von Bertalanffy, "The Meaning of General System Theory," reprinted as Chapter 2 of Ludwig von Bertalanffy, General System Theory, Foundations, Development, Applications, George Braziller, New York, 1968, pp. 35, 36. Reprinted with permission.

5 David Berlinski, On Systems Analysis: An Essay Concerning the Limitations of Some Mathematical Methods in the Social, Political, and Biological Sciences, The M.I.T. Press, Cambridge, Massachusetts, 1976.

6 von Bertalanffy, op cit, pp. 56-63.

7 Berlinski, op cit, p. 4.

8 Kenneth Boulding, "General Systems Theory, the Skeleton of Science," Management Science, April, 1956, pp. 197-208.

9 Fremont E. Kast and James E. Rosenzweig, Organization and Management, a Systems Approach, McGraw Hill, New York, 1974, second edition, pp. 101, 102. Copyright 1974 by McGraw Hill Book Company. Used with permission of McGraw Hill Book Company.

10 Boulding, op cit, p. 205.

11 Ibid., p. 205.

12 Ibid., p. 206.

[13] *Ibid.*, p. 202.

[14] *Ibid.*, p. 202.

[15] The meaning of the term "simple machine" is the same as what W. Ross Ashby intends by his phrase "determinate machine."

[16] Boulding, *op cit*, pp. 202, 203.

[17] John E. Hunter, "Mathematical Models and the Cybernetic Equation," (mimeographed), p. 4.

[18] John Hunter has posed a counter example to refute the universality of these observations about the reversibility of time in closed system dynamic models. It is possible for two trajectories of such a model to converge and form one trajectory, like the two branches of a Y joining to form the stem. If time is reversed in such a configuration, the trajectories split from the stem to the branches of the Y. The implication of such a split is that the model is not state determined, and therefore does not conform to the definition of a simple machine.

[19] David Layzer, "The Arrow of Time," *Scientific American*, December, 1975, p. 69.

[20] Adapted from class notes for Psychology 820, "Mathematical Models in Psychology," Michigan State University, Fall, 1975. The format and symbolism in this definition have been altered to parallel Hunter's definition of a simple machine, quoted above.

[21] More technically, the expression $e^{A(t-\tau)}$ is a weighting function. It plays a role in the forced response analogous to that of the expression e^{At} in the free response.

[22] For a mathematical demonstration of this point, see Appendix A.

[23] There are exceptions to this pronouncement. The open system model with an undelayed step input, illustrated as a phase plane in Figure 3-4, is a good example of the exceptions.

[24] Walter F. Buckley, *Sociology and Modern Systems Theory*, Prentice Hall, Englewood Cliffs, New Jersey, 1967, p. 50. Reprinted with permission.

[25] Kast and Rosenzweig, 1974, *op cit*, p. 102. Used with permission of McGraw Hill Book Company.

[26] Francisco Jose Ayala and Theodosius Dobzhansky, eds., *Studies in the Philosophy of Biology, Reduction and Related Problems*, University of California Press, Berkeley, 1974.

[27] Peter Medawar, "A Geometric Model of Reduction and Emergence," in Ayala and Dobzhansky, eds., *op cit*, pp. 57-63. Medawar's paper includes a layman's interpretation of topology which I found illuminating. If a closed figure such as a circle is drawn on a sheet of flexible

rubber, the figure will preserve a meaningful inside and outside, but the regular shape of the circle will be destroyed. No matter how the rubber is stretched, and so long as it is not torn, there will be a continuous point-to-point transformation between the original circle and the new shape on the surface of the rubber. Topology, Medawar asserts, is the study of such continuous one-to-one mappings in space.

[28] Giuseppe Montalenti, "From Aristotle to Democritus via Darwin," in Ayala and Dobzhansky, op cit, p. 12.

[29] Jacques Monod, Chance and Necessity, An Essay on the Natural Philosophy of Modern Biology, Vintage Books, New York, 1971.

[30] S. E. Luria, Life, the Unfinished Experiment, Charles Scribners and Sons, New York, 1973.

[31] Solomon Lefschetz, Differential Equations, Geometric Theory, Interscience Publishers, New York, 1957, p. 239.

[32] von Bertalanffy, op cit, p. 34. Reprinted with permission.

[33] Paul Chambodal, Paradoxes of Physics, Transworld Publishers, London, 1971, p. 35.

[34] Nicholas Wade, "Nicholas Georescu-Roegen: Entropy the Measure of Economic Man," Science, 31 October 1975, V. 190, p. 448. Copyright 1975 by the American Association for the Advancement of Science. Reprinted with permission.

[35] Quoted in Cynthia Eagle Russett, The Concept of Equilibrium in American Social Thought, Yale University Press, New Haven, 1964, p. 39.

[36] Layzer, op cit.

[37] Robert C. Cowen, "Challenges to the Second Law: Nonsense," The Christian Science Monitor, June 20, 1979.

[38] Ilya Prigogine, "Time, Structure, and Fluctuations," Science, V. 201, No. 4358, September 1, 1978, pp. 777-785.

[39] Monod, op cit, pp. 68, 69.

[40] Robert N. Anthony, Planning and Control Systems, A Framework for Analysis, Harvard Graduate School of Business Administration, Boston, 1956, pp. 16-18. Reprinted with permission.

[41] Talcott Parsons, Structure and Process in Modern Societies, The Free Press, Glencoe, 1963, pp. 59-96.

[42] In evolutionary terms, plants are conceived of as having developed in a different direction from animals. The way Boulding has ordered his typology, by contrast, makes plants appear more primitive than animals.

[43] Di Steffano, op cit, p. 3. Used with permission of McGraw Hill

Book Company.

[44] Henry A. Kissinger, Nuclear Weapons and Foreign Policy, Doubleday Anchor Books, Garden City, 1958, p. 163.

[45] William A. Schrode and Dan Voich, Jr., Organization and Management: Basic Systems Concepts, Richard D. Irwin, Homewood, Illinois, 1974, p. 506.

[46] Kast and Rosenzweig, op cit, p. 112.

[47] Ibid., p. 113. Used with permission of McGraw Hill Book Company.

[48] Ibid., p. 101.

[49] Ibid., p. 111.

[50] Ibid., p. 115. Used with permission of McGraw Hill Book Company.

[51] Monod, op cit, p. 110, 111.

[52] Kast and Rosenzweig, op cit, p. 111.

[53] Ibid., p. 120.

[54] Akhter Hameed Khan, Community and Agricultural Development in Pakistan, Asian Studies Center, Michigan State University, East Lansing, 1969, p. 31.

CHAPTER 4

The Structural Subsystem

	Operating plant	Operational control	Management control	Strategic planning
Static systems	S			
Simple machines				
- - - - - - - -				
Machines with input				
Organic systems				

Traditionally, organizations are described by organization charts. An organization chart specifies the authority or reportorial structure of the system. Although it is subject to frequent private jokes, considerable scorn on the part of sophisticated observers, and dubious championing by archaic organizational architects, the organization chart communicates some of the most important attributes of the system. It usually errs by not reflecting the nuances of relationships within the organization; it usually deals poorly with informal control and informal authority, usually underestimates the role of personality variables in molding the actual system, and usually exaggerates the isomorphism between the authority system and the communication system. Nevertheless, the organization chart still provides a lot of information conveniently -- partly because the organization usually has come to consider relationships in terms of the chart.[1]

Introduction

Systemic architecture, or the established pattern of relationships among the component parts of an organization, is the proper focus of investigation when we consider the structural subsystem. Unlike animals, which have well defined skeletons, organizations do not typically have a single describable pattern of internal structure. Top management may conceive of the significant internal patterns as following an organization chart. Middle level managers who get things done may be more concerned with tracing patterns of personal influence -- patterns which as often as not criss-cross and short-circuit the formal hierarchy. Production personnel may think of the organization in a more linear, horizontal fashion, as a chain of work stations. Each of these categories of personnel may be thought of as having their own sociological equivalent of an x-ray; on the emulsion of their minds, they each burn a different image of the bone structure of the organization.

My discussion will be biased toward the organization chart image of systemic architecture. For all its omissions and limitations, the organization chart does summarize much that is crucial in the understanding of formal organizations. An organization chart can give clues, for instance, about how activities are differentiated and coordinated, and about channels of authority. For practical administrators, institution-builders, and organization theorists alike, organization charts stand in the same fundamental relationship to the comprehension of modern organizations as does the Copernican model of the solar system to the understanding of the movement of the planets around the sun.

To the degree that an organization chart or some such model can be fitted to an organization, moreover, the model defines the rules of established relationships which allow us to characterize the structure of the organization as a subsystem. Without such rules, the relationships among the members of the group, though they may have form at any given time, cannot be said to comprise a subsystem. Many significant human groups, such as crowds and friendly gatherings, are of this ameboid sort. If a group does not have a structural subsystem, it does not have the most elementary characteristic of a system, much less of an organization.

The study of organizational structure, and of the charts which delineate that structure, is just as significant for the understanding of rural development organizations as it is for any other class of organizations. The first of Norman Uphoff and Milton Esman's seven design principles for rural development institutions, cited in chapter two, was a structural prescription. They recommended that "Local institutions should have <u>more than one level of organization</u>, probably a two-tier pattern, in which the lower tier performs functions at the neighborhood or small group level, while the other undertakes more complex business activities that require relatively large scale operations."

The idea of tiers of organization is not common in the literature of organization theory, where the unified bureaucratic hierarchy is the conceptual and empirical norm. A concept which is frequently encountered in the literature on organization theory is that of levels in a hierarchy of authority. Levels should be distinguished, however, from tiers. In the quotation above Uphoff and Esman use the words synonymously ("...more than one <u>level</u> of organization, probably a two <u>tier</u> pattern..."), yet this practice can lead to confusion. A level, as the term is customarily employed in the organization theory

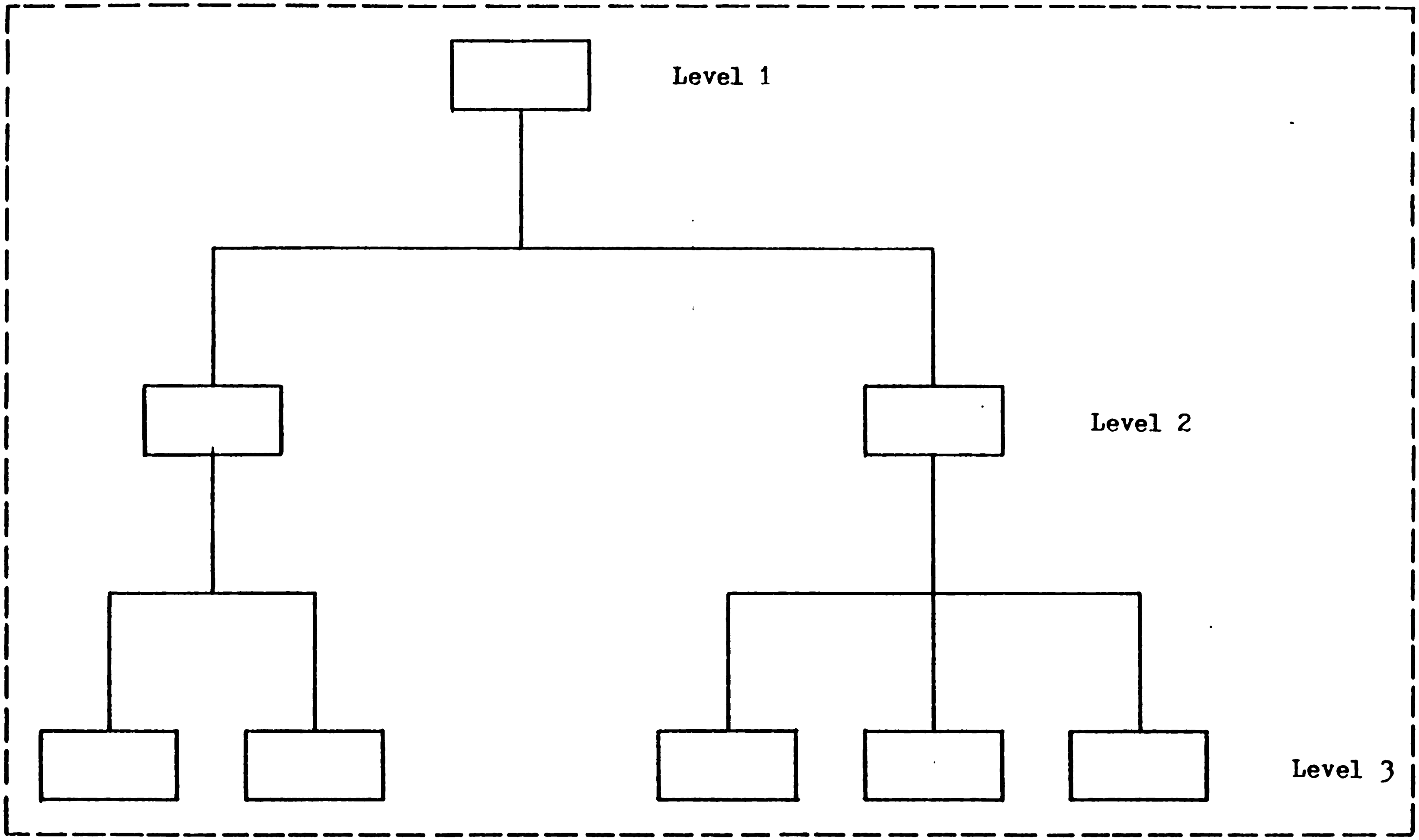

Figure 4-1: A three level bureaucracy. The dotted line indicates the organizational boundary.

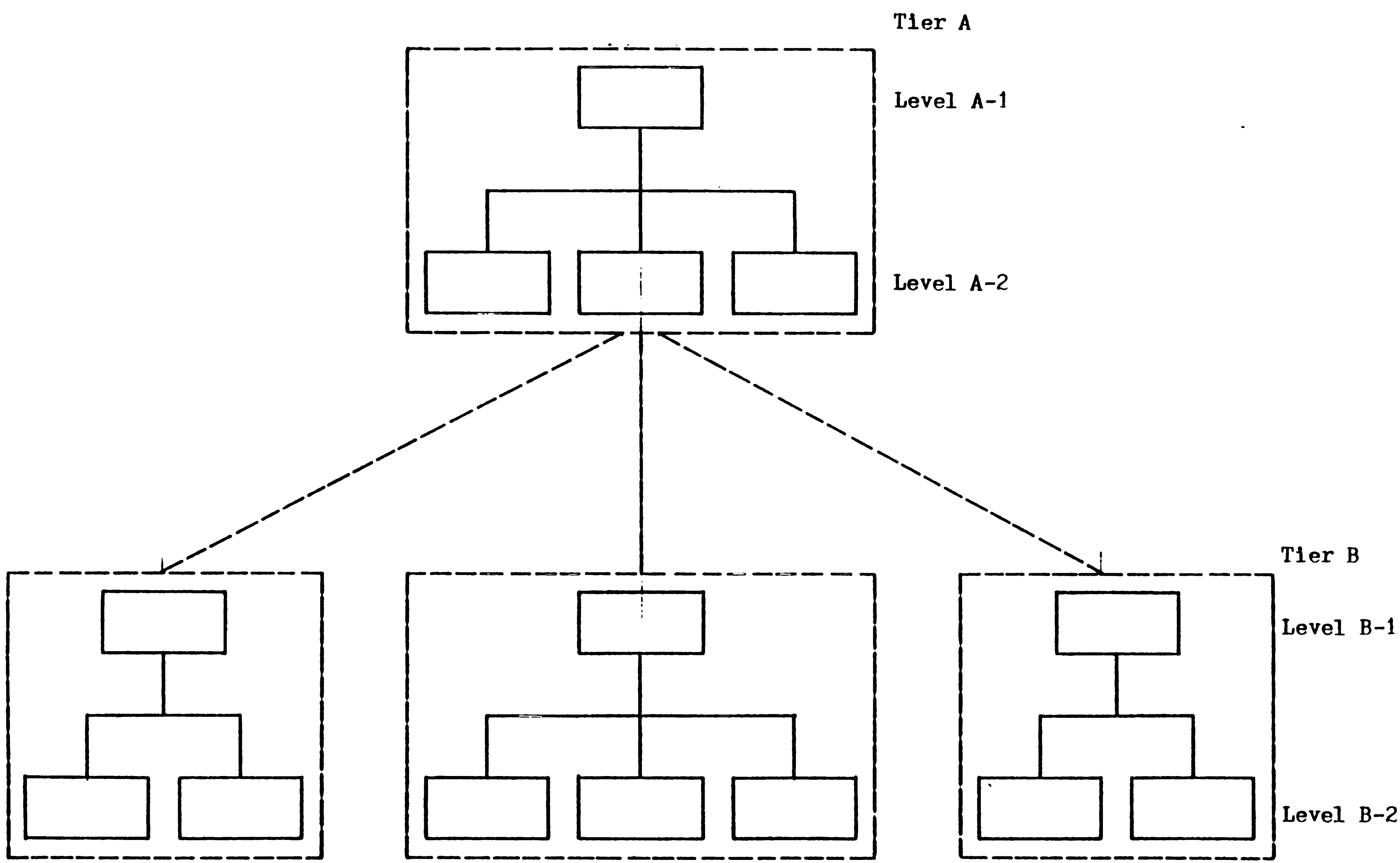

Figure 4-2: A two-tiered organization. There are two levels at each tier.

literature, means a step in the vertical chain of command in a bureaucracy. Organizations characterized by tiers, on the other hand, have well-defined boundaries at each tier. The units at each tier have greater autonomy (in terms of decision making power and the acquisition and use of resources) than do the units at each level of a bureaucracy. The distinction is presented schematically in Figures 4-1 and 4-2. It would be misleading to assert that the organization whose structure is diagrammed in Figure 4-1 has three levels and that the organization shown in Figure 4-2 has four levels, and to leave the matter at that.

The structural representation in Figure 4-2 is not very different, as it happens, from the basic form of the two-tiered Comilla cooperative system. The units at level B-2 can be thought of as farmers (about 30 per primary cooperative), the units at level B-1 as the managing committees of the village cooperatives, the units at level A-2 as the sections (divisions, in the American phrase) of the thana cooperative association, and the unit at level A-1 as the director of the thana cooperative association. In the Expansion Program thanas where cooperatives of the Comilla type were set up during the nineteen sixties, the only variation on this pattern was to form blocks in the field supervision section, thereby introducing three levels into tier A. In Comilla Kotwali Thana structural experimentation was carried further, to include the multiplication of tiers above the thana cooperative federation.

Relevant Research

In an article on the general theory of growth, published in 1953, Kenneth Boulding[2] hypothesized that as an organization increases in scale its internal relationships, which would be comparable to volume in a three-dimensional pyramidal model of an organization, increase as the cube of changes along any of the height, width, or depth dimensions. Because the administrative portions of organization are charged with coordinating these internal relationships, the administration would grow disproportionately in size as the organization expands.

Boulding's reasoning by geometric analogy has not held up well under the brunt of subsequent research. Some of the more recent empirical research on organizational structure might not have been conducted, however, if it had not been for Boulding's provocative contention.

An impressive investigation of the relationship between organizational size and organizational architecture was reported in 1970 by Peter M. Blau, a sociologist who was then on the faculty of the University of Chicago.[3] In a cross-sectional study, Blau examined the structure of 1201 local branches of 53 employment security agencies in the United States. He plotted distinctly curvilinear relationships between organizational size and a) the number of hierarchical levels in the organizations, and b) the percentage of supervisory personnel. (As his index of size, Blau used the total number of employees in the employment security agencies.) Organizational architecture, in other words, did not remain constant as the scale of the organization changed. Due to economies of scale, larger organizations could make do with a proportionately smaller administrative staff. This finding was precisely contradictory to the law of swelling management which Kenneth Boulding had proposed.

Blau interpreted the primary effect of an enlargement in organizational scale as being the increase in homogeneity within specialized units in larger organizations; as a consequence of this specialization, the organizational units find their tasks increasingly well-defined and they therefore require less supervision. In large employment security agencies, Blau discovered, managers typically had a wider span of control than in small agencies. But a secondary, and opposite, effect of increasing organizational size is to increase the diversity among specialized units, and thereby to compound problems of inter-unit coordination. Blau proposed that this secondary effect (which was the only one that Boulding had considered) puts a brake on the primary effect, and explains the curvilinear relationship between size and differentiation. He summarized his findings with the assertion that "Increasing size generates structural differentiation in organizations along various dimensions at decreasing rates."

To anyone familiar with the calculus, the mention of decreasing rates of change is an indication that a second derivative with a negative sign is lurking in the shadows. In an elegant demonstration for which Blau himself has admitted his admiration, Norman P. Hummon restated the propositions contained in Blau's paper in mathematical terms.[4] Hummon showed that most of Blau's nine propositions about organizational structure were mathematically derivable from the proposition quoted above.

Another sociologist who felt challenged to improve on Peter Blau's research was Marshall W. Meyer.[5] He pointed out that since Blau's study had been cross-sectional in nature, it could not be used as the basis for causal inferences about the relationships of variables to one another. Using his own data from 194 departments of finance in city, county, and state governments that were studied in 1966 and again in 1971, Meyer claimed to have demonstrated, through the application of the technique of path analysis, "that size is a cause of other parameters of organizational structure, whereas other parameters neither cause size nor are causally related to one another.... Once size is taken into account, the other parameters show no causal effects; organizational structure is thus the result of size."[6] As had Peter Blau before him, Meyer took the number of full time employees in a department of finance as the measure of size. The structural variables which Meyer contended that he had explained in terms of the longitudinal influence of size were: the number of horizontal divisions in the organizations, the number of vertical levels, and the number of supervisors.

Marshall Meyer's model of univariate causation in the structuring of formal organizations is a crushing simplification. His assertion of the ubiquitous influence of size is unmodified and categorical. Some reinforcement of Meyer's views may be derived, it must nonetheless be admitted, from the literature on the mathematical theory of organizations. For example, Childers _et al_ have argued that if organizations were randomly structured, then the expected value of a variable of structural differentiation (defined as the number of occupations in an organization) would be $\frac{1}{2}(S + 1)$, where S is the number of employees in the organization. According to this formulation, structural differentiation is a linear function of size alone. Surprisingly enough, Childers and his colleagues found that the predictions of their model of random organizational differentiation matched the actual patterns of differentiation found in units of the United States Coast Guard.[7] David Specht strengthened the credibility of the Childers model by showing that the same expression for the expected value of structural differentiation, $E(D) = \frac{1}{2}(S + 1)$, could be derived from the assumption that the distribution of the random variable D is binomial.[8] Childers had assumed that the distribution of random differentiation is uniform.

The equation $E(D) = \frac{1}{2}(S + 1)$ is an algebraic expression. In the previous chapter, a resemblance between algebraic statements, frameworks, and structural subsystems was suggested. A review of Figures 3-9, 3-10, and 3-16 reveals that algebraic expressions such as $AX = K$, the "frameworks" of Kenneth Boulding's typology of systems, and the structural subsystem of Kast and Rosenzweig's analytic paradigm can all be classified as fitting into the upper left hand cell of the typological matrix of systems. This congruence suggests that algebra might be the usual mathematical mode for describing organizational structure. And such has generally been the case. In addition to Childers' and Specht's articles, in which mathematical descriptions of organizational structure fell exactly into the anticipated category, other algebraic models of organizational structure have been advocated by Meyer,[9] and by Mayhew.[10] Some of the more abstruse connections between algebra and organization charts were explored by Morris Friedell,[11] who has noted that formal organizations can be viewed as semi-lattices. Since most studies of organizations have been cross-sectional -- equivalent, in other words, to the study of organization charts -- the predominant mode of discourse has been algebraic.

Four years after the publication of his mathematical reformulation of Blau's research, Norman Hummon broke into the literature of organization theory once more, this time as the principal author of a paper which modelled the development of organizational structure.[12] And once again, Hummon took Peter Blau's formal theory of differentiation in organizations as a point of departure. The core of Blau's theory, Hummon claimed, was the causal ordering: size $\rightarrow$ differentiation. Yet the cross-sectional study which Blau conducted could equally well support the hypothesis: differentiation $\rightarrow$ size. To probe more deeply into causal relationships in the development of organizational structure, Hummon and his colleagues created an ingenious differential equation model which tied together actual and ideal forms of organizations. Although I think that Hummon's presentation of this model is flawed, I will nonetheless explain it in some detail because I will use it as the take off point for my own mathematical model of the structural subsystem of thana cooperative organizations in East Pakistan.

As the four basic variables whose relationship to one another he wished to explain, Hummon took:

> P, the number of employees primarily performing the output tasks of the organization, e.g. the production employees;
>
> D, the number of divisions which functionally differentiate the work force;
>
> S, the number of supervisory employees in the organization;
>
> L, the mean number of hierarchical levels over all divisions.[13]

Since I have difficulty remembering the significance of the symbol P, and since I suspect that the reader may as well, I will substitute the symbol W, for workers, in the following discussion.

All of these four variables describing organizational structure are readily observable in most formal organizations. Linked to these observable variables Hummon postulated that there are four ideal and unobservable variables W*, D*, S* and L*. There is a linear algebraic relationship, Hummon posited, between any one of these ideal variables (called structural control variables in the article) and the other three observable variables. Thus,

$$W^* = a_{12} D + a_{13} S + a_{14} L + r_1. \qquad (4.1)$$

Change is introduced into the structural control model by means of what John Hunter of Michigan State University calls the cybernetic feedback equation. The change in W, the number of workers, is governed by the difference between the ideal number of workers and the actual number of workers.

$$\frac{dW}{dt} = c_1 (W^* - W) \qquad (4.2)$$

This equation indicates that when the number of workers is below the ideal level ($W < W^*$), the change in W will be positive. The size of the coefficient c_1 indicates how responsive the change in W will be to this discrepancy.

The transition from equation 4.1 to 4.2 is equivalent to the shift from the first to the second row of the typological matrix of systems, that is: from static systems to simple machines. Time is a basic part of simple machines; the solutions to such system models are functions of time. Despite the fact that Hummon reached into the realm of dynamic systems to fashion his complete model, it seems to me that his work is not incompatable with the proposition that the fundamentally most fitting way to represent the structural subsystem of an organization is as a static system. The fact that equations of the form of 4.1 are at the core of Hummon's model lends credence to this proposition. Equation 4.1 has all of the attributes that we might expect to encounter in a mathematical representation of the structural subsystem, or of what Kenneth Boulding called frameworks. The equation is static. Like an organization chart, the equation summarizes relationships in which time plays no part.

Substituting the right hand side of equation 4.1 into equation 4.2, in place of the variable W*, gives

$$\frac{dW}{dt} = -c_1\ W + c_1\ a_{12}\ D + c_1\ a_{13}\ S + c_1\ a_{14}\ L + c_1\ r_1. \qquad (4.3)$$

By applying identical reasoning to the other four observable variables and to their unobservable counterparts, Hummon obtained a dynamic linear translate mathematical model of the form $\dot{X} = AX + R$. X in this instance is the vector of variables (W, D, S, L). R is simply a vector of scalers ($c_1\ r_1$, $c_2\ r_2$, $c_3\ r_3$, $c_4\ r_4$). Since there are no inputs, the model is closed. But because the vector of scalers is appended, the model is not linear.[14] Following John Hunter's terminology once again, I have classified it as a linear translate mathematical model.

To test their model empirically, Hummon and his colleagues made use of Marshall Meyer's data on government finance departments studied in 1966 and 1971. Instead of the univariate pattern of causation which Meyer claimed to have uncovered with his path analysis of the same data, the Hummon group ascertained that their structural control model showed the pattern of causation to be as shown in Figure 4-3. (Those who read the Hummon article itself will notice that I have rotated his diagram ninety degrees. It seems more appropriate to have the supervisors placed above the workers, rather than next to them as in the original diagram.)

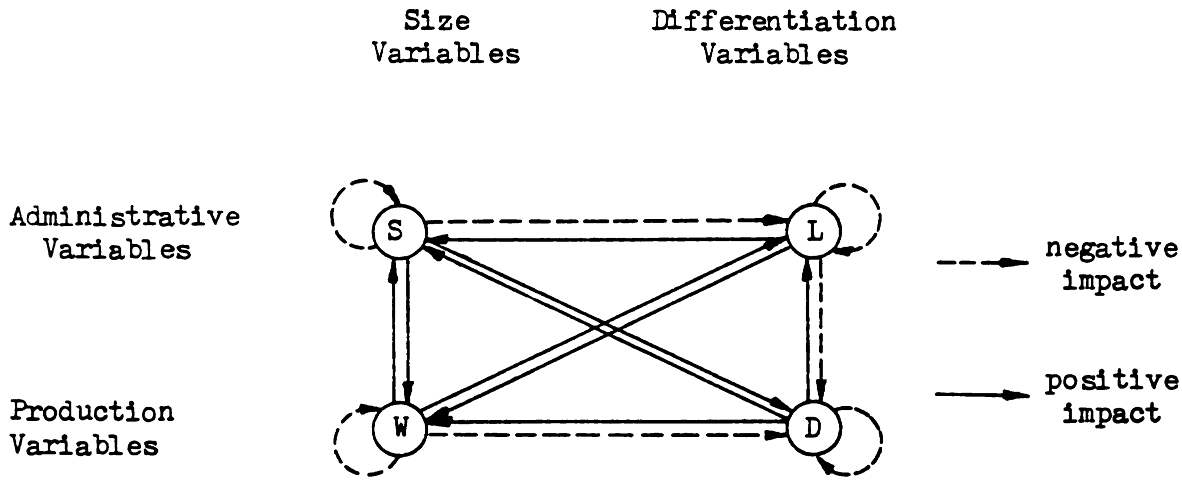

Figure 4-3: Causal loop diagram[15] showing the interaction among structural variables in the Hummon model.

Meyer's argument, and Peter Blau's, was that the growth of organizational structures is governed by the causal ordering size $\rightarrow$ differentiation, which would correspond to the rightward pointing arrows in Figure 4-3. There are four of these: the dashed arrows leading from S to L and from W to D, and the solid arrows leading from S to D and from W to L. Even in the absence of the equations on which Figure 4-3 is based, a glance at the diagram gives the impression that the causal ordering size $\rightarrow$ differentiation encompasses only a portion of the interactions among the four variables describing organizational structure. In the case of the dashed arrows pointing rightward from S to L and from W to D, moreover, the diagram shows that the Hummon model indicates that increasing size decreases differentiation, which is the opposite of what Blau and Meyer had proposed.

Since the Hummon model describes a <u>system</u> of interactions among structural variables in organization, indirect effects of one variable upon the change in another must also be taken into account. Figure 4-3 shows, for example, that a chain of positive influence leads from W to

S to D to L and then back to W. Tracing indirect effects through Figure 4-3 is no easy task. To simplify the interpretation of systemic patterns of causal interaction among the structural variables, the Hummon group redrew the causal loop diagram shown in Figure 4-3 so as to eliminate the less important mechanisms of interaction. Their simplified causal loop diagram is shown as Figure 4-4.

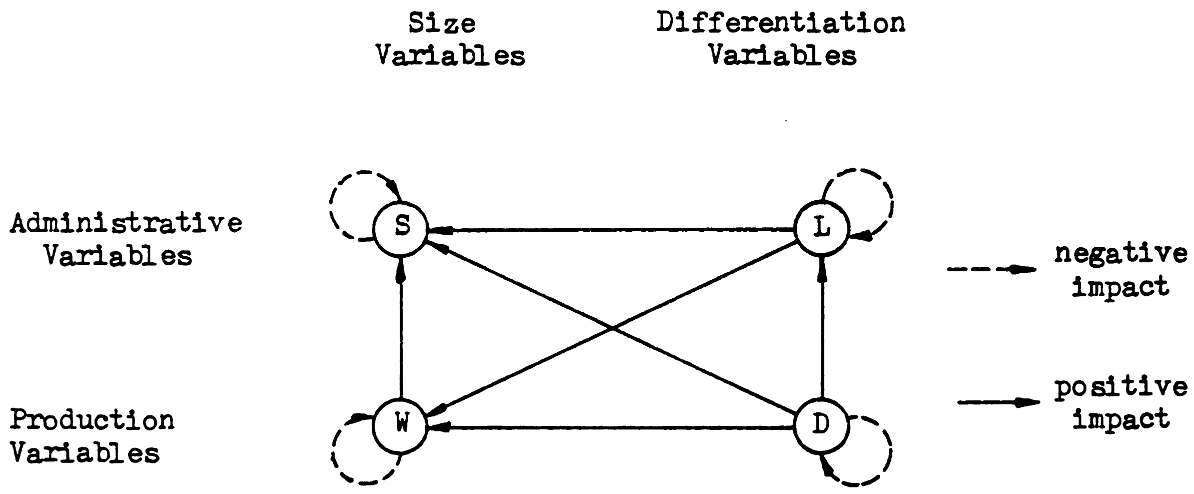

Figure 4-4: Simplified causal loop diagram of the Hummon model.

Although Hummon and his colleagues extracted only the sparsest of conclusions from this simplified causal loop diagram, it would seem to have devastating implications for the theories of organizational structure proposed by Blau, Meyer, Childers, Specht, and Mayhew, all of which were reviewed earlier in this chapter. There is no direct <u>or</u> indirect route of influence in Figure 4-4 that leads from <u>either</u> of the size variables, W and S, to <u>either</u> of the differentiation variables, D and L. The clear implication of Figure 4-4 is that differentiation leads to size, but that size does not lead to differentiation.

When a study contains implications which are so sharply at odds with the bulk of the contemporary literature on organization theory, the validity of the research needs to be examined with special rigor. And when it is examined closely, the Hummon study reveals many deficiencies.

The most obvious problem with the Hummon methodology is the assumption, implicit in the mathematical model but not explicitly addressed in the text, that the four organizational variables W, D, S and L constitute a closed system. To assert that the ideal number of workers in an organization is determined only by the actual number of supervisors, levels and divisions would seem to contradict the premises of production economics and of managerial practice. The assumption shared by both disciplines is that the number of workers hired is likely to be determined at least in part by the amount of work to be done. If an automobile manufacturer wishes to increase his production of cars, he hires more workers -- subject to whatever labor saving substitutions he might wish to make so as to increase productivity in other ways. And in a municipal, county or state department of finance -- the type of organization from which Hummon, via Meyer, derived his test data -- the chief of the department would most likely seek authority to hire more clerks as the number of taxpayers and the volume of financial transactions grew.

Although this line of argument is appealing from one direction it is troublesome from another. In the typology of systems presented in Chapter 3 the structural subsystems of organizations were classified as closed systems. If an input variable representing workload were added to the mathematical model of the structural subsystem, the doors of the system would be thrown wide open: it would become a machine with input. So to the extent that Hummon is correct in modeling the structural subsystem as closed, to the same extent the validity of the general systems typology is affirmed.

Another criticism of the Hummon paper is that it presents broad conclusions about a dynamic system on the basis of only two data points: the observations of finance departments in 1966 and in 1971. A test of the validity of the model would require a third set of observations to test the predictions derived from the first two data sets. Since the Hummon model has four system variables, it can be said to trace out a trajectory in a four dimensional phase space. Through the application of _expost_ statistical estimation procedures, Hummon calculated parameters for his model so as to assure that the system trajectory passed through the 1966 and 1971 data points in the four dimensional phase space. But did the model trajectory pass near the actual 1968 data point? And as the system trajectory in the phase space continues to, say, the 1976 data point, will it hit or miss the target?

A final objection is that the Hummon paper does not link the rationale for the concept of structural control to any of the existing literature on organization theory. The first step in the formulation of the Hummon model is the postulation of the existence of an unobserved "control structure," an image residing in the minds of organizational directors which describes how the organizational structure <u>should</u> be patterned. The directors attempt to minimize the discrepancy between this ideal pattern and the observed, realized organizational structure. From this adjustment process the Hummon model derives its dynamics.

Once the vocabulary has been altered so as to put the proposition in more familiar terms, the existence of such an adjustment process becomes plausible. The relevant phrase in the real world is not "control structure" but "staffing pattern." The military have carried the idea of staffing patterns the farthest, making it into a doctrine of organizational structure. The organizational doctrine of staffing patterns in the U.S. army decrees, for example, that there should be 12 men in a squad, and that each squad should be led by a sergeant; that there should be three squads in a platoon, and that each platoon should be led by a lieutenant; that there should be three platoons in a company, and that each company should be led by a captain; and so on up to the staffing patterns for divisions, corps, and armies. When his company is depleted in battle, the company commander requests replacements to bring his unit up to its full complement of troops, a process of structural control resembling the one that Hummon and his colleagues propose. Organizational managers do attempt to adjust the rank, number, and roles of their personnel so as to make them accord with staffing patterns. And interestingly enough, those staffing patterns are often tied to rules of proportionality -- spans of control, ratios of professors to secretaries, ratios of occupants of different civil service grades. The algebraic equation which Hummon proposes for the ideal number of supervisors in an organization,

$$S^* = a_{31}\, W + a_{32}\, D \qquad + a_{34}\, L + r_3, \qquad (4.4)$$

is like a composite of several ratios. If all variables on the right hand side except W are zero, for example, the coefficient a_{31} indicates the ideal ratio of supervisors to workers. So the equation is plausible.

The Structural Subsystem at the Village Tier

Few of the preceding theoretical considerations can readily be applied at the village tier of the Comilla cooperative organization. The primary cooperatives in the villages were more primitive in organizational form than were the thana cooperative associations. As we shall see in later chapters, some organizational subsystems which were present at the thana tier were absent at the village tier of organization. The village cooperatives, moreover, were less formal in their specification of many aspects of their organization. Furthermore, since most of the theories of organizational structure reviewed above are numerical in character, the testing of these theories at the village tier would require the accumulation of survey research data on the structure of primary cooperatives. Such a survey has not been undertaken, either by the author or by any other investigator. The following remarks, then, should be taken as general background information on the structure of the village cooperatives.

The basic organizational unit at the village tier was the primary cooperative. Occasionally, farmers from two villages would join together to form a primary cooperative, but ordinarily the members of one cooperative were drawn from one village. (The very concept of a village is ill-defined in the Comilla area. Houses are scattered in small clumps around the delta's plain, rather than being gathered in village clusters. Several Bengali words, with different referents, have been translated into the single English term "village.")[16]

At its annual general meeting, each primary cooperative was required to select a third of the members of the cooperative's managing committee, who served for overlapping three year terms. As a rule, the selection was by common consent rather than by vote.[17] These directors then selected from among themselves a manager, a chairman, and a vice chairman.

The manager (called the organizer until 1962) was the most important officer in the cooperative. His duties were numerous and critical. He collected and disbursed loan funds, served as financial agent for the village cooperative in its dealings with the central association, oversaw the keeping of accounts and records, arranged for the rental and use of machinery owned by the central association, encouraged the members to attend meetings, save, purchase shares, and repay loans, and acted as agent for the cooperative in joint marketing ventures. The central association paid the manager several sorts of commissions as well as a travel allowance for attending weekly training classes; he received no salary from either the central association or the primary cooperative.

The chairman's role appeared more honorary than operative. His major job was to chair the weekly cooperative meetings which were in practice usually dominated by the manager. Often the managing committee selected a prestigious member of their group to serve as chairman. A good chairman could use his prestige in the village to lend respectability and order to cooperative meetings. He could be of help to the manager in enforcing the attendance at weekly meetings, the deposit of savings, or the repayment of loans. He received no salary, commission, or travel allowances.

The vice chairman and the other members of the managing committee had, in the early sixties, no defined job in the village cooperative. They were installed in office in conformance with the cooperative regulations of East Pakistan, but the leader of the thana-wide cooperative project, Akhter Hameed Khan, opposed their assuming any regular functions. In his view, the failure of the Union Multi-Purpose Cooperatives, which had been active in the Comilla area for decades, resulted from the assumption of operational authority by their managing committees. Akhter Hameed Khan advocated conducting all business in the weekly general meetings of the cooperative societies rather than in sessions of their managing committees.

In the long run, Akhter Hameed Khan's philosophy of direct democracy through the weekly general meeting did not prevail. The managing committees assumed more and more responsibility, until in 1972 they were described by Badruddin Ahmed as making most policy decisions on matters of budget, membership, credit, production, supplies, and marketing. Ahmed described the weekly general meeting as a control mechanism which approved or disapproved the decisions of the managing committee, and kept the functionaires of the cooperative from deviating too far from the general sentiment of the membership.[18]

In addition to the managing committee, the members of each village cooperative also selected a model farmer. The model farmer was expected to attend monthly training classes arranged by the central cooperative association. In those classes he was taught improved methods of agriculture, pisiculture, and animal husbandry. He was expected to adopt these methods himself and to use his farm, pond, and herd as demonstration models for the cooperative members. The model farmer was paid only a travel allowance, which the central association gave him for rickshaw fare to and from his training classes.

The Structural Subsystem at the Thana Tier

In the Comilla cooperative system, organizational structure was more formal at the thana than at the village tier. Constructs drawn from organization theory could more readily be applied and tested at the thana tier. A study of the central cooperative association in Kotwali Thana of Comilla would have been insufficient, though, as a data base for such research. To enlarge the number of cases, the author surveyed all of the 24 thanas in which a central cooperative association of the Comilla type was established during the decade of the nineteen sixties. Comilla Kotwali Thana was the first of these. In 1963-64, experimental cooperative associations on the Comilla model were launched in Gaibandha thana of Rangpur district, in Natore thana of Rajshahi district, and in Gouripur thana of Mymensingh district. Two years later seven more thanas of Comilla district were brought into the expansion program, followed by the remaining 13 thanas in Comilla district in 1967-68. The project directors of the central cooperative associations in all of these thanas were sent questionnaires in September of 1977. Eventually, all but one of them responded. The results of this survey of organizational structure in the thana cooperative associations will be reported later in this chapter. To introduce that aggregate investigation, though, let us examine first the structural evolution of the central association in Comilla Kotwali Thana as a case

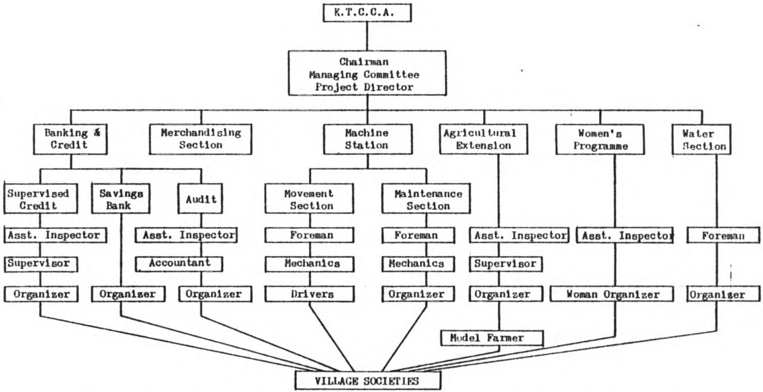

Figure 4-5: Organization Chart of the Kotwali Thana Central Cooperative Association (KTCCA) as of 1961.

study.

The Kotwali Thana Central Cooperative Association (KTCCA) was registered as a cooperative society on January 26, 1962, nearly two years after the first local cooperative had been organized in South Rampur village on March 15, 1960. Even though the village cooperatives had a head start, the thana association quickly outstripped them in influence and sophistication. It could be said, indeed, that the Comilla system did not significantly accelerate rural change until the thana association got into gear.

From 1962 to 1966 the KTCCA expanded its operations into new sorts of activity until it included nine sections: field supervision, maintenance, movement, dairy, grain mill, cold storage, accounting, water development, and marketing. The purpose of the subsidiary sections was to service the primary cooperatives, but the very volume of effort required to manage and coordinate the sections distracted the administrators of the KTCCA from the immediate problems of the individual cooperatives. The field supervision section was lagging from administrative neglect at the very time when the scale of its operations should have called for more decisive attention.

In January of 1966 the chairman of the KTCCA, Akhter Hameed Khan, decided that the credit program of the agricultural cooperatives would benefit from an independent managing structure. On the precedent of the non-agricultural cooperatives, which had been divided out into a separate federation in 1964, the Agricultural Cooperative Federation (ACF) was set up. According to ACF by-laws, the KTCCA was to serve as its financing bank. Shamsul Huq, who had been the KTCCA deputy director in charge of field supervision, was deputed by the KTCCA to serve as project director of the new federation.

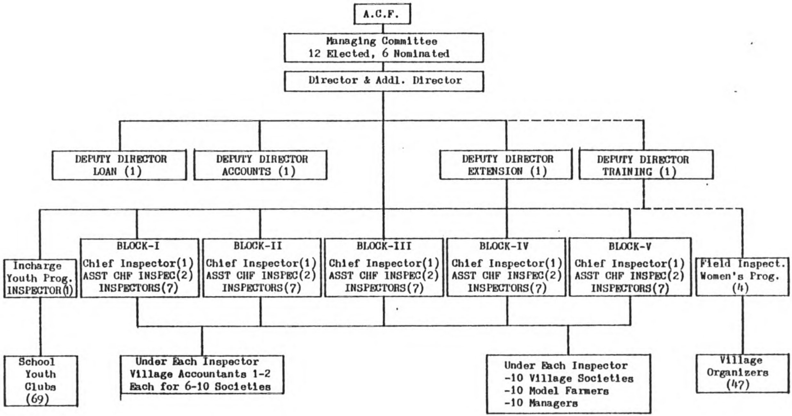

Figure 4-6: Organization Chart of the Agricultural Cooperatives Federation (ACF) as of 1969.

Most of the author's on-site research on the Comilla cooperatives was done in the winter and spring of 1966 while the new federation was being organized. It was a time of shake-up and reconsideration in the Comilla cooperatives. It was an excellent time for an inquiry into fundamentals, since the bone structure of the old field supervision section, the main support of the credit system, was at that time revealed and rearranged.

Because the organizational upheaval of 1966 was so comprehensive, the faculty at the Academy for Rural Development who were charged with writing annual reports of the cooperative experiment devoted considerable amounts of text in the seventh (1966-67) through ninth (1968-69) reports to explanations of the structural transformation. It was as if the academy faculty, and perhaps the leaders of the thana cooperative organizations, were seeking to fix in their minds a comprehensible image of the new organizational relationships. The explanatory technique to which they often resorted was the organization chart.

The eighth annual report, covering the year 1967-68, opens with a diagramatic explanation of the original, two-tiered organizational form of the Kotwali Thana Central Cooperative Association. The organization chart shown as Figure 4-5, which shows the structure of the KTCCA in 1961, is displayed on page 1 of the report. Even in its very first year, evidently, the organizational structure of the KTCCA had been horizontally differentiated, with distinct organizational sections for banking and credit, the machine station, and so forth. In the vertical dimension, the original design entailed a careful layering of supervision. Attention to formal organizational structure had characterized the KTCCA from its beginning.

By the end of the decade, the KTCCA had been significantly rearranged. Figure 4-6, which shows the organization of the KTCCA in June 1969,[19] is taken from the ninth annual report. The KTCCA had become, in the words of that report, "an association of associations." No longer did the KTCCA relate directly to the village cooperative societies, but rather to federations of societies such as the Agricultural Cooperatives Federation (ACF) and the Special Cooperative Societies Federation (SCSF). A few primary cooperatives, such as the Comilla Housing Cooperative Society, were still linked directly to the KTCCA, with no intervening federation, but these served a professional clientele which was a class apart from the village population. Indeed, the ACF was the only one of the seven organizational members of the KTCCA in 1969 which was predominantly rural in its orientation. The members of the other six cooperative associations lived mainly in Comilla town or in the suburban enclave at Kotbari, where some of the faculty and employees of the Academy for Rural Development resided. The roots of the KTCCA, evidently, had extended themselves as much into the urban as into the rural areas of the thana.

Within the KTCCA, the most notable organizational change from 1961 to 1969 was the addition of a complement of upper-echelon managers, the senior vice chairman and the two vice chairmen, whose positions on the organization charts resembled that of vice presidents in a large corporation. Indeed, the similarities to the more intricate forms of corporate organization were numerous -- so numerous, in fact, as to lead one to suspect that the organizational image which Akhter Hameed Khan had in his mind as he constructed the cooperative organization was not that of the Chinese commune (which he claimed later to have been imitating) but rather a multi-tiered corporation such as General Motors. In this regard, the influence of the foreign, largely American, corps of project advisors in Comilla should not be overlooked. The Michigan State advisors there during the sixties were typical of their countrymen in recommending American organizational solutions to management problems encountered in the developing nations.

The most astounding trend in the organizational evolution of the cooperatives was toward vertical differentiation in the organization. At its start, the Comilla cooperative project adopted a two-tiered organization, with primary cooperatives at the village level and with the KTCCA at the thana level. When the Special Cooperative Societies Federation was introduced in 1964, followed by the Agricultural Cooperatives Federation in 1966, the basic pattern became three-tiered. At the top, the KTCCA came to be described as an "apex organization" and as a "superstructure." Its role became analogous to that of a holding company in a corporate empire. The ideological distinction between a cooperative and a corporation, according to which the pattern of ownership and control in the cooperative pyramided upwards rather than downwards, was nearly moot in practice. Farmers did, to be sure, purchase shares in their primary cooperative societies, which purchased shares in the Agricultural Cooperatives Federation, which purchased shares in the Kotwali Thana Central Cooperative Association. The influence of the lowest upon the highest tier of the organization, though, was diluted by these stages.

Three tiers was not the limit. An effort was made, late in the nineteen sixties, to bring together the thana central cooperative associations of the Comilla type into one master cooperative association, the Comilla Industrial Cooperative Society. The KTCCA bought shares in this organization, as did the cooperative associations in nine other thanas. The two cold storage warehouses (used mainly for holding potatoes for sale at higher prices in the off-season) and the creamery in Comilla were turned over to the Industrial Cooperative Society. The idea was that the management of these capital intensive, industrial-type projects should not be limited by the production or marketing potential of a single thana.

As the number of tiers of organization in the Comilla cooperatives grew in the nineteen sixties, so did the organizational distance between the peasant farmers of the thana and the leaders of their cooperatives. This increasing distance contributed to the dry rot which afflicted many of the primary societies, and even the lower levels of the ACF, toward the end of the decade. As the distractions of horizontal and vertical coordination multiplied, it became increasingly difficult for the incorruptible idealists at the top of the cooperative organization, acting through the filters of many layers and tiers of management, to hold all their subordinates accountable.

Standing as gatekeepers between the primary cooperatives and the thana level organization were the inspectors. To anyone trained in the reading of organization charts, the key role of the inspectors within the Agricultural Cooperatives Federation is obvious from Figure 4-6. In 1969, when the organization chart shown in Figure 4-6 was drawn, each inspector was expected to supervise 10 primary societies. The actual ratio was closer to 8 village cooperatives per inspector.

The key personnel in the Agricultural Cooperatives Federation were the cadre of inspectors. Three of the nine inspectors employed by the ACF in 1966 had worked previously in the Village Agricultural and Development (V-AID) program in the nineteen fifties. Indeed the very notion of the inspector's task could be traced conceptually to that of the old village level workers in V-AID. The village level workers, who are still extant in India and in the Peace Corps, were expected to catalyze community organization and modernization in the villages.

By the middle of the decade, many of those exhortative community-development functions were still apparent in the inspectors' own conception of their duties. In December of 1965, the author submitted a questionnaire to each of the nine inspectors of the KTCCA, and followed up with an individual interview with each inspector. The inspectors gave a moderately high ranking (fifth place out of 15 ranked functions) to the relative amount of time they spent "urging society members to adopt more improved agricultural practices." The functions on which the inspectors said they spent the most time throughout the year were, in order from first to fourth ranking, "urging society members to save more;" "urging society members to buy more share capital;" "organizing new societies;" and "collecting loan repayments."[20]

By the mid-sixties it was already apparent that the ACF leadership was using the inspectors as an echelon of middle level organizational managers through whom it could communicate with the primary cooperative societies. And by 1973, when Harry W. Blair conducted his research on the Comilla cooperatives, the role of the inspector seemed to have become entirely that of the bureaucratic middleman. Blair wrote that the duties of an inspector were:

> ...to prepare loan proposals for each KSS (the Bengali acronym for primary cooperative) to borrow from the ACF, to make recommendations concerning loans from the ACF to the KSS, to keep data on weekly meetings of the village societies, purchase of shares and savings deposits, loan issue and repayment, to assist and supervise the KSS manager in disbursing loans to individual farmers, signing receipts, and so on. In short, he is the intermediary between the primary society at the village level and the administration at the thana level.[21]

In the author's 1966 survey of the ways in which inspectors allocated their time, most of the duties mentioned by Blair ranked in the bottom half of the list. "Processing loan applications," "advising primary societies how to apply for loans," and "recommending loan limits" ranked 10, 11 and 15 in the 1966 survey, whereas Blair gives the impression that overseeing the loan process was a very important function of the inspectors in 1973. Still more significant, however, is that Blair's description of the inspector's role includes not a trace of the idealistic V-AID concept of a village level worker who would inspire and organize the villagers. In the course of a decade, the inspectors had been transformed from community development activists into functionaries.

The need for some sort of intermediate managerial personnel is apparent, nonetheless, from an examination of statistics about the scope of the cooperative movement in Comilla. In the 107 square miles of Comilla Kotwali Thana there were approximately 24,000 farm families at the beginning of the nineteen sixties. In the first five years of the Comilla experiment, membership in the village cooperatives rose above 6,000, implying that one fourth of the farm families had associated themselves with the cooperatives. One hundred sixty primary cooperative societies had been organized by the middle of the decade, indicating that farmers in a third of the 460 villages had joined the movement.

It would have been impossible for the staff of the Central Association to have kept track of the affairs of all 160 primary societies, and of the patterns of influence of the 6,000 members upon them, if it had not been for the intervening field staff of inspectors. Even in 1966, the Comilla credit cooperatives formed a large, complex organization.

That organization could not have functioned without the middle level management provided by the inspectors.

The activities of the Comilla cooperatives attained a certain stability in the mid sixties, and at the level of operations then attained things ticked along quite nicely. But in 1966-67 the Pakistan government decided, with Akhter Hameed Khan's approval, to push beyond the 1964-66 plateau and to raise the membership and loan volume of the cooperatives in Kotwali Thana. From the plateau of 1964-66, a hundred new cooperatives were organized in 1967-68, membership almost doubled, and loan issue shot up six times.

This helter-skelter growth was achieved at the cost of the relaxation of many aspects of cooperative discipline. The growth occured, moreover, at the very time when many of the richer farmers were for the first time showing a strong interest in joining the cooperatives and turning them to their own ends, because of the newly apparent benefits of tubewell irrigation and the Green Revolution. The opportunities for subversion and corruption were just too numerous to handle, and the solidarity of many village societies disintegrated.

The Comilla cooperative movement struggled for at least five years to recover from its attempt in 1967 to bite off more than it could chew. Efforts to retrieve the gusher of loans issued in 1967 were complicated by political turmoil and civil war. The origin of the problem, nonetheless, had been a deliberate policy decision by the cooperative leadership, so the bloated loan account could not be excused by reference to external factors alone. A campaign of retrenchment brought the annual loan issue down to about the level of the 1964-66 plateau by 1970-71. The number of loan recipients fell back to below the 1964-66 level, but since so many newly enrolled members were still on the books, the rate of participation in the loan program dropped to a mere 33% in 1970-71. Even in the peak loan issue year of 1967-68, over sixty percent of the cooperative members had taken loans, and the participation rate had been over eighty percent prior to the 1967 expansion. The 1970-71 annual report of the Comilla cooperative experiment states that ACF personnel explained the decreasing trend of loan participation as being due to "(1) non-repayment of previous loans which disqualified the members for further loan receipts, (2) political turmoil leading to the War of Liberation, and (3) limitation imposed on the types of loans issued by the ACF."[22] Investment in agriculture was limited because of political and military turmoil from 1969 to 1971, the report notes. Morever, as part of its retrenchment strategy the ACF cut back drastically on the number of purposes for which loans could be issued. By 1970-71 there were only 10 approved loan categories, all directly related to agriculture, whereas in 1965-66 farmers had been permitted to borrow for 24 categories of expense, some of which were personal.

A bleak interpretation of what he terms the "administrative decline" in the Comilla cooperatives in the late sixties is given by Harry W. Blair.[23] He avers that because of the pressure to issue more and bigger loans in 1967, many suspect societies and bogus members were enrolled, and many loans were rolled over. To administer the rapidly growing loan program, Blair contends that the central federation undertook emergency recruitment of inspectors, and drew many from among primary society managers who were themselves big borrowers. These ex-managers sometimes used their new positions to cover up their own loan defaults. Some of the inspectors in this period, Blair reports, accepted bribes and arranged kickbacks, while others took a lax attitude toward irregularities in the village cooperatives under their supervision.

This unhappy set of events is ascribable to growth which was overly rapid. But it is conceivable as well that the Comilla form of cooperative organization had attained a near-optimum size in the mid-sixties, and that organizational breakdown resulted from the attempt to push membership and the volume of loan transactions beyond that optimum.

In the literature on rural development organizations, little guidance is to be found on the question of optimum scale. Arthur R. Mosher, then president of the Agricultural Development Council, proposed in 1970 an optimum size for integrated rural development projects, but the geographic area of 1,000 to 3,000 square miles which he advocated was from 10 to 30 times bigger than Comilla Kotwali Thana. Mosher reasoned that the farming district to be included in an integrated rural development project should be "large enough to include at least ten farming localities and to include at least twenty to twenty-five extension workers (since that is the minimum number for effective and continuous in-service training). The upper limit is set by convenience in supervision and servicing from the district headquarters."[24] For an integrated rural development project of the Comilla type, that upper limit of convenience will be encountered, at least in a country as densely populated as Bangladesh, in a region far smaller than 1,000 square miles.

Uphoff and Esman, in their analysis of rural development in Asia, argue for the efficacy of a two-tiered organization, and they comment on the size which is workable for each tier. Unfortunately they remark only on the minimum, and not on the maximum, desirable size for the second tier.

> The primary level of organization tends to be the hamlet, the neighborhood or some other group of from 30 to 100 families. Organizations of this scale can be effective for pooling labor, regulating irrigation water at the field level, controlling pests and weeds, harmonizing planting, weeding and harvesting schedules, and performing some common services....
>
> These organizations need in turn to be knit into some larger organization which can provide the benefits of scale -- 1,000 families or 5,000 persons as a minimum -- to afford the managerial cadres and the physical facilities necessary to operate complex structures handling large sums of money as well as physical inputs, storage, and even processing activities.[25]

With an average primary cooperative membership during the nineteen sixties of 34 -- each member commonly being presumed to represent one family -- the lower tier of the Comilla cooperatives matched Uphoff and Esman's prescription for size. With 6,000 families covered by the mid-sixties, though, the upper tier of the Comilla cooperative structure was six times the minimum size which these authors recommend. By 1967 the thana organization covered more than ten times that minimum number of families. At the size which it had attained in the mid sixties, had the Comilla cooperative structure already reached its scale of maximum efficiency, so that the 1967 expansion carried the cooperatives into a region of diminishing absolute returns to growth?

Considerations of maximum organizational scale were prominent in Akhter Hameed Khan's thoughts when he undertook his tour of twenty thanas in December of 1970 and January of 1971. The tour, which covered the twenty thanas of Comilla District in which cooperatives of the Comilla type had been established at the time, was undertaken on his own initiative and as the result of his personal curiosity. In his remarks on the development projects in Laksam thana he wrote:

> But the task in Laksam is indeed daunting. In the first place the thana is far too big: 209 sq. miles, 27 unions, 542 villages. Ten years ago the population was three hundred and sixteen thousand; now it must be near four hundred thousand. The average thana in East Pakistan is about half the size of Laksam. A hundred square miles of land with two thousand persons living in one square mile can be managed with much difficulty. With much trouble and effort planning and servicing institutions, local government councils and central cooperative associations can be built. Fifty square miles could be better organized; two hundred square miles is an impossible unit. Unless an energetic government sheds the inertia of tradition and rearranges reasonably the units of development administration, thanas like Laksam will suffer the consequences of haphazard planning and poor coordination.[26]

A Systems Interpretation

Peter Blau, it may be recalled, described two contradictory relationships between the size of employment security agencies and the efficiency of their supervision. He observed positive returns to scale for management, in that smaller organizations had more hierarchical levels and more supervisors relative to their total size than did large organizations. In his view, these returns to scale resulted from the greater internal homogeneity of specialized units in larger organizations. On the other hand, Blau also reported that the increasing need for coordination among units in a large organization had exactly the opposite influence, in that it tended to narrow the span of administrative control and increase the number of hierarchical levels of supervision. Since this latter effect was the one propounded by Kenneth Boulding in his seminal article "Toward a General Theory of Growth," I have labelled it the "Boulding Effect." In Figure 4-7 below, I have termed the first effect, which Peter Blau considered to be the primary one, the "Blau effect."

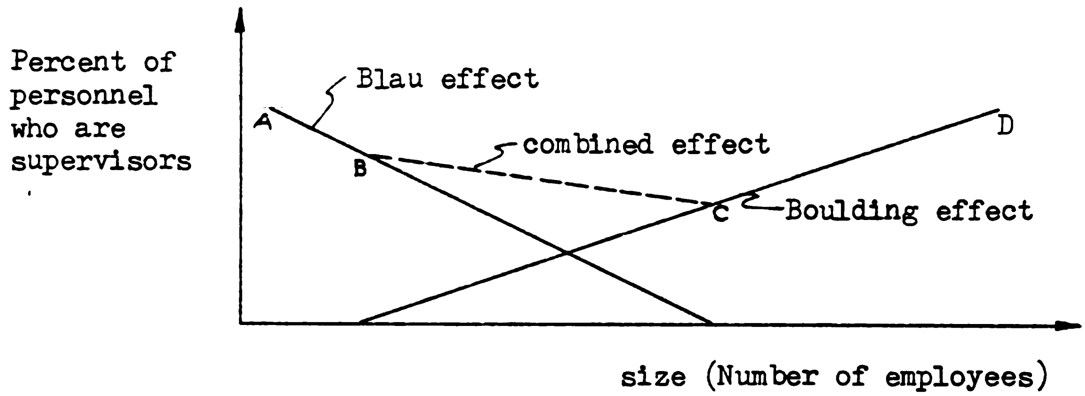

Figure 4-7: The Blau and Boulding effects.

If both the Blau and Boulding effects were linear algebraic functions of size, and if neither took on negative values, the combination of the two effects might be as shown by the line ABCD in Figure 4-7. Angular as it is, the ABC portion of the curve, at least, bears a certain resemblance to the smooth descending curve, asymptotically approaching the horizontal axis, which Peter Blau inferred from his data on structural differentiation in employment security agencies. If the Blau and Boulding effects were themselves curvilinear, as in Figure 4-8, a "U" shaped combined effect curve would be generated. The left hand, descending, portion of this curve would resemble the one which Blau traced through his data. The existence of the right hand portion of the combined effects curve, the part labelled BC in Figure 4-8, was not even a topic of speculation in Blau's research. Perhaps this was because the largest of the 1201 local employment security offices in his sample had only 225 employees.

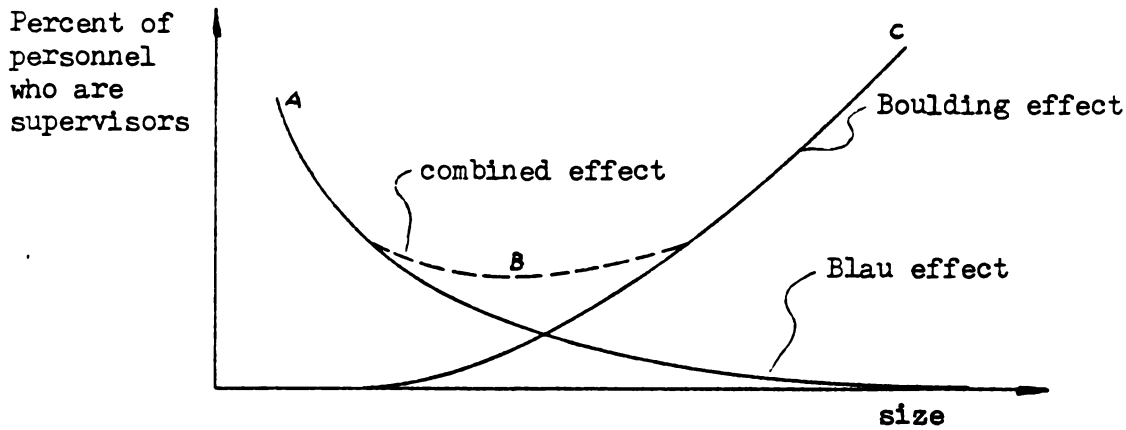

Figure 4-8: A curvilinear version of the Blau and Boulding effects.

Clearly point B in Figure 4-8 represents an organizational size of maximum administrative efficiency, a size at which a minimal percentage of supervisors could manage the enterprise. At this optimum, the increasing returns to scale of the Blau effect are balanced by the decreasing returns to scale of the Boulding effect.

The organizational scale yielding maximum <u>administrative</u> efficiency is not directly related to, and could be quite different from, the scale of operations yielding maximum <u>productive</u> efficiency. The economic theory of production functions explains the potentially curvilinear relationship between the size of the workforce and economic productivity. The interaction of the Blau and Boulding effects, comparably, explains the curvilinear relationship between the size of an organization and its administrative efficiency.

Evidence from the literature for the existence of a U shaped curve of administrative efficiency is admittedly slight. Most empirical studies of the relationship between size and the proportion of supervisors in an organization have traced a curve such as AB in Figure 4-8, but have not shown a rise such as BC at the upper end of the scale of size. The only study I have read about which directly supports the proposition summarized in Figure 4-8 was conducted by Haas, Hall, and Johnson. They sampled organizations of widely differing types, and found that the proportion of support personnel (including supervisors and all staff personnel not directly engaged in the primary work of the organization) was greater for small organizations (0-700 employees) and for large organizations (more than 1,400 employees) than for organizations of intermediate size.[27] But the small size of their sample and the fact that other factors were not controlled (the organizations in their sample included an educational television station, a municipal airport, and a railroad) cast doubt on the generality of their findings.

Within the Agricultural Cooperatives Federation in Comilla Kotwali Thana there clearly was an administrative optimum, as can be seen in Figure 4-9. In 1967, when the Agricultural Cooperatives Federation had attained a size of 75 employees, the percentage of those employees who were supervisors was at an all time minimum of eight percent. As the Agricultural Cooperatives Federation grew thereafter, it swelled disproportionately at the upper levels, adding deputy directors and chief inspectors faster than it added non-supervisory employees.

To find out whether the case of the Agricultural Cooperatives Federation was a fluke or was representative of some more general organizational principle, data were analyzed from questionnaires which the author mailed to the directors of thana central cooperative associations of the Comilla type that were active in the nineteen sixties. The questionnaire was to be filled out once for each year in which a thana cooperative association was active. Most of the project directors complied with this request, although it entailed a good deal of backtracking through their own records. Of the possible total of 82 questionnaires for the expansion projects in Nator, Gaibandha, and

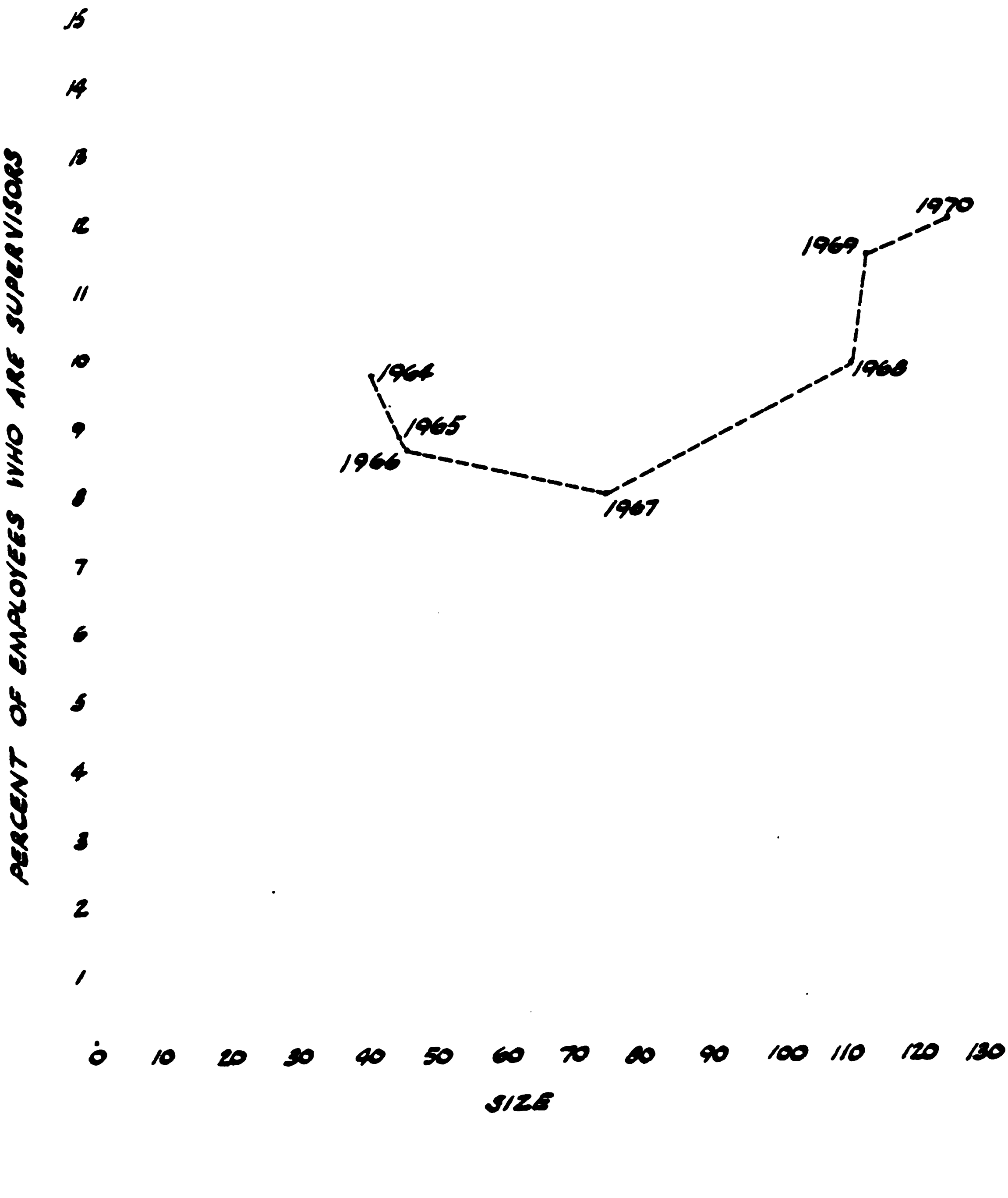

FIGURE 4-9 SIZE VERSUS PERCENT OF SUPERVISORS IN THE AGRICULTURAL COOPERATIVES FEDERATION.

Gouripur thanas and in 20 thanas of Comilla district, 69 useable questionnaires were returned, for a response rate of 84 percent.

Careful examination of the questionnaire responses caused me to discard two groups of them for the analysis of the structural sub-system of the thana cooperative associations. Responses from the first three expansion projects, those in Nator thana in Rajshahi district, Gaibandha thana in Rangpur district, and Gouripur thana in Mymensingh district, showed strange breaks in the evolution of those organizations. Between 1969 and 1970, for example, the number of employees in the Gaibandha Thana Central Cooperative Association fell from 87 to 48; the irrigation section of the association was disbanded that year, and the size of the transportation section was cut by 60 percent. In Gouripur thana, a machine station with 40 workers was supervised for four years by one administrative officer, Mr. M. A. Kadir, whose span of control was enormous by the standards of most organizations. Several other factors bore on the decision to discard structural data from the final 13 projects that were started up in Comilla district in 1968. Funding for that last increment of pre-independence expansion projects was constricted due to the hostility toward the Comilla academy of the Governor of East Pakistan, Abdul Monem Khan. A maximum of only two data points were collected from these 13 projects (the questionnaires for 1969 and 1970), so their utility in time series analysis was slight. Also, some of the questionnaires for the 13 projects were completed improperly, so that data set was of doubtful validity. After the subtraction of data from the projects founded in 1963-64 and in 1968-69, the remaining sample of expansion project questionnaires consists of 29 responses from the 7 thana cooperative associations that were launched in Comilla district in 1965-66.

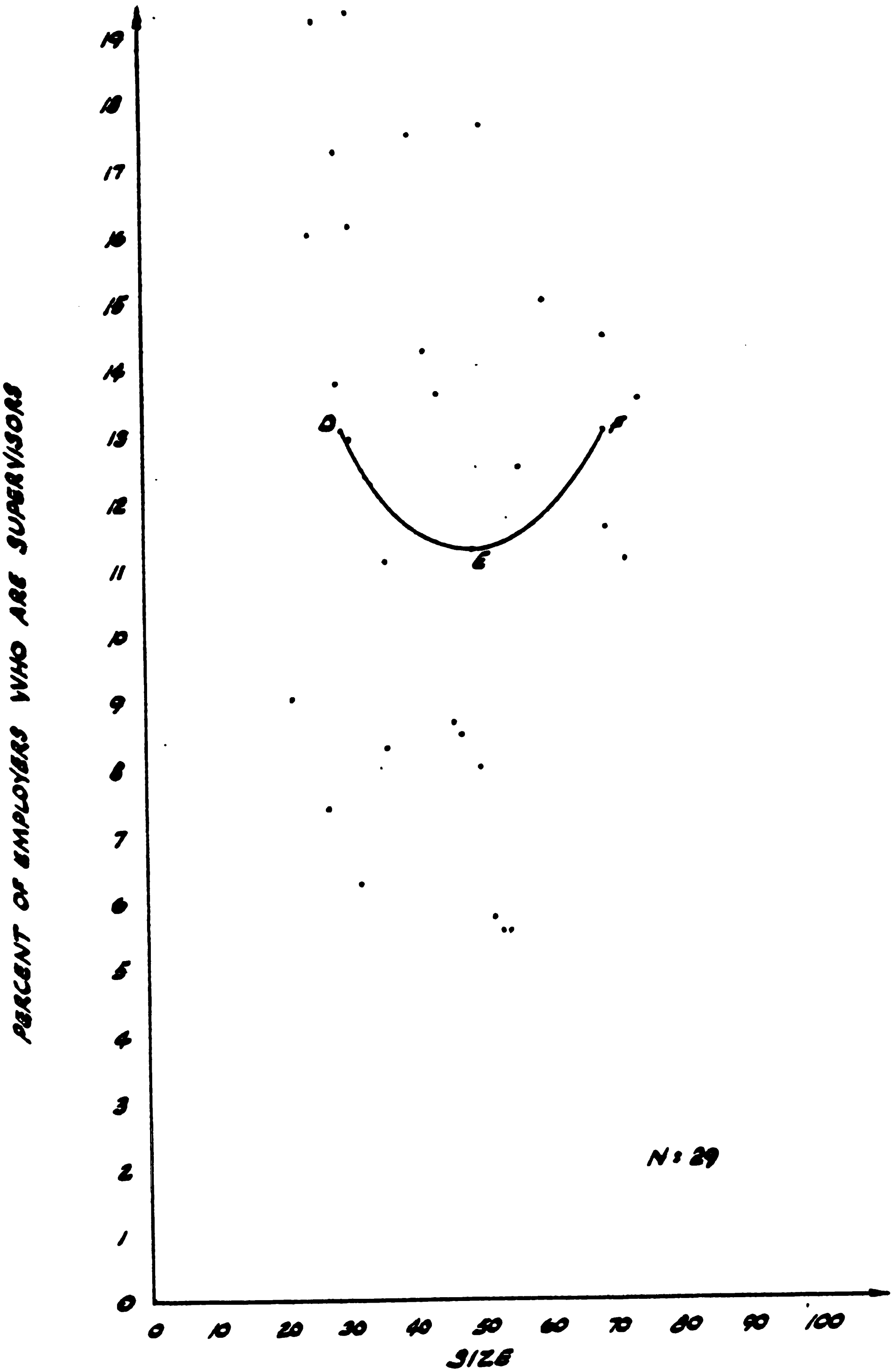

FIGURE 4-10 SCATTERGRAM OF SIZE VERSUS PERCENT OF SUPERVISORS IN THE 1966 PROJECTS.

Eighty-three percent of the potential total of 35 questionnaires were received from this group of organizations.

Each questionnaire was to be filled out with data as of June 30, the end of the fiscal year on which the cooperative projects operated. My first data point for the cooperative projects founded in 1965-66, therefore, is June 30, 1966. Since my data set for these projects begins in 1966, rather than in 1965, I will refer hereafter to the projects that were launched in 1965-66 as the "1966 projects."

When Peter Blau analyzed the organizational structure of local employment security offices, he found that the percentage of supervisors was scattered around a curve resembling the segment AB in the combined effects curve of Figure 4-8. A similar scattergram for the 1966 projects, with a curve traced through it according to the same methods used by Blau,[28] is shown here as Figure 4-10. The resemblance of the curve DEF in Figure 4-10 to the curve ABC in Figure 4-8 is strong.

How much confidence can be placed in the U-shaped curve in Figure 4-10? Was the mean of percent supervisors in the middle, point E, significantly lower than the two points on either side, D and F? Or might the apparent minimum have been a random phenomenon, ascribable to chance and a small sample? Two sample, one-tailed T-tests were made between point E and the points plotted on either side. The T-tests reveal that there was about a 20% chance that the data plotted as a minimum were drawn from the same population as the data for the neighboring points. (See Table 4-1.) In other words, the existence of the administrative optimum for the 1966 projects can be affirmed, according to this test, with about 80 percent confidence.

Table 4-1: T-tests for minimum in percent of supervisors in the 1966 projects.

1966 Projects			
Comparison	t	Degrees of Freedom	Probability of t
de	.926	22	.82
fe	.826	15	.79

All of Peter Blau's observations of U.S. employment security agencies were made in the same year, in a cross-sectional survey, so his data do not reveal growth patterns in the organizations he analyzed. In the present study all the thana cooperative associations were surveyed longitudinally. As a consequence, a picture of their evolution can be drawn, as in Figure 4-11. There was a change in the growth pattern of these organizations, it appears, after 1968. The rate of their growth, as measured by the annual increase in their employees, decelerated sharply.

1969-70 was the post-Ayub era in Pakistan. During the previous decade President Ayub Khan had been a vigorous supporter of the Comilla experiment, and of its expansion into other thanas. Without the influence of Ayub Khan in the central government to hold him in check after 1968, the conservative governor of East Pakistan, Abdul Monem Khan, enjoyed a long-sought opportunity to put the Comilla experiments in their place by restricting funds. The *ceteris paribus* condition was violated in the two years at the end of the decade, and as a consequence the cooperative projects were driven by a different

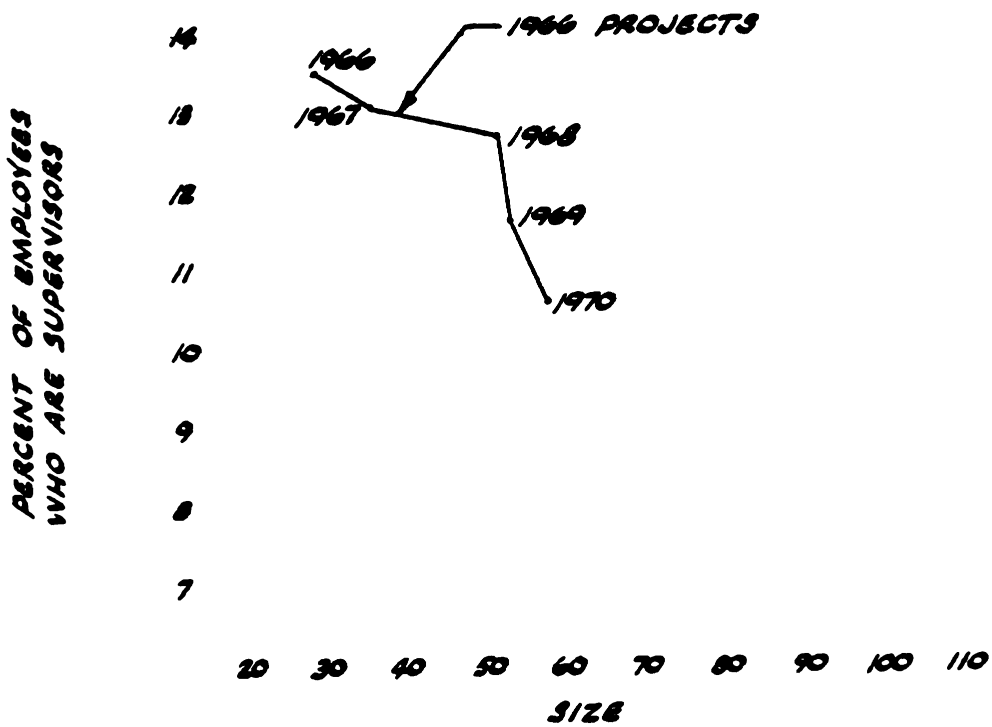

FIGURE 4-11 EVOLUTION OF PERCENT OF SUPERVISORS VERSUS SIZE IN THANA COOPERATIVE ASSOCIATIONS. POINTS PLOTTED ARE AVERAGE VALUES.

dynamic.

From a theoretical as well as a practical standpoint, this environmental change was unfortunate. Had it not been for the fall of Ayub Khan and the rise of Abdul Monem Khan, the trajectory of percent of supervisors versus size for the 1966 projects might not have turned downwards after 1968, thereby casting doubt on the existence of a U-shaped curve showing an administrative optimum for these thana cooperative associations.

Any extrapolation or generalization based on the points plotted in Figures 4-10 and 4-11 would be essentially an exercise in curve fitting. For a more theoretically rigorous interpretation of this data on the structural subsystem of thana central cooperative associations, let us turn to the sort of dynamic model of organizational structure proposed by Norman Hummon. I have already mentioned several points of disagreement with Hummon's structural control model. The dynamic model elaborated below overcomes some of those deficiencies.

In order to make further use of the thana cooperative association data -- which, instead of the two annual data points in the Hummon study, covers several years -- let us construct a mathematical model based on difference equations rather than on differential equations. Each annual data point can then be used in the estimation of system parameters, and in testing the accuracy of the model. For the study of public organizations, at least, difference equations seem more appropriate than differential equations anyway. Changes in the staffing of a publicly funded organization occur mainly in annual increments, not as continuous and infinitely divisible alterations.

Let us begin by positing a set of linear algebraic equations similar to those which Hummon proposed to describe ideal, unobservable relations among system variables. As the system variables themselves, we take W for the number of workers (non-supervisory employees) in a thana cooperative association, D for the number of divisions, S for the number of supervisors, and L for the number of levels. Precise descriptions of how these variables were evaluated from the survey questionnaires are to be found in Appendix B. Since I criticized the Hummon model for not taking the influence of external factors into account, let us include one input variable: T for the total loan transactions of the thana cooperative association. Unlike the state (or level) variables W, D, S and L, the variable T represents a rate.[29] It is the sum of the annual rate of loans issued by the thana cooperative association, and the annual rate of loans repayed to the association. T is an indicator of workload. If we were modelling the growth of a college, instead of a thana cooperative association, an analogous input variable would be the annual rate of student credit hours taken. As our set of structural control equations we have, then:

$$\begin{aligned}
W^* &= \phantom{a_{21} W +} a_{12} D + a_{13} S + a_{14} L + g_1 T \\
D^* &= a_{21} W \phantom{+ a_{32} D} + a_{23} S + a_{24} L + g_2 T \\
S^* &= a_{31} W + a_{32} D \phantom{+ a_{43} S} + a_{34} L + g_3 T \\
L^* &= a_{41} W + a_{42} D + a_{43} S \phantom{+ a_{14} L} + g_4 T,
\end{aligned} \qquad (4.5)$$

where W^*, S^*, D^* and L^* are the ideal values for workers, divisions, supervisors and levels, given the configurations described on the right hand side of each equation.

Suppose, now, that the annual change in any one of the observable systemic variables was governed by a cybernetic feedback process directed at reducing the difference between the ideal and the actual numbers of workers, divisions, supervisors, and levels. Mathematically, such a feedback adjustment could be described as:

$$
\begin{aligned}
\Delta W &= c_1 \, (W^* - W) \\
\Delta D &= c_2 \, (D^* - D) \\
\Delta S &= c_3 \, (S^* - S) \\
\Delta L &= c_4 \, (L^* - L).
\end{aligned}
\tag{4.6}
$$

By substituting the expressions on the right hand side of each equation in 4.5 for the starred variables in 4.6, we arrive at the following open system dynamic model:

$$
\begin{aligned}
\Delta W &= -c_1 \, W + a_{12} \, c_1 \, D + a_{13} \, c_1 \, S + a_{14} \, c_1 \, L + c_1 \, g_1 \, T \\
\Delta D &= a_{21} \, c_2 \, W - c_2 \, D + a_{23} \, c_2 \, S + a_{24} \, c_2 \, L + c_2 \, g_2 \, T \\
\Delta S &= a_{31} \, c_3 \, W + a_{32} \, c_3 \, D - c_3 \, S + a_{34} \, c_3 \, L + c_3 \, g_3 \, T \\
\Delta L &= a_{41} \, c_4 \, W + a_{42} \, c_4 \, D + a_{43} \, c_4 \, S - c_4 \, L + c_4 \, g_4 \, T.
\end{aligned}
\tag{4.7}
$$

This is cumbersome, so we will summarize the model in the matrix format $\Delta X = AX + GU$, in which X, the vector of system variables, is $(W, D, S, L)^T$; U, the vector of input variables, is $(T, 0, 0, 0)^T$, and the matrices A and G are

$$A = \begin{bmatrix} -c_1 & + a_{12}\, c_1 & + a_{13}\, c_1 & + a_{14}\, c_1 \\ a_{21}\, c_2 & - c_2 & + a_{23}\, c_2 & + a_{24}\, c_2 \\ a_{31}\, c_3 & + a_{32}\, c_3 & - c_3 & + a_{34}\, c_3 \\ a_{41}\, c_4 & + a_{42}\, c_4 & + a_{43}\, c_4 & - c_4 \end{bmatrix} \tag{4.8}$$

$$G = \begin{bmatrix} c_1\, g_1 & 0 & 0 & 0 \\ c_2\, g_2 & 0 & 0 & 0 \\ c_3\, g_3 & 0 & 0 & 0 \\ c_4\, g_4 & 0 & 0 & 0 \end{bmatrix} . \tag{4.9}$$

What is the meaning of the expression ΔX? It is a symbolic representation of the change in system variables from one time to another. The usual way to designate the data sampling points is with subscripts: X_n denotes the value of the system variables at time n. The expression ΔX, then, can be rewritten as $X_{n+1} - X_n$. This yields the equation $X_{n+1} - X_n = AX_n + GU_n$. Some very simple matrix algebra allows us to rewrite this as:

$$X_{n+1} = (A + I)\, X_n + GU_n, \tag{4.10}$$

in which I is the identity matrix. Still further simplification, substituting B for (A + I), gives

$$X_{n+1} = BX_n + GU_n. \tag{4.11}$$

Equation 4.11 can be used as an estimating equation for this model of structural change. The set of variables on the left hand side, represented by the vector X_{n+1}, can be treated as dependent variables and regressed against the independent variables on the right hand side. The regression gives estimates of the parameters contained in the matrices B and G. One feature of this method is peculiar, though, from the perspective of standard regression theory. The regression must be forced through the origin, since no vector of constants appears in 4.11. While it is entirely possible to accomplish such a regression, the results are hard to interpret. The usual measure of the proportion of variance explained by the regression, r^2, does not apply because the correlation coefficients have not been adjusted for the means of the variables. Rather than forcing the regression equations through the origin, a safer and more general procedure would be to allow for the possibility of regression constants, and to see if they did indeed turn out to be zero.

Constants in the equations for W*, D*, S* and L* would enter the overall model as a vector $R = (c_1\, r_1,\ c_2\, r_2,\ c_3\, r_3,\ c_4\, r_4)^T$, which would be the final term in the matrix equation

$$X_{n+1} = BX_n + GU_n + R. \qquad (4.12)$$

I have used equation 4.12 as the basic estimating equation for a mathematical model of the structural subsystem in thana cooperative associations of the Comilla type. The dependent variables in the vector X_{n+1} were regressed against independent system variables in the vector X_n and the input variable in the vector U_n.

When stepwise regressions were performed on the structural subsystem data from the 1966 expansion projects, the results in Table 4-2 were obtained. Excluded from the table are all regression steps in which an independent variable entered the equation with an F ratio which was significant at the .25 level or above. Even though this exclusion policy was based on a generous entry criterion, its consequence was to render the coefficient matrix B sparce, with few entries off of the main diagonal. And because of the exclusion policy, the matrix G was

Table 4-2: Regression estimates of structural subsystem parameters for the 1966 projects. The number of predictions for all four regressions was 23.[30]

X_{n+1} =	BX_n	$+ GU_n$	$+ R$	Multiple R	Overall F	Significance of F
W_{n+1} =	$.85W_n - 2.69D_n$		+ 21.97	.82	20.86	.000
D_{n+1} =	$.70D_n$		+ 1.48	.72	23.10	.000
S_{n+1} =	$- .44D_n + .88S_n$		+ 2.96	.84	24.91	.000
L_{n+1} =		$.95L_n$	+ .14	.69	19.17	.000

In order to compare these results with those reported for the Hummon study of structural control in finance departments, one must bear in mind that the matrix B in the recursive equation $X_{n+1} = BX_n + GU_n + R$ is not directly analogous to the A matrix in Hummon's differential equation model $\dot{X} = AX + R$. The closest analog to Hummon's differential matrix A is the difference matrix A in the general equation $\Delta X = AX_n + GU_n + R$. This matrix A and the B matrix in Table 4-1 have the relation $A = B - I$. Subtraction of the identity matrix gives:

$$A = \begin{bmatrix} -.15 & & & \\ & -.30 & & \\ & & -.12 & \\ & & & -.05 \end{bmatrix} = \begin{bmatrix} -c_1 & & & \\ & -c_2 & & \\ & & -c_3 & \\ & & & -c_4 \end{bmatrix} \qquad (4.13)$$

This result is similar to the one Hummon obtained. He reported negative inertial effects of the variables W, D, S and L upon their own rates of change. His study showed the values of the diagonal coefficients to be: $c_1 = .10$, $c_2 = .24$, $c_3 = .23$, and $c_4 = .23$.

In other respects, though, the matrix A given in 4.13 is different from the A matrix reported in the Hummon study. (Hummon's A matrix was reproduced earlier in this chapter as equation 4.4.) Even the simplified version of Hummon's findings, shown earlier as Figure 4-4, does not have much resemblance to these results. In his study of state and local finance departments, Hummon found that several system variables influenced the rate of change of other system variables. His A matrix was dense with coefficients off of the main diagonal.

For the thana cooperative associations, the input matrix G is empty, indicating that their evolution was not influenced by workload, at least insofar as the rate of loan transactions can be taken as an indicator of workload. In this respect, Hummon's closed system model would seem to have been vindicated.

Graphically, the structural subsystem model derived from these regressions can be depicted as in Figure 4-12. A comparison of this diagram with the simplified causal loop diagram for the Hummon model shown as Figure 4-4 demonstrates that the only commonality between the two sets of findings is in the negative inertial effect that each structural variable has on its own rate of change. While the Hummon study of government finance departments in the United States showed that organizational divisions influenced workers and supervisors, the effect was positive rather than negative. The effect was, however, in the same direction, leading from the differentiation variables toward the size variables. So in contradistinction to the published findings of Peter Blau, Marshall Meyer, Grant Childers, Bruce Mayhew, and other major researchers who have investigated the structure of formal organizations, I am led, reluctantly, to assert that this set of thana cooperative association data appears to support the contention that differentiation $\longrightarrow$ size, albiet diminished size rather than expanded size.

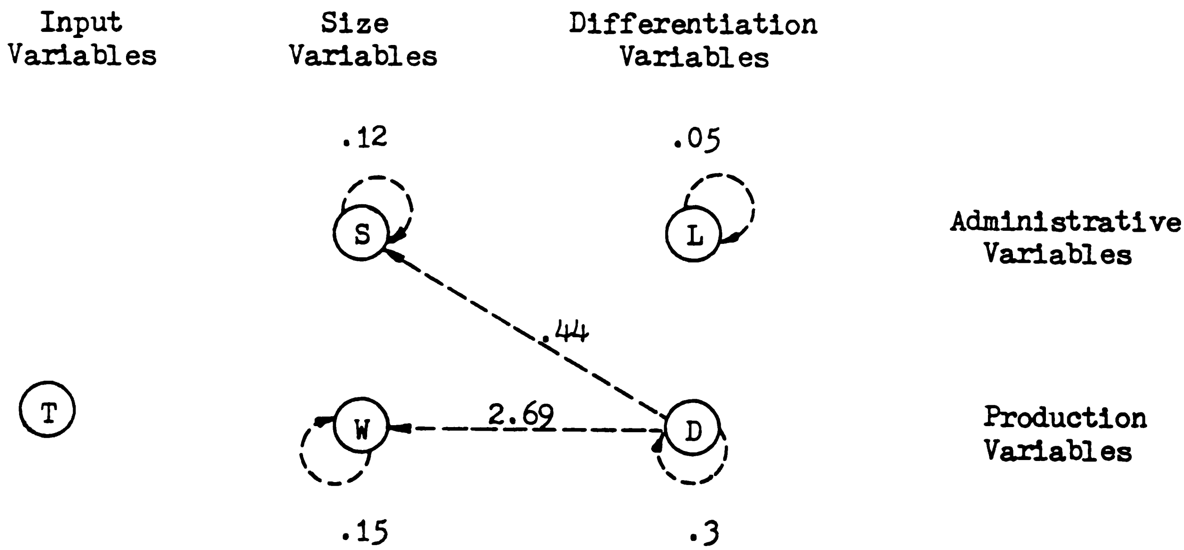

Figure 4-12: Causal loop diagram for the structural subsystem in the 1966 projects.

Since there are so many features of Figure 4-12 which are contrary to expectation, it would seem worthwhile to look into the possibility that its anamolies -- such as the closed character of the system, or the negative impact of divisions on workers -- might be due to a break in the time series after 1968. In Figure 4-11 we saw that the system trajectory took a sharp turn downwards in 1968, after the fall of President Ayub Khan. By cutting out the predictions in the post-Ayub era, and thereby reducing the sample of predictions from 23 to 12, we obtain a data base for the regression estimates shown in Table 4-3.

A graphical presentation of these regression results, in Figure 4-13, makes it clear that in most respects they are not in accord with the findings from the whole series of observations of the 1966 projects, running from 1966 to 1970. The structural subsystem portrayed in Figure 4-13 is open; it shows only one negative inertial effect of a variable upon its own rate of change; and the interaction among state variables supports the theory that size differentiation.

Table 4-3: Structural subsystem regressions for the 1966 projects in the Ayub Khan era. Predictions for 1969 and 1970 excluded.

X_{n+1} =	BX_n	$+ GU_n$	$+ R$	Multiple R	Overall F	Significance of F
W_{n+1} =	$2.06W_n$	$- .03T$	$- 11.51$	.86	12.84	.002
D_{n+1} =	$.05W_n + .84D_n$		$- .16$	.85	11.73	.003
S_{n+1} =	$1.11S_n$		$+ .89$	.78	15.91	.003
L_{n+1} =		L_n		Constant in this range		

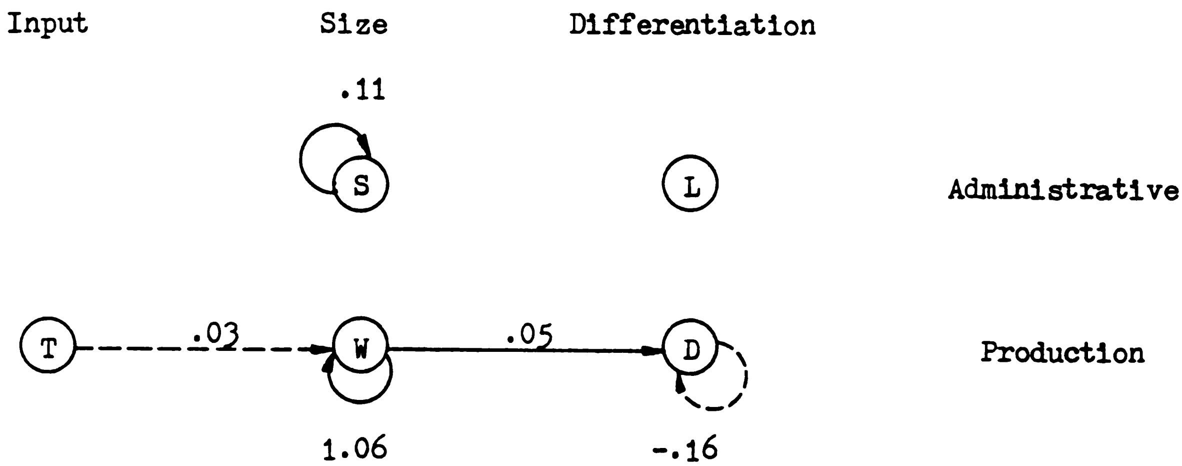

Figure 4-13: Causal loop diagram of structural subsystem parameters for the period 1966-1968. Solid lines indicate positive impact, dotted lines negative impact.

Where lies the truth of the matter? Was the structural subsystem of the thana cooperative associations influenced by workload or not? And if it was, how could the causal relationship be such that the more work there was to be done, in the form of cooperative loans to be issued and collected, the smaller the workforce that would be required? And does differentiation   size, or does size   differentiation?

From a small sample study such as this one, no clear resolution of these questions can be obtained. Inasmuch as the findings of this study are contradictory from one sub-sample to the next, I cannot say that I have reached any firm conclusions about the interaction of state variables in the structural subsystem of the thana cooperative associations, or about the influence of workload on the evolution of these organizations.

In the absence of well validated detail about the structural subsystem of the thana cooperative associations, the most prudent course seems to be to adopt a conservative standard, and pursue the implications only of those research findings for which the strongest evidence is available. To maximize the size of the sample on which our conclusions would be based, let us work from the entire series of observations, from 1966 through 1970. Furthermore, let us impose a more rigid criterion for permitting independent variables to enter the regression equations: instead of a .25 significance criterion, let us say that no variable will be allowed into the regression unless it enters with an F ratio which is significant at at least the .10 level. Upon imposing these more conservative standards, we obtain the regression results in Table 4-4. This is a closed system model, in which all four state variables are independent of each other. Size does not lead to differentiation, nor does differentiation lead to size.

Table 4-4: A conservative interpretation of the structural subsystem parameters for the 1966 projects. F level for entry set at significance of .10.

X_{n+1} =	BX_n	$+ GU_n$	+ R	Multiple R	Overall F	Significance of F
$W_{n+1} = .77W_n$			+ 15.37	.80	36.83	.000
D_{n+1} =	$.70D_n$		+ 1.48	.72	23.10	.000
S_{n+1} =	.89S		+ 1.32	.82	45.59	.000
L_{n+1} =	.95L		+ 0.14	.69	19.17	.000

To demonstrate the dynamic implications of these regression results, the coefficients shown in Table 4-4 can be incorporated in the solution of the mathematical model of the structural subsystem. Since the matrix G is empty, the model can be reduced to the form $X_{n+1} = BX_n + R$. If such a system has an equilibrium X^*, a point in phase space from which the solution does not deviate with the passage of time, then the system solution has the form

$$X_n = X^* + B^n (X_o - X^*), \tag{4.16}$$

in which X_o is the vector of initial values of the system variables.[31]

Recall that the ideal number of workers in the thana cooperative association was assumed to be $W^* = a_{12} D + a_{13} S + a_{14} L \quad + g_1 T + r_1$. All of the subscripted "a" and "g" coefficients in this equation have been found to be zero. So the ideal number of workers is $W^* = r_1$. What is the value of r_1? With a little manipulation, r_1 can be derived from the regression results. In Table 4-4 the equation for the number of workers in the next time period was $W_{n+1} = .77 W_n + 15.37$. The remainder, 15.37, is equal to $c_1 r_1$. To find c_1, we subtract 1 from 0.77, since c_1 is a diagonal element in the change matrix A = B - I. Therefore,

$$W^* = c_1 r_1 \div c_1 = 15.37 \div .23 = 66.83. \tag{4.17}$$

According to this method, the full set of equilibrium, or ideal, values of the state variables can be determined as $W^* = 66.83$, $D^* = 4.93$, $S^* = 12$, and $L^* = 2.8$. Given the ambiguities in interpretation of this data set, I would not place much substantive significance on these values.

Since the matrix B is in this case a diagonal matrix, any power of the matrix can be found simply by raising the coefficients along the diagonal to the desired power. (Actually, matrix methods for solution are not even needed, since the state variables are independent of each other.)

For purposes, the most interesting predictions of this mathematical model are those for W and S, since these variables can be used to form the variable Size = W + S, and Percent of Employees who are

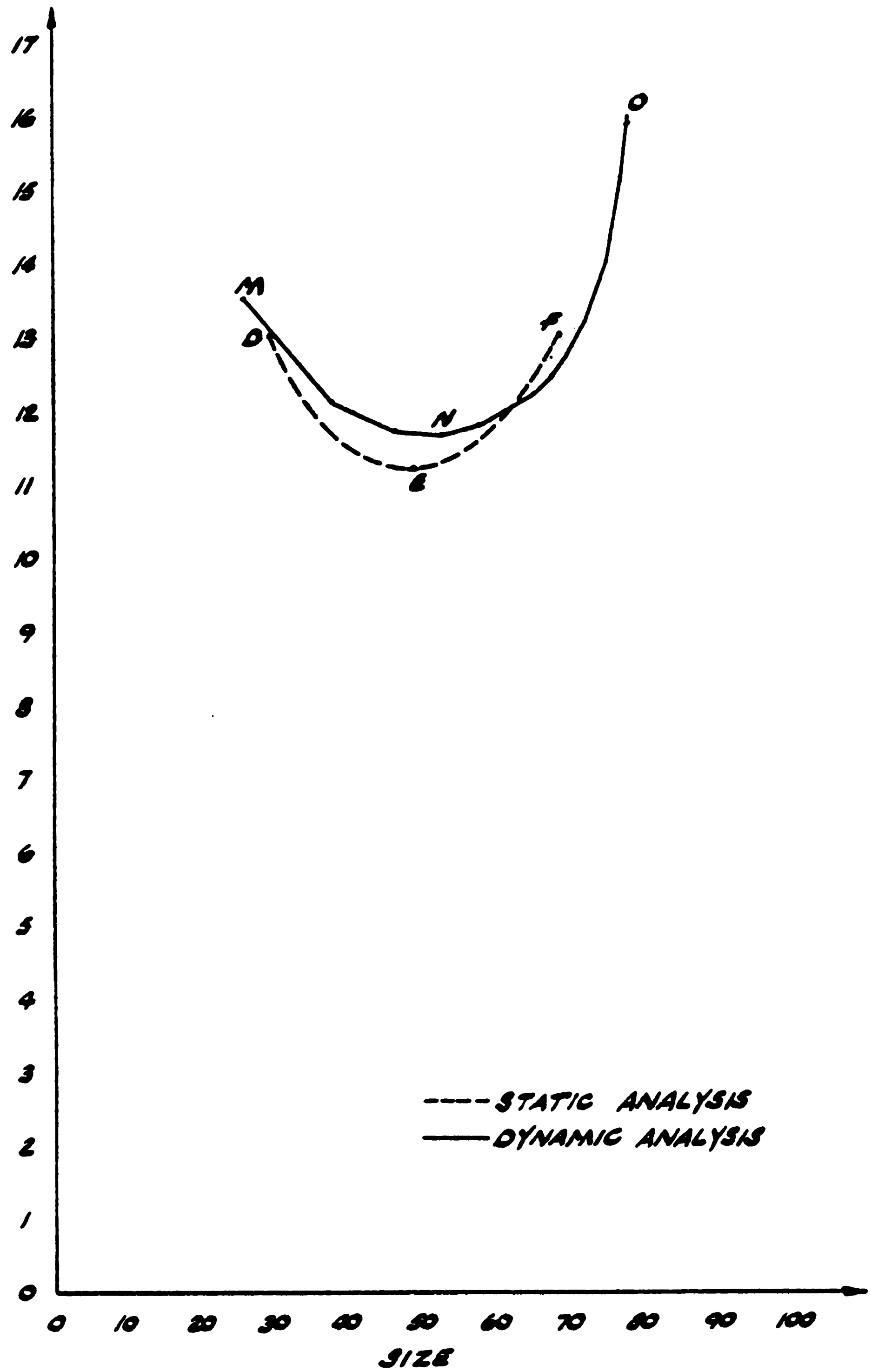

FIGURE 4-14 DYNAMIC MODEL PREDICTIONS COMPARED WITH STATIC FINDINGS FOR THE 1966 PROJECTS.

Supervisors = $\frac{S}{W + S}$. A plot of the model's predictions for Size versus Percent of Supervisors is shown as the solid line MNO in Figure 4-14.[32] The dotted curve in the figure is the same as curve DEF in Figure 4-10. The similarity of the two curves is remarkable, and may be taken as further evidence in support of the contention that there was an administrative optimum for the thana cooperative associations. Point N, the minimum of the dynamic curve, is at a size of 53 employees. By using the static investigative methodology employed by Peter Blau, point E on the dotted curve was found to be at an organizational size of 49 employees. From the proximity of these two estimates of the location of the administrative optimum, we can assert that thana cooperative associations were most efficiently staffed at a scale of about 50 employees. Beyond that size, they became loaded down with supervisors.

This chain of reasoning proceeds from the very narrow assumption that a rural development organization should operate at the scale of greatest administrative efficiency, as expressed in the ratio of supervisors to size. Such a criterion would have made sense if it had been possible to serve the needs of the rural population in a thana by establishing several thana cooperative associations (each of an optimum size) covering the same region. This was not ordinarily a feasible alternative because the government assumed that one thana should be served by one thana cooperative association. So long as that assumption was respected, the only really satisfactory alternative would be to subdivide the thanas, much as Akhter Hameed Khan advocated splitting up Laksam into several thanas each of which would be of more manageable dimensions. But his call for revamping the territorial hierarchy of administration was not heeded, and probably never will be.

Short of the radical solutions of splitting the thana cooperative associations or splitting the thanas, there was an intermediate way of restraining the thana cooperative associations from the temptations of administrative overload and inefficiency. (These temptations present themselves to the administrators of any organization, but they are especially acute in the less developed countries, where self-serving public bureaucracies are a principal source of employment for the middle class.) Instead of attacking the problem through horizontal segmentation, it could be resolved through vertical reorganization. Such was the solution to which Akhter Hameed Khan resorted in Comilla Kotwali Thana, where he split off the field supervision section of the KTCCA to form the compact subordinate entity known as the Agricultural Cooperatives Federation.

Before I end this discussion of the structural subsystem, I should like to report one more curious finding about the thana cooperative associations. In reviewing the literature about mathematical interpretations of organizational structure, I encountered Grant Childers' article on "System Size and Structural Differentiation," which I mentioned earlier in this chapter. Childers developed an argument for the equation $E(D) = \frac{1}{2}(S + 1)$, in which $E(D)$ is the expected value of differentiation in the organization, and S is the size of the organization. (These variables should not be confused with D and S in the Hummon model.) Childers' measure of differentiation was the number of occupations in an organization, and his measure of size was total personnel. To see whether this theory applied to the thana cooperative associations, I tested it against data from all of the thana cooperative association questionnaires that were returned to me, including those for the Agricultural Cooperatives Federation, for the projects

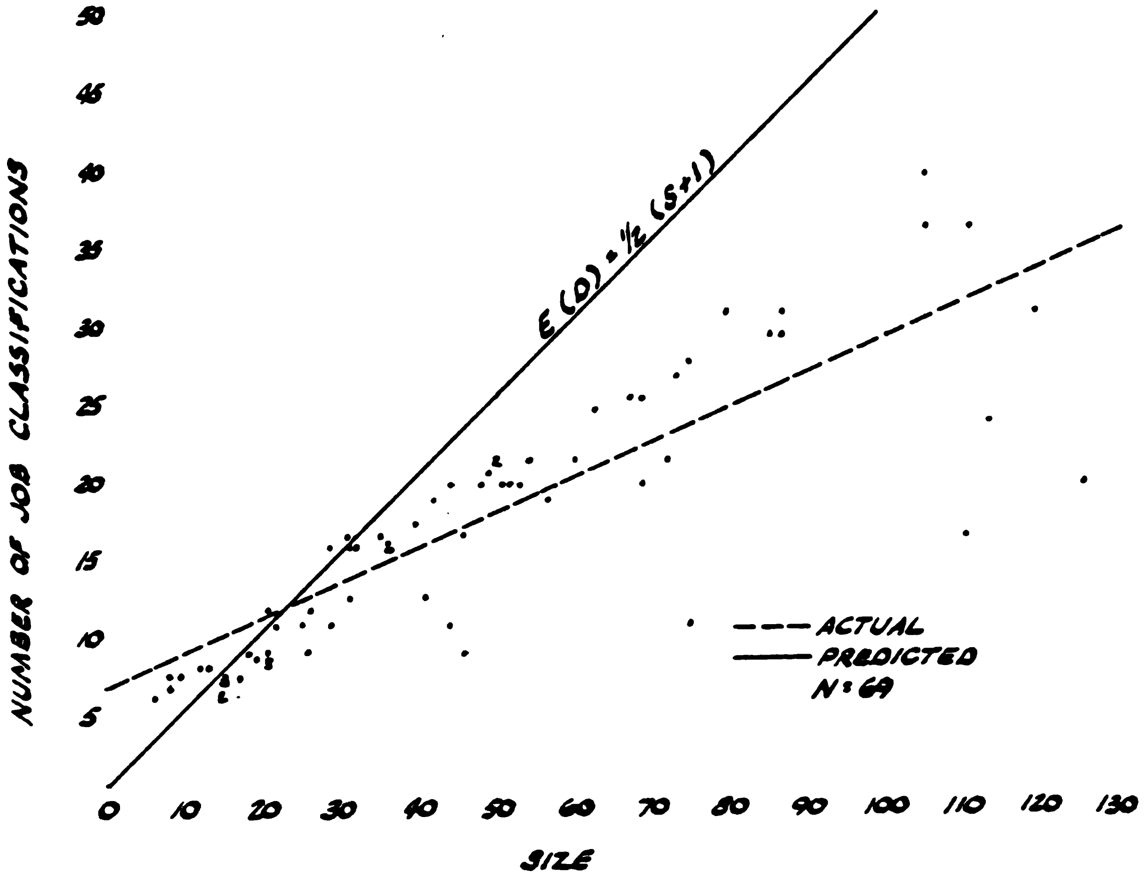

FIGURE 4-15 SIZE VERSUS DIFFERENTIATION IN THE THANA COOPERATIVE ASSOCIATIONS.

founded in 1963-64, for the projects founded in 1965-66, and for the projects founded in 1968-69.

If the actual number of occupational classifications in the thana cooperative associations were the same as the expected value of differentiation, we would find that a regression of job classifications (as the dependent variable) against size would have a slope of 0.5 and an intercept on the job classification (vertical) axis of 0.5. When the regression was carried out, with data from 69 questionnaires, the slope turned out to be 0.23 and the intercept 6.62. The anticipated values of these coefficients are not included in either 95% confidence interval; for the slope, the 95% confidence interval extends from .19 to .26, and for the intercept from 4.66 to 8.58. The results do not support Childers' hypothesis about the way differentiation is related to size.

Yet a relationship between size and differentiation clearly did obtain in the thana cooperative associations, even if it was not the one proposed by Grant Childers. The regression of the number of job classifications against size explained 72% of the variance in job classifications. The F ratio for the regression was 168.78, which was significant at the .000 level. In the scattergram shown as Figure 4-21 one can see that only a handful of the 69 cases strayed from the dotted regression line $D = .23S + 6.62$.

Since the one theoretical explanation which I know of for this phenomenon does not seem to apply, I am at a loss to explain the very strong relationship between size and differentiation in the thana cooperative associations. I can only speculate that different kinds of organizations may have different "signatures" of differentiation. Childers, for example, found that differentiation was related to size according to three distinct regression equations in vessels, headquarters offices and lifeboat stations in the U.S. Coast Guard. The regression equation for lifeboat stations near Seattle ($D = .23S + 6.33$) was just about identical to the one which applies to the thana cooperative associations in East Pakistan. The reader is free to make his own inferences about the cause of this surprising commonality.

Notes for Chapter 4

The Structural Subsystem

[1] Richard M. Cyert and James G. March, A Behavioral Theory of the Firm, Prentice Hall, Englewood Cliffs, N.J., 1963, p. 289. Copyright 1963 by Prentice Hall, Inc. Reprinted with permission.

[2] Kenneth E. Boulding, "Toward a General Theory of Growth," Canadian Journal of Economics and Political Science, V. 19, August, 1953, pp. 326-40.

[3] Peter M. Blau, "A Formal Theory of Differentiation in Organizations," American Sociological Review, V. 35, No. 2, April, 1970, pp. 201-218.

[4] Norman P. Hummon, "A Mathematical Theory of Differentiation in Organizations," American Sociological Review, V. 36, April, 1971, pp. 297-303.

[5] Marshall W. Meyer, "Size and the Structure of Organizations: A Causal Analysis," American Sociological Review, V. 37, August, 1972, pp. 434-441.

[6] Ibid., p. 437.

[7] Grant W. Childers, Bruce H. Mayhew, Jr., and Louis N. Gray, "System Size and Structural Differentiation in Military Organizations: Testing a Baseline Model of the Division of Labor," American Journal of Sociology, V. 76, March, 1971, pp. 813-30.

[8] David A. Specht, "System Size and Structural Differentiation in Formal Organizations: An Alternative Baseline Generator," American Sociological Review, V. 38, August, 1973, pp. 479-80.

[9] Marshall W. Meyer, "Some Constraints in Analyzing Data on Organizational Structures: A Comment on Blau's Paper," American Sociological Review, V. 36, April, 1971, pp. 294-297.

[10] Bruce H. Mayhew, Roger L. Levinger, J. Miller McPherson, and Thomas F. James, "System Size and Structural Differentiation in Formal Organizations: A Baseline Generator for Two Major Theoretical Propositions," American Sociological Review, V. 37, October, 1972, pp. 629-633.

[11] Morris F. Friedell, "Organizations as Semilattices," American Sociological Review, V. 32, February, 1967, pp. 46-54.

[12] Norman P. Hummon, Patrick Doreian, and Klaus Teuter, "A Structural Control Model of Organizational Change," American Sociological Review, V. 40, December, 1975, pp. 813-824.

[13] Ibid., p. 816. In most of the research papers cited previously in this chapter, including Peter Blau's and Marshall Meyer's, the size of the organization was indicated by a single variable, usually designated S, which corresponded to the total number of employees in the organization. In the Hummon paper, size is broken down into two components: the number of production employees, P, and the number of supervisors, S.

[14] In order for a mathematical model of a simple machine to be linear, it must be true that if S is a solution and if T is a solution, then S + T is a solution. In the case of $\dot{X} = AX$, the general solution is $X = e^{At} X_o$. If $\dot{T} = AT$ and $\dot{S} = AS$, then $T = e^{At} T_o$, $S = e^{At} S_o$, and $S + T = e^{At} T_o + e^{At} S_o = e^{At} (T_o + S_o)$, so the system meets the conditions of linearity. But for $\dot{X} = AX + R$, $X = e^{At} S_o + R$. If $\dot{T} = AT + R$ and $\dot{S} = AS + R$, then $T = e^{At} T_o + R$, $S = e^{At} S_o + R$, and $S + T = e^{At} T_o + R + e^{At} S_o + R = e^{At} (T_o + S_o) + 2R$. This last equation does not have the form $X = e^{At} X_o + R$, so S + T cannot be a solution to the system. The conclusion is that the system $\dot{X} = AX + R$ is not linear.

[15] For an explanation of causal loop diagrams and their significance in the modelling of dynamic systems, see Thomas J. Manetsch and Gerald L. Park, System Analysis and Simulation with Applications to Economic and Social Systems, Part 1, Department of Electrical Engineering and System Science, Michigan State University, 1974, pp. 16-24. Causal loop diagrams are used extensively in Dennis Meadows, et al, The Limits to Growth, New American Library, 1972. I have added circles around the variables in Figures 4-1 and 4-2 to make them resemble standard causal loop diagrams more closely. Hummon seems to be unaware of the generality of the type of diagram he has drawn, since he does not refer to it either as a "causal loop diagram," or by the alternative name, promoted by W. Ross Ashby in Design for a Brain, of an "effects diagram."

[16] Peter J. Bertocci, Elusive Villages, Social Structure and Community Organization in Rural East Pakistan, Ph.D. Thesis, Michigan State University, 1970.

[17] This method of decision-making pervaded all village institutions in Comilla. Few issues were ever brought to a vote in the cooperative weekly meetings or in the sessions of the local government bodies known as the Union Councils. When the voting method was required, as in the election of Union Council members, the villagers tended to divide into antagonistic factions which sometimes persisted for years.

[18] Badruddin Ahmed, Manual of Comilla Cooperatives, Bangladesh Academy for Rural Development, Comilla, 1972.

[19] As it is printed on page 4 of the report, the heading of the organization chart contains a typographical error. The printed heading reads "Organization Chart of Kotwali Thana Central Cooperative Association (KTCCA) as on June 1967." The chart can be correctly dated at June 1969, since it shows the number of members of the Agricultural Cooperatives Federation as being 11,673, which was the membership figure for June 1969.

[20] The list of fifteen functions which the inspectors ranked was prepared by the author and Shamsul Huq, who was at the time the director of the field supervision section of the KTCCA. When the Agricultural Cooperatives Federation was formed, Shamsul Huq was appointed as its director.

[21] Harry W. Blair, The Elusiveness of Equity: Institutional Approaches to Development in Bangladesh, Rural Development Committee of Cornell University, Ithica, 1974, p. 51.

[22] A New Rural Cooperative System for Comilla Thana, Eleventh Annual Report, 1970-71, Bangladesh Academy for Rural Development, Comilla, 1973, p. 40.

[23] Harry W. Blair, op cit, pp. 49-52.

[24] Arthur T. Mosher, "Projects of Integrated Rural Development," paper presented at the Seminar on Small Farmer Development Strategies, Ohio State University, September, 1970 (Mimeograph), pp. 16, 17.

[25] Norman T. Uphoff and Milton J. Esman, Local Organization for Rural Development: Analysis of the Asian Experience, Rural Development Committee, Cornell University, 1974, pp. 67-69.

[26] Akhter Hameed Khan, Tour of Twenty Thanas, East Pakistan Academy for Rural Development, 1971, p. 24.

[27] Eugene Haas, Richard H. Hall, and Norman J. Johnson, "The Size of Supportive Components in Organizations: A Multi-Organizational Analysis," Social Forces, V. 42, pp. 9-17.

[28] Peter M. Blau, op cit, p. 205. Blau segmented the size axis and calculated the mean value of the percent of supervisors for each segment. He plotted these values against the mean value of size within each segment, and drew a smooth curve connecting the resultant points. In constructing Figure 4-10, the horizontal axis was divided into three equal segments, from 20 to 39, 40 to 59, and 60 to 79. Blau's procedure for tracing a curve was then followed.

[29] The distinction between level and rate variables is clearly described by Jay W. Forrester in Industrial Dynamics, John Wiley and Sons, New York, 1961, pp. 68, 69.

[30] The observant reader may have noticed the discrepancy between N = 29 in Figure 4-10 and N = 23 in Table 4-2. The sample size is smaller for the regressions because they are based on the number of predictions derivable from the data. With two consecutive annual data points in one thana, for example, only one prediction can be estimated.

[31] This solution form is given in John M. Hunter, "Solving Linear Translate Systems with Matrices," mimeographed handout for Psychology 400H, Michigan State University, p. 3. Hunter's derivation is given in Appendix A.

[32] Point M, the beginning of the trajectory of model predictions, represents the average size (27 employees) and percentage of supervisors (13.6) of the 1966 projects at the end of their first year of operation; that is, on June 30, 1966.

CHAPTER 5

The Technical Subsystem

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static systems	S			
Simple machines	ST			
- - - - - -				
Machines with input				
Organic systems				

> A social system is a structuring of events or happenings rather than of physical parts and it therefore has no structure apart from its functioning. Physical or biological systems such as automobiles or organisms have anatomical structures which can be identified even when they are not functioning. In other words, these systems have both an anatomy and a physiology. There is no anatomy to a social system in this sense. When the biological organism ceases to function, the physical body is still present and its anatomy can be examined in a post-mortem analysis. When a social system ceases to function, there is no longer an identifiable structure.[1]

Introduction

What does an organization do? What are its functions? One does hear charges, usually political in character, that certain comatose agencies do nothing. Yet a defender of the bureau can always be found who explains that the personnel of the unit do this or do that. There are always functions to be found. Without them, as Daniel Katz and Robert Kahn explain in the passage quoted above, the grouping could not properly be described as an organization.

Anthropologists such as Bruno Malinowski[2] and sociologists such as Philip Selznick[3] have built their professional reputations around descriptions of the interplay of structure and function. The conceptual framework of the structural-functional school is that "functions determine the structure of organizations and that structures can be understood by analyzing their functions."[4] In anthropology, sociology, and political science, structural functionalism had its heyday in the United States in the nineteen fifties. Structural functionalism is a powerful analytic approach, but it has been displaced by more encompassing perspectives. Modern organization theorists such as Amitai Etzioni[5] are inclined to examine the three way interaction among structure, function and goals. Other contemporary pundits take the even broader view of systems theory, which in the opinion of writers such as Fremont Kast and James Rosenzweig[6] is capable of interpreting the complicated relationships among structure, function, goals, management, psychosocial processes, and the organizational environment. The price to be paid for such inclusiveness should be intuitively obvious. The more factors are considered, the more diffuse and potentially incoherent is the analysis.

Qualified credit is due to the systems theorists, though, for attempting to sharpen our perception of organizational functioning. Because of the commentary of the systems analysts, it is no longer so fashionable to refer to the functions of an organization. Instead, analysts writing in the contemporary vein discuss the technology of the organization. As defined by Kast and Rosenzweig, organizational technology is the technique used for the transformation of inputs into outputs.[7] For a steel mill, this definition of technology would lead to the consideration of open hearth furnaces and such -- the common concept of technology. For a service organization like the Comilla cooperatives, however, the usual ideas of inputs, transformational processes, and outputs must be reexamined. Technology needs to be thought of as being embodied in more than a set of mechanical artifacts (such as irrigation pumps). Broadly speaking, the up-to-date idea of technology encompasses the human interactions which result in providing a service, and even the ideas, rules, and standards according to which those productive interactions are patterned. For this enlarged concept of technology it might seem that we could just as well substitute the fuzzy old idea of functions.

The same conundrum which confronted us in the last chapter arises here as well. Is it possible to construct realistic closed system models of the structural subsystem or of the technical subsystem of organizations? For the structural subsystem, we found that the organization chart, which is a closed and static representation, has all the characteristics that would be expected in the kind of model which Kenneth Boulding termed a framework, and which I have called a static system. But when it came to the mathematical representation of the structural subsystem, my presentation in Chapter 4 wavered back and forth between the closed and open systems points of view. For the technical subsystem this theoretical issue presents itself more forcefully. As was noted above, Kast and Rosenzweig have defined organizational technology in terms of inputs and outputs, which clearly indicates an open system perspective. How can I justify, then, the classification of the technical subsystem in the row of the typological matrix for simple machines? The dotted horizontal line in that matrix, which is reproduced at the head of this chapter, designates the division between closed and open systems. The T which stands for technical subsystems is placed above that dotted line, in the region of closed system models.

The breed of organization theorists who have been infected, as I have, with general systems theory often show a fondness for the comparison of system structure with anatomy and of system function with physiology. An example of this predilection is to be found in the passage by Daniel Katz and Robert Kahn at the head of the chapter. Much of the subject matter of physiology does consist of closed system models. The circulation of the blood, for example, can be modeled to a good approximation as a closed system, even though nutrients and oxygen are continually entering the bloodstream, and waste products are being extracted from it. If these inputs to and outputs from the bloodstream are ignored, a great deal can still be explained about the nature of the circulatory system.

The criterion of classification for an organizational subsystem, I suggest, is that it should be located in the cell of the typological matrix which permits a minimally acceptable description of the subsystem. An organization chart, which is a static closed system model, provides a minimally acceptable description of the structural subsystem. Therefore the S for structural subsystem is appropriately placed in the upper left hand cell of the typological matrix. If the technical subsystem can in some minimally acceptable sense be described as a closed system, then the placement of the T in the typological matrix will be justified. In the last section of this chapter, where a simulation of the credit operations of a thana cooperative association is presented, we will, therefore, examine whether in some minimally acceptable sense that model of the technical subsystem can be considered a closed dynamic system, or simple machine.

One functional prescription from the Cornell canon deserves to be heeded in this chapter. As the third of their seven maxims on the design of rural development organizations, Uphoff and Esman asserted, "Though specialization may be indicated for some activities, local institutions should ordinarily be vested with multiple functions in order to achieve benefits of scale and to facilitate the local integration of services."

Relevant Research

In the social sciences, the study of technology has been primarily a concern of economists. The classic example of such a study was provided by Adam Smith, the first great economist, who described how the specialization of labor could increase the production of pins. The economic theory of production functions (in what different ways can units of labor and units of capital be combined to produce 10 widgets?) is essentially a theory about technologies; for each production function there is a distinctive underlying technology.

Contemporary organization theorists have paid relatively little attention to technology *per se*. Although a spate of studies have recently appeared which have examined how technology influenced organizational structure, on the one hand, or organizational management, on the other, technology in and of itself has not been a topic of interest to modern organization theorists.

Such was not always the case. The founder of what has come to be known as the classical school of organization theory, Frederick W. Taylor, was fascinated by the arrangement of work. Writing with the enthusiasm of an evangelist, Taylor once described how his associate, Frank B. Gilbreth, investigated and restructured the job of a bricklayer.[8] By introducing such technological innovations as a frame for holding pre-sorted bricks, and an adjustable scaffold which could keep the supply of bricks at a convenient height (eliminating the need to turn and stoop to pick up a new brick), Mr. Gilbreth accomplished a threefold increase in the productivity of bricklayers. In the spirit of scientific management, a movement which he founded, Taylor praised Gilbreth for designing this new configuration for the bricklayer's workspace, a configuration which permitted the laborer to work with two hands at once -- picking up a new brick with his left hand at the same time as he scooped up a trowelful of mortar with his right hand. The organizational implication of this technological advance, in Mr. Taylor's view, was that all the bricklayers working in a row along the wall of a building under construction must be brought up to the same rate of production, since the wall should rise along its whole length at an even speed. It therefore became the responsibility of the construction management to teach and enforce the new techniques, and to discharge any workmen who failed to cooperate. (There were no trade unions to speak of in that autocratic era at the beginning of the twentieth century.) The comparison of a scientifically managed workman to a science fiction robot has been drawn, and it is appropriate.

By the middle of the twentieth century, complex organizations had come to dominate the social and industrial landscape in the United

States and in Europe, and the attention of many organization theorists shifted to the internal functioning of these behemoths. William Whyte's exposition of the way that giant corporations enforce conformity and supress individualism was typical of the mid-century literature.[9] The relationships of personnel to one another <u>within</u> the bureaucracy became the topic of interest. The interface between management and the work force, which was the level of Frederick Taylor's concern, was generally relegated to the industrial engineers, or to the experts on collective bargaining and industrial relations.

That technology should have receeded from view as the size of typical organizations grew is consistent with the findings of cross-sectional empirical studies of the relationship of size, technology, and organizational structure. A group of researchers at the University of Aston, in Birmingham, England, investigated these relationships in a sample of 52 organizations in the Birmingham area ranging from factories to stores. They concluded that:

> The smaller the organization, the wider the structural effects of technology; the larger the organization, the more such effects are confined to particular variables, and size and dependence and similar factors make the greater overall impact. In the smaller organizations, everyone is closer to the "shop floor," and structural responses to the problems of size (for example) have not begun to show. In larger organizations, managers and administrators are buffered from the technology itself by the specialist departments, standard procedures, and formalized paperwork that size brings with it.[10]

This explanation by the Aston group is an intuitively reasonable reconstruction of the relative influence of technology in small and large organizations. But this ray of common sense is a rarity in the literature on technology and organizational structure. Several empirical studies of organization and technology have been published in the last decade or so, but they seem to have generated more controversy than agreement.[11]

The pioneering work in this field was that of Joan Woodward, who reported in 1965 her findings from a study of some 100 industrial firms in the English midlands. Woodward and her associates found a strong correlation between the technology of a firm and such aspects of its structure as the length of the line of command, the chief executive's span of control, and the ratio of direct to indirect labor. Woodward's studies indicated, moreover, that there was an optimum form of organization for each technology, since the most successful companies within each industry had similar structures.[12] Woodward's research has subsequently been referred to as the "technological imperative" school of thought, which contends that for every technology there is an appropriate organizational structure.

Such a provocative contention is likely to stir other scholars to challenge the original research methodology, or to find out if the basic findings can be replicated or refined. Several authors, for example, have questioned Joan Woodward's concept of the way that the technology of an industry should be measured. She classified the firms in her study along a scale of technical complexity which ranged through (1) unit to small batch, (2) large batch to mass production, and (3) continuous processing. Examples of these three types of industrial technologies would be shipbuilding, automobile manufacturing, and petroleum refining. Among the alternative scales for a technological variable which have since been proposed are that of Edward Harvey,[13] who measured "technical diffuseness" by the number of product changes recorded for the firm in the last 10 years, and that of

Van de Ven and Delbecq,[14] who created a matrix taxonomy of work units from the two dimensions of task variability and task difficulty. Each such researcher, as might be expected, has presented elaborate statistical evidence, in the form of correlations, factor analysis, analysis of covariance, and so forth, which supports his own interpretation of the validity or invalidity of the concept of the technological imperative. Pradip Khandwalla has summarized the findings of the many studies which were inspired by Woodward's research:

> 1. There is no unanimity that technology affects organizational structure. Some studies show a pronounced effect; others show a very weak effect.
>
> 2. Measurement of operations technology is a serious problem.
>
> 3. The impact of technology on organizational structure, if any, is likely to be quite selective. In other words, it is likely to affect some -- perhaps few -- dimensions of organizational structure rather than all structural dimensions.
>
> 4. The search for empirical relationships between technology and organizational structure may best be described as serendipitous. The major researchers have not been guided by propositions derived from an explicit model of how technology might affect organizational structure.
>
> 5. There is no clear evidence that relationships, if any, between technology and organization remain when size of the organization is controlled.
>
> 6. The research to date has virtually no prescriptive implications.[15]

Another major group of organization theorists have looked at the influence of technology upon organizational management. In the terms of reference used in this book, this group of investigators can be said to have examined the influence of the technical subsystem upon the managerial subsystem. The preeminent study in this field is that of Burns and Stalker.[16] They investigated the way that 20 English and Scottish firms which had operated with stable technologies responded to corporate moves into the rapidly changing electronics industry. These firms had previously been managed in a mechanistic way: that is, the tasks, methods, duties and powers attached to each role in their fixed organizational structures had been rigidly prescribed. Success in the electronics field, by contrast, seemed to demand an organic system of management, in which there was a continual adjustment and redefinition of roles within a flexible network (as opposed to a hierarchy) of control. In a review of this research, Kast and Rosenzweig commented, "Burns and Stalker also emphasize the difficulties involved in making the transformation from the mechanistic to the organic system by the firms that were trying to move into the electronics industry. The unstructured and highly dynamic nature of the organic system often created anxiety and insecurity on the part of the managers who had been used to working in the structured, mechanistic system."[17]

In a critique of Max Weber's abstract model of bureaucracy, Eugene Litwak has made a similar argument about the appropriateness of different methods of management. The Weberian model is the classic mechanistic administration. In the hierarchical bureaucracy described by Weber, the system of authority and obligations is specified <u>a priori</u>, and is attached to the roles of the bureaucracy rather than to the individuals who occupy those roles. Litwak pointed out that such a rational, impersonal ordering is suitable only if the tasks which the bureaucracy is to perform are uniform. "In short," he wrote, "where organizations deal with non-uniform events, a model of bureaucracy may be more efficient which differs in degree from Weber's in at least six characteristics: horizontal patterns of authority, minimal specialization, mixture of decisions on policy and on administration, little _a priori_ limitation of duty and privileges to a given office, personal rather than impersonal relations, and a minimum of general rules."[18] The electronics industry, Burns and Stalker would agree, is characterized by non uniformity of tasks. The organic pattern of management which Burns and Stalker found suitable in the electronics field, moreover, is similar to the non-Weberian administrative model described by Litwak.

It seems that there is relatively less disagreement about the probable influence of technology on management than there is about the influence of technology on structure. The cause of this apparent consensus, however, may well be that the definition and dimensions of the variables describing organizational management are as yet so nebulous as to preclude substantial contention.

In the following sections of this chapter I discuss three significant technologies in the Comilla cooperatives: dry-season irrigation, tractor cultivation, and credit. The first two of these are assessed mainly at the village tier, while the credit system is evaluated primarily at the thana tier. At several points I have made inferences as to how these technologies influenced the structure, management, and costs of the cooperatives. But I have made no attempt to substantiate these anecdotal inferences concerning Comilla Kotwali Thana with statistical evidence drawn from survey research across thanas. Toward the end of the chapter I present a dynamic systems model of the credit operations of a thana cooperative association. Most of the parameters of this model were estimated from financial data from the Comilla type cooperative associations founded in 1965-66. The model is then tested against data from that same group of organizations, much as was done in Chapter 4. The focus of the model, though, is exclusively on the economic aspects of cooperative credit. The model does not, in its present state of development, allow for the investigation of the implications of the credit technology for the structure and management of the cooperatives. The system model of cooperative credit has been constructed, thus, more nearly in the tradition of economic theory than of organization theory. For organizational technology, there is nothing comparable to Norman Hummon's structural control model to draw upon, so I have built an economic model instead.

The Technical Subsystem at the Village Tier

As was noted above, the concept of technology and the concept of function are closely related. Let us begin our investigation of the technical subsystem, then, with a review of the functions which are appropriate to rural development organizations.

In their summary volume for the Cornell study of rural local government in Asia, Norman Uphoff and Milton Esman describe six major functions which constitute, in their estimation, a taxonomy of the most important things that rural development organizations should do. To one of these five, the provision of services to farmers, they alloted fifty out of the hundred weighting points distributed across the six functions. These functions are:

(a) Planning and goal-setting (10 points)
(b) Resource mobilization (10 points)
(c) Provision of services (50 points)
   (1) water (10 points)
   (2) fertilizer (10 points)
   (3) credit (10 points)
   (4) extension information (10 points)

(5) marketing (10 points)
(d) Integration of services (10 points)
(e) Control over bureaucracy serving rural development (10 points)
(f) Making claims for more and better support of rural development (10 points).[19]

Although most of what has been published about the village cooperatives of the Comilla type emphasizes their participation in the provision of services, in point of fact all of these functions were exercised by the primary village cooperatives. In most cases the primary cooperative did not perform these functions alone; rather they did so in collaboration with the thana level association. Function e, control over the bureaucracy serving rural development, is the most obvious instance in which the village cooperative would have been unable to fulfill one of these rural development functions without the support of the thana organization. The installation and repair of irrigation pumps, to take one example, was the responsibility of a section of the thana cooperative association headquartered in Comilla town. Electrification of the motors of tubewell pumps, which resulted in economies of pump operation and maintenance, required coordination at the provincial level of government, in Dacca, between advocates of the Comilla cooperative project and the leaders of the East Pakistan Water and Power Development Authority, which had to be convinced to string power lines to particular villages in Comilla thana.

At the thana tier, responsibility for each of four of the five sub-functions listed above under "Provision of Services" was allocated to a separate section of the thana cooperative organization. The pumping of irrigation water was the responsibility of the water section of the machine station of the KTCCA, and the provision of credit was the task of the Agricultural Cooperatives Federation, which had separate sections for extension and marketing. Only the provision of fertilizer, among the five crucial services in Uphoff and Esman's list, was not made the special responsibility of a distinct organizational section at the thana tier. At the village tier, by contrast, all of these functions were fused within the structurally undifferentiated primary cooperative societies. In accordance with Eugene Litwak's theory, we might expect that the multiplicity of functions performed by the village cooperatives would cause them to have horizontal patterns of authority, minimal specialization, a mixture of decisions on policy and administration, little a priori limitation of duties and privileges to a given office, personal rather than impersonal relations, and a minimum of general rules. All of these attributes did, in fact, apply to the village cooperatives.

Although the irrigation of dry season crops falls under category c, the provision of services, in the above taxonomy of rural development functions, the accomplishment of this objective entailed the fulfillment of all of the other rural development functions as well. Or to put the matter the other way around, in order to provide water for dry season irrigation, a multi-functional organization with village roots such as the Comilla cooperatives was a necessity. Zaker Hussain, who was the chairman of the KTCCA during much of the nineteen sixties and who became the director of the Bangladesh Academy for Rural Development at Comilla in the mid-seventies, graphically described the necessity of village organization:

> For making pump irrigation a success the organization of a village or a pump group is a must. A one-cusec pump can irrigate 60 to 70 acres. Unless a compact block is organized the operation is bound to be wasteful. Turns of irrigation have to be decided upon in order that

> each plot gets irrigation at regular intervals. There will be complaints; there will be disputes; there will be farmers who would like to go their own ways. All these problems have to be tackled. Unless there is an organization to take care of all these problems there is bound to be chaos and confusion leading to the collapse of the programme.[20]

Among the most important functions of such a village organization are planning and goal setting, and resource mobilization. The significance of these functions is illustrated in a passage from S. A. Rahim's report on "Voluntary Group Adoption of Power Pump Irrigation in Five East Pakistan Villages:"

> In the case of water distribution the groups, at the initial stage, showed resistance in digging water carrying channels over the entire crop area. In early 1960, when Tongipar was visited, we found no arrangements for a water channel. Water discharged from the mouth of the pipe was simply overflowing the nearest plots. Even hours later the water did not reach the distant plots. In spite of repeated insistance by the (pump) driver, no suitable action was taken. Even our advice could not convince the group. The problem was to determine who would take the trouble of performing the manual work. Soon, however, the members of the group found that without channels the pumps would be useless. The group discussed the problem and arrived at a decision. It was decided that the major channels carrying water to blocks of plot would be dug jointly. From these main waterways each individual would dig his tributaries to carry water to his own plots. This arrangement worked very satisfactorily. Within a week a network of channels was dug. When we made our next visit the whole scene had changed.[21]

Irrigation of small farms, the Tongipar villagers had discovered, is inherently a cooperative activity requiring planning of the location of the irrigation channels, the setting of goals such as the number of acres to be irrigated, and the mobilization of labor to dig and repair the channels. Technology, in other words, promoted cooperation and organization.

The underlying reason why these activities had to be accomplished in an organized group, rather than by individuals, was that the size of the farmers' holdings was small, and that each farmer's holdings were fragmented in turn into little plots each of which was often no bigger than a backyard garden would be in the United States. "Because of the small fields and scattered land holdings," Levern Faidley remarked, "the technically simple task of building a small water canal across a quarter mile of level alluvial plain became a major organizational problem. Even a wealthy man could not afford to purchase the easements and rights-of-way needed to irrigate all of his plots. Therefore, the only solution was for all of the owners to come together and agree that canals could be built across their lands."[22]

More was involved in growing a dry season, or boro, crop of rice or potatoes than delivering water to the otherwise sun-baked earth. For the high yielding rice varieties from the International Rice Research Institute which were introduced in Comilla in 1965, and which were grown by 98% of Comilla farmers by 1970, successful agriculture in the dry season required increased inputs of labor, fertilizer, and insecticides, as well as new methods of sowing and threshing. (The traditional threshing method was to have bullocks tread over the harvested rice and straw. This did not work well for the high yielding rice varieties, so a pedal driven thresher with a rotating drum was introduced as an alternative.) Assuring the availability of these supplies at the right time and in the right quantities was an exercise in the integration of services, listed by Uphoff and Esman as function d in their taxonomy of organizational activities for the promotion of rural development.

Once the profitability of the new agricultural technology centering on high yielding rice varieties and dry season irrigation had been demonstrated, competition for the requisite inputs commenced. Some of these, such as fertilizer and insecticides, were available on the market as well as from the public sector, so the laws of supply and demand governed much of their distribution. The central cooperative association, however, had a virtual monopoly on the distribution of means of supplying irrigation water. There were three of these: a gravity flow irrigation canal leading from the Gumti river to villages in the Sonaichuri basin, low lift pumps which drew water from canals and rivers and from village ponds (called tanks in the local parlance), and deep tubewells which drew up water from an aquifer about 250 feet below the surface. There was no prohibition on the private sale of pumps and tubewells, which sold briskly in West Pakistan during the same era. No farmer in Comilla Kotwali Thana, though, held enough contiguous acreage to justify the cost of buying his own irrigation well or pump. The local cooperative societies assumed the function, therefore, of lobbying the thana central association for the installation of tubewells, for the rental of low lift pumps, and for the provision of increased agricultural credit to finance the more expensive, and more profitable, modern agricultural inputs. (Some villages which already had one tubewell, such as Sreemontapur, lobbied for a second, while other villages sought to emulate their prospering neighbors.) This claim-making function which the local cooperatives assumed is the last of the six functional requisites of rural development mentioned in Uphoff and Esman's taxonomy.

When the faculty of the Comilla Academy first broached the idea of dry season irrigation in 1959 and 1960, many of the local farmers laughed. It seemed absurd to suggest that a seasonal shortage of water was a problem in a land which was drenched during the monsoon by a hundred inches of rainfall, and which was inundated annually to depths of as much as twenty feet of floodwater. But the villagers' scepticism was overcome, and the irrigation of farmland in Comilla rose in a steadily ascending curve to over 15,000 acres in 1970-71.

The introduction of another mechanized agricultural technology, tractor cultivation, was more problematic. One of the Peace Corps volunteers who helped set up the Comilla tractor station recounted that a farmer had told him, in a tone of disgust, that he would not try to use a tractor to harrow his fields again. What was the matter, the young American inquired. The farmer spat red beetle nut juice and replied that the tractor had slipped into a ditch. "When my bullock falls down he gets up again, but that useless tractor just lies there and doesn't stand up."

In his doctoral dissertation in agricultural engineering at Michigan State University, Lavern Faidley tabulated the slight economic advantages accruing to the farmers who employed a combination of tractor and bullock power to prepare their land for planting a dry season crop of high yielding rice. Using bullock power alone, the farmer would incur total tillage costs averaging 54.54 rupees per acre, while with a combination of bullock and tractor power the farmer would spend an average of 48.62 rupees per acre. (Even when the land had been harrowed by tractor, bullocks were still needed for the final field leveling and puddling which preceeded planting.) The cost differential of about six rupees or one dollar per acre contrasted markedly with the net return from irrigation of high yielding rice of as much as 1,200 rupees per acre. In proportion to total potential profit, the cost saving from using tractors was insignificant. As might be expected, the number of acres tilled by tractor in Comilla Kotwali Thana did not increase as rapidly as the number of acres irrigated. By the late sixties, a plateau of about 6,000 acres of tractor tillage in the thana was reached.[23]

As was the case with irrigation, villagers who wished to avail themselves of the tractor technology were compelled to cooperate. To open up a block of land sufficiently large for a 35 horsepower tractor to cultivate efficiently, the owners of adjoining plots had to agree to join in the tractor rental, and to demarcate their plot boundaries (usually with stakes) so that ownership could be reestablished after the tractor had tilled straight across the land. In some instances farmers who intended to hire a tractor from the central cooperative association also had to synchronize their harvesting, so as to clear the area for block cultivation prior to the planting of the next crop.

In the preceding section of this chapter, I reviewed research on the influence of technology on the structure and management of organizations. The Aston group of researchers, it will be recalled, asserted that the impact of technology is more apparent in small organizations than in large ones. From that premise alone, it might be expected that technology would have a strong impact on the village cooperatives, all of which were small. But the variety of technologies with which the village cooperatives dealt tended to cancel out any strong pattern of influence.

Judging from what I learned during the field research project which took me to 45 village cooperatives in Comilla Kotwali Thana in the 1966 dry season, I would say that in the village cooperatives the influence of technology upon structure was less often noticeable than was the influence of technology upon management.

The field research team, which was led by Zaker Hussain, observed that in the village of Bordoil paid personnel were engaged by the local cooperative to supervise the distribution of irrigation water from the tubewell. Many village cooperatives instituted water management committees, another structural innovation, for the same purpose. In such cooperatives, it could be said that the technical subsystem had influenced the structural subsystem.

Given the fragmented pattern of landholdings, the technologies of irrigation and tractor cultivation were management-intensive. Water channels and cultivation blocks had to be planned, fees had to be assessed and collected, and accounts had to be maintained. For irrigation pumps, fuel and oil had to be purchased and repairs had to be arranged. Discipline in adhering to the plan for the method and sequence of distributing water was important, lest water be wasted and irrigated acreage decline. All of these activities called for strong leadership and sound management in the village cooperatives. The new technologies thereby enhanced the authority of the manager of the primary cooperative, and of its managing committee.

The Technical Subsystem at the Thana Tier

Technology in the broad sense -- to include not only the processes by which machines turn raw materials into useable products but also the procedures according to which human knowledge and effort are transformed into services -- had a strong influence, perhaps a predominant influence, on the structure, management, and costs of the thana cooperative associations in Comilla. Some of the sections of the KTCCA were technologically-based in the narrow, mechanical and commonly accepted sense of technology. The cold storage section, for example, operated chilled warehouses where potatoes were held for sale at optimum off-season prices. The creamery section operated a milk pasteurizing and butter and cheese manufacturing plant. The machine station ran the fleet of tractors and the tubewells. On the other hand, the main business of the KTCCA's two major subsidiary cooperative federations -- the Agricultural Cooperatives Federation and the Special Cooperative Societies Federation -- was to provide a service: cooperative credit. If the procedures according to which that service was provided can be considered a technology, as the broad definition of technology assumes they should, then technology can be said to have influenced those federations as well.

The impact of technology upon units such as the machine station was easily discerned. The cost of tractor repairs in Comilla was 100% greater than in the United States. Tractors broke down frequently in the humid environment and flooded fields of East Pakistan, which caused deterioration of rubber and of insulation around electrical wiring. Wear on the tractors was excessive, because fuels and lubricants were of low standard and because tractor drivers were poorly trained. Whereas tractor repairs in the U.S. are often accomplished in hours, in Comilla days and even months were typically required to repair a tractor. Spare parts for the Massey Ferguson 35 h.p. tractors used in Comilla had to be imported, so the machine station stocked an unusually large inventory of spares as a hedge. Even so, broken tractors sometimes stood idle for 6 months to a year waiting for parts to be imported.[24] Because of these repair problems, the machine station had to hire a large staff of mechanics, and had to allot an exceptionally large portion of its budget to maintenance.

The cooperative creamery employed a continuous processing technology. The equipment of the creamery, much of which was donated and installed by the Danish government as part of their foreign aid program, had a capacity in excess of the capability of local farmers to supply it with milk, so the processing was in reality more intermitent than continuous. In the Western nations continuous processing industries such as steel and petroleum have resorted to vertical integration -- ownership of their sources of raw materials and of their marketing outlets -- in order to protect their core processing technologies from the effects of fluctuations in raw materials or product markets. The corner gasoline station, which is linked within the same corporation all the way back to oil fields in distant corners of the globe, is a symbol of vertical integration. The creamery section in Comilla reacted much as other continuous processing industries have responded when threatened with large oscillations in production. To boost and sustain the supply of raw milk, the creamery section sponsored special dairy cooperatives in Comilla villages. On the output side, the creamery section personnel tended to bypass the marketing section of the KTCCA, and to make their own marketing trips to Dacca and Chittagong to arrange outlets for cheese and butter.

The impact of technology upon some of the other units of the thana cooperative association was not as obvious. I would argue that the structure, management, and costs of the Agricultural Cooperatives Federation were influenced by the technology of its credit operations. But to assess the validity of that contention, the changing nature of the credit technology must first be understood.

From the beginning, the leaders of the Comilla cooperatives believed that credit should be supervised. In the course of the first decade of the operation of the cooperatives, they held to two successive concepts of why and how that supervision should be effected.

Until July, 1965, the theory and practice of credit supervision in Comilla were aligned with those of supervised credit programs in other countries. The American influence was notable, especially in the requirement that every farmer applying for a loan draw up a production plan. Among county agents in the United States, a favorite extension technique is to assist a farmer in drawing up such a plan, either for his whole farm or for some segment of its operations.

The orthodox concept of supervised credit which prevailed during the first five years in Comilla was closely linked to the idea that agricultural extension was the key to rural development. It was believed that the techniques for improved agricultural production were known, and that the problem was how to accelerate their adoption by peasant farmers. Supervised credit was a mildly coercive method for inducing the adoption of modern farming techniques.

Under the orthodox supervised credit system, farmers wishing to apply for loans would first hold a general discussion of agricultural plans in one of the weekly meetings of their village cooperative. Each member would state how much land he intended to plant in the coming crop season, and how much credit he needed to finance each of his anticipated categories of expenditure. The manager and other members of the village cooperative would discuss whether the loan request was justified, and would try to persuade the member that he could finance his crop with a smaller loan. The member's request would be cut down if the consensus was that he did not need so much credit for the agricultural operations he had specified, or that he would be unable to repay the loan on time. The manager would then enter the mutually agreed-upon total loan request on the production plan sheet of the village cooperative, and the member would say how he thought he would divide up his total loan for the finance of his different inputs and operations. (Production planning, it might be noted, was thereby conducted in a communal setting quite different from that of the individualistic farmer in the United States.)

When the village production plan was complete, the manager would take it to the inspector, who would check it over for inconsistencies and errors of form. If the inspector found such mistakes, he would discuss them with the manager in the weekly class which all managers attended at the Thana Training and Development Center. The manager would then either make the suggested changes himself, or take the plan back to his village society for reconsideration.

When the inspector was satisfied that the production plan was formally correct, he would refer it to the agricultural extension section of the KTCCA. There a trained agronomist would compare the figures entered by the farmers with standard production formulae. If the agronomist recommended changes in items such as the planned dosages of fertilizer and insecticide, the inspector would consult again with the manager who might take the plan back to his society for further corrections.

Preconceptions of the foot-dragging traditional farmer and the go-getter modernizing agronomist might lead to the supposition that the agronomist, when he reviewed the production plan, would recommend a doubling of fertilizer use or a tripling of the dosage of insecticide. In practice, the process worked exactly the other way around. The farmers would ask for more fertilizer or insecticide than they needed, or intended to use, in hopes of selling the surplus. When the market for these commodities was depressed, farmers would still typically request extra credit so that they could divert funds to personal consumption, or to pay off debts to moneylenders, or to other purposes not specified in the production plan. The agronomist's task, then, was usually to cut down credit requests to what would be needed to secure the recommended combination of inputs.

What was the purpose of this rigamarole? The orthodox program of supervised credit made sense only as a supplement to agricultural extension. Supervised credit was supposed to act like an afterburner on the jet engine of extension. It was expected to give extra thrust and speed up the movement of improved agricultural technology into the countryside.

The advocates of orthodox supervised credit proposed that if the farmers could actually be held to the implementation of the production plan, rather than letting them treat it as an exercise in chicanery, they could thereby be inveigled to try out new production techniques.

The low interest supervised credit program posed the farmer with the following alternatives.

1. Finance his consumption and traditional agricultural inputs by taking a high interest, high collateral loan from the village moneylenders; or

2. Finance modern agricultural inputs by taking a low interest, low collateral loan from the supervised credit agency.

If the credit had been unsupervised, the farmer might have taken the low-interest, low-collateral government loan and used it to finance his consumption and traditional agricultural inputs. But supervision was intended to remove this third possibility. If he had to make a choice between the first two alternatives, the farmer would probably decide to take part in the supervised credit program, though all the while he might try to subvert the program so as to achieve the third course of action.

Several assumptions were implicit in the orthodox approach to supervised credit.

1. It was assumed that the profit to be had from adopting improved practices of cultivation was not large enough, or sure enough, that these practices would sell themselves. Instead, the farmers had to be coaxed into using methods which would yield a small margin of gain.

In the years prior to the Green Revolution, which were indeed the years of the orthodox approach to supervised credit in Comilla, this assumption may unfortunately have been valid. In a faculty meeting at the Pakistan Academy for Rural Development in August, 1966, Akhter Hameed Khan related that in 1960, when the Academy formed its first village cooperatives, the major improved practices being taught were low lift pump irrigation, line sowing, and the use of fertilizer. Although the farmers did take to irrigation once the appropriate technology and organization had been worked out, there was but a faltering adoption of line sowing and chemical fertilization. The acreage under line sowing in 1962-63 was much less than in 1961-62. It was apparent that the farmers had rejected line sowing, and it seemed the reason was that the effect of line sowing on yields was nominal. There was no such spectacular reverse in the history of the adoption of fertilizer, but it was found that the farmers were for a long time wary of their use because of the tendancy of local rice varieties to lodge (fall over) when too great a dosage was applied.

Taking a lesson from these experiences, the leaders of the Comilla experiment concluded that the route to agricultural modernization in Kotwali Thana was not through the alteration of the techniques of cultivation of the existing aus and amon rice crops, but through the provision of irrigation water and tractor services which would allow the farmers to grow a third dry season crop of boro rice. Because tubewells and tractors are management-intensive inputs, the emphasis of the cooperative program shifted from extension to organization.

2. It was assumed that the cost of cooperative loans was considerably lower than that of credit provided by local moneylenders. In the absence of such a cost differential, farmers would prefer to finance their operations through familiar sources, and forgo the effort and discipline required by the cooperatives.

What motivated the small farmer to put up with all the paperwork and policing of supervised credit was fear of the moneylender. The more extortionate the moneylender's terms, the more willing were the farmers to participate in the supervised credit program.

Shamsul Huq, the man who was in charge of the Comilla supervised credit system for the first half decade, reported that interest rates charged by moneylenders averaged 100 percent per year when he organized his first cooperative in South Rampur village in 1960. The interest was charged in a curious fashion. To make a loan of 100 rupees, the moneylender would require the borrower to sell him a parcel of land valued at 150 to 250 rupees. The moneylender would pay the borrower 100 rupees for the land, which was turned over to the moneylender with full legal certification of the sale. When the debt came due, the borrower would repurchase his land at its market value of 150 to 250 rupees. Should the borrower be late in repaying his debt, the moneylender could raise the price of resale.

From the moneylender's point of view, this system of selling and reselling land had the advantage of absolute security for the loan transaction. In case of a default, there was no need to foreclose on a mortgaged asset, since the creditor possessed the land already. Ideologically, the villagers justified the system as conforming to the Muslim religion, which forbids usury. The moneylender would say that the difference between the price he paid for the parcel of land and the price at which he resold it represented profit, not interest.

There is some evidence that fear of the moneylenders and the desire to repay old debts to them was among the strongest initial motivations of small farmers who joined the Comilla cooperatives. A study conducted by the Academy for Rural Development in 1963 showed that the largest category of loan funds requested (as stipulated in the production plans), and the largest category of the actual utilization of loan funds (as determined by a survey) was for the repayment of outstanding debts.[25]

3. The orthodox supervised credit program also assumed that borrowers could be held accountable for the expenditure of their loan in accordance with the production plan. Without such accountability, village cooperative members might use the loans for whatever purpose they pleased, undermining the purpose of the orthodox supervised credit program.

In the early stages of the Comilla project, the inspectors were asked to visit the villages to check on individual member's loan utilization to see that it conformed to the production plan. This supervisory technique proved impractical, though, because the inspectors usually visited the villages at night to attend cooperative meetings, whereas the farmers cultivated their fields by day. In those cases in which the production plan had called for services from the cooperative association, such as tractor cultivation, the use of the credit could be controlled. In most cases, though, the cooperative association found itself incapable of restricting loan diversion.

As might be suspected from the above discussion, the cooperative association came to recognize that the orthodox approach to supervised credit was unworkable. The production plan requirement for loan applications was abandoned in 1965. Akhter Hameed Khan put the case against the production plan in the following terms:

> The production plan was useless. It was a favorite device of the agricultural extension people in the United States, who liked to have a farm plan for each farmer that the extension worker served. It was also recommended by the Ford Foundation group in their report on India's Food Crisis and Steps to Meet It. In our villages it didn't work. We found that we had nobody who could draw up a good production plan for the farmers, because nobody knew what to recommend. There was so much variation in the actual practices. We were encouraging the inspectors to participate in a deception in drawing up these plans which we could not enforce or check up on. The purpose of the production plan was to encourage the farmers to adopt improved practices, but we had evidence from our field research that they were adopting the improved practices anyway. So what was the point of the production plan?[26]

As the rationale for the production plans crumbled, so likewise did the justification for employing the staff required for their review. The trained agronomist who had been in charge of production plan review left the KTCCA in August of 1964, and was not replaced. For a year thereafter, the cooperative association continued the ritual of requiring production plans, but with no one to check the plans the procedure was a farce. In July, 1965 the production plan requirement was dropped altogether.

If all controls had been lifted in 1965 the inspectors might have seen their own jobs emperilled. For if credit had been granted without restriction, there would have been no need for the inspectorate. The central association could have granted unsupervised credit in the same manner as it ran the cold storage facility, by direct negotiation with the managers of the primary cooperative societies.

But in the place of the orthodox system of supervised agricultural practices, the central association introduced a new system of supervised management. As the production plan had been the keystone of the orthodox system, the loan limit upheld the arch of the new regime. And the inspectors, it turned out, played a more influential role in the new system than in the old.

As can be seen in Table 5-1, there was a sharp break in the ratio of cooperatives per inspector between 1966 and 1967. The ratio dropped from 15.8 to 9.78 in one year. Despite a push for expansion in the number of primary cooperatives in Kotwali thana, the inspectorate grew disproportionately. It would be wrong to attribute all of this growth to the changeover from the system of supervised agricultural practices to the system of supervised management. That change of policy had taken effect two years previously, in 1965, so whatever effect it had was a delayed one. Two other factors were at play. 1966-67 was the first full fiscal year in which the Agricultural Cooperatives Federation operated as an independent entity, and the doubling of the inspectorate between June of 1966 and June of 1967 could well have been a response to that structural change. Also, the volume of loan transactions was surging ahead, and the increase in staffing may have been partly

Table 5-1: Growth of cooperatives, loan transactions, and inspectors in the field supervision section of the KTCCA (1962-66) and in the Agricultural Cooperatives Federation (1967-70).

Year	Village Cooperatives	Loan Transactions[a]	Inspectors[b]	Cooperatives per inspector	Transactions per inspector
1961-62	59	295	4	14.75	73.75
1962-63	110	583	6	18.33	97.17
1963-64	122	591	8	15.25	73.88
1964-65	152	1430	10	15.20	143.00
1965-66	158	1456	10	15.80	145.60
1966-67	225	2643	23	9.78	114.91
1967-68	261	6046	41	6.36	147.46
1968-69	301	5285	37	8.14	142.84
1969-70	316	3487	32	9.88	108.97

[a] Sum of loan issue and loan repayment during the fiscal year. Thousands of rupees per year.

[b] Includes assistant inspectors. Data for cooperatives and inspectors are as of the end of the fiscal year.

Sources: Annual reports of the KTCCA, and questionnaire responses.

attributable to the increased workload. Yet as I pointed out above, the greater workload might have had no effect at all on the size of the inspectorate if the abandonment of the policy of supervised agricultural practices had not been followed by its replacement with the policy of supervised management. All in all, I think it is fair to say that the change in loan policy did have an influence on the structure of the Agricultural Cooperatives Federation. The new loan policy provided a justification for the perpetuation, and indeed for the continued growth, of the inspectorate. The technical subsystem, in sum, influenced the structural subsystem.

The fundamental concern of the system of supervised agricultural practices was loan demand. The objective was to influence the pattern of loan demand so as to promote agricultural modernization.

By contrast, the system of supervised management was concerned with the pattern of loan supply. The basic question was how much should be loaned to each primary cooperative. Since the supervised management system was not built around an attempted control of credit demand, the diversion of loans to unauthorized purposes ceased to be a major concern of the thana cooperative association. The categories of purposes for which loans were issued remained fairly stable, as can be seen from Table 5-2, but the inspectors of the central association were no longer charged with checking to assure that every rupee was spent for the purposes authorized. Some controls were retained: if a loan to a village cooperative was for the purpose of financing the spring season, or aus, rice crop, then enough of the authorized loan to pay for seed would be released first, an amount sufficient to pay for fertilizer would be released later, and so forth. But the major responsibility for assuring that loan funds were spent properly was shifted from the thana

Table 5-2: Distribution of Agricultural Cooperatives Federation Loans by Purpose (percent of annual loan issue per purpose).

	1964-65	1965-66	1966-67	1967-68	1968-69
Crop financing					
Aus rice crop (spring)	20	32	33	19	17
Amon rice crop (fall)	7	6	4	6	13
Boro rice crop (winter)	7	3	5	10	16
Sugarcane	11	11	9	3	-
Potato	11	9	4	4	4
Vegetable	1	1	-	-	-
Sub total	57	62	55	52	60
Land					
Release from moneylender	11	7	9	17	8
Lease	5	3	6	17	19
Purchase	-	-	-	1	2
Sub total	16	10	15	35	29
Agricultural inputs[a] (Irrigation, fertilizer, insecticides, fuel and lubricants)	7	5	5	4	2
Animal husbandry (Milch cow, poultry pisiculture, bullock)	14	2	5	2	1
Personal (Food, house repair, house construction)	1	-	-	1	2
Other	5	21	20	6	6
Total percent	100	100	100	100	100

[a] Most agricultural inputs were paid for through crop financing loans, rather than through special loans.

Source: Annual reports of the cooperative experiment.

association to the village cooperatives, which had to collect from individual borrowers to repay one loan from the central association before another loan would be granted. (In accordance with the multi-tiered pattern of cooperative organization, individual farmers borrowed from and repaid loans to the village cooperative, which borrowed in turn from the thana association.)

Table 5-2 shows that in the period from 1967 to 1969, when the Green Revolution in irrigated production of high yielding rice varieties swept the hitherto barren dry season fields of Comilla, loans for the boro rice crop grew to the largest category of credit. The high yielding rice was more profitable than sugarcane or vegetables, and so replaced them as a crop. The increased profitability of farming is also reflected in the jump in loan issue for the lease, and even for the purchase, of land.

The change in the purposes for which loans were taken coincided in time with a sharp increase in loan volume, and in the size of the organizational base in the villages. But this growth was not synchronized. The rise in loan issue outstripped the increase in membership and in cooperative societies, as can be seen in Table 5-3. Through the decade of the sixties, the average loan issue per member per year was 180 rupees. Twice as much money, 370 rupees per member, was loaned out in 1967-68. Because the average number of members per village cooperative swelled as well in 1967-68, the spike in loan issue per cooperative in that year was even more pronounced.

The intent behind this big push was to spread the Green Revolution in rice cultivation as quickly as possible through the experimental thana in Comilla, so that it could become a model of technically progressive farming. That goal was largely achieved. But as I have remarked on several occasions in this book, some of the organizational side effects of the big push were deleterious.

Table 5-3: Growth in membership, cooperatives, and loan issue in Kotwali thana.

Year	Members	Cooperatives	Loan Issue*	Loans per Member	Loans per Cooperative
	(a)	(b)	(c)	(c/ax1,000)	(c/bx1,000)
1961-62	1860	59	235	130	3980
1962-63	3156	110	366	120	3330
1963-64	3833	122	304	80	2490
1964-65	4910	152	878	180	5780
1965-66	5161	158	796	150	5040
1966-67	8462	225	1671	200	7430
1967-68	11518	261	4244	370	16260
1968-69	11673	301	2930	250	9730
1969-70	11151	316	1713	150	6420
Av. 61-60	6858	189	1460	180	6610

*Loan issue in thousands of rupees.

Source: Annual reports of the KTCCA.

The Agricultural Cooperatives Federation was formed in 1966, a year before the big push was launched. My own field research into the Comilla cooperative system was conducted in 1965-66, during the period when the ACF was created. I had no inkling then of the impending drive for a massive increase in loan issue. However, my interviews with officials of the thana cooperative organizations, and with farmers in the 45 villages visited by the field research team,[27] revealed some of the financial stresses with which the Agricultural Cooperatives

Federation would have to contend.

Separation from its parent organization, the KTCCA, impelled the Agricultural Cooperatives Federation toward financial self-sufficiency. Loanable funds could be obtained more cheaply from the village membership -- in the form of savings and share purchases -- than they could be borrowed from the KTCCA. The Kotwali Thana Central Cooperative Association assumed the role of a financing bank for the ACF, and charged interest accordingly. The effective interest rates on savings and the effective dividend rates on shares were lower than the interest rate on borrowed funds charged by the KTCCA, so the financial self-interest of the ACF drove this new association to rely more heavily on equity capital raised in the villages. In this instance, it appeared that a change in the structural subsystem of the thana cooperative association induced a change in the technical subsystem.

When roll was called in the weekly nighttime meeting of the primary cooperatives, each member was asked to make a savings deposit. The amounts deposited were usually less than a rupee per member per week, but spread over thousands of cooperative members in the thana the savings deposits could accumulate to substantial amounts. The manager, when he went to attend his weekly training class at the Thana Training and Development Center, deposited the collected cash in his society's account at the United Bank Limited, a private bank with a branch office on the campus of the thana center. (By engaging the services of the United Bank as an intermediary in all financial transactions, the central association kept actual cash out of the hands of all of its officers, including the inspectors, and thereby reduced the potential for corruption.)

Interest payments on the savings deposits of the primary societies were calculated annually at the compounded rate of 3.5%. In fact, those interest payments did not reach the individual cooperative members until 1966, because the managers and village accountants had not bothered to enter interest earnings in the members' passbooks. Only in August of 1966, one month after the Agricultural Cooperatives Federation was registered as a cooperative organization distinct from the KTCCA, did Shamsul Huq, the ACF director, put enough pressure on the village accountants to get them to calculate and enter the individual interest payments. Shamsul Huq's action was an excellent indication of the long-standing need for autonomous management of the credit program. In order to raise equity capital, the new management of the ACF began to hustle for savings.

According to the bylaws promulgated for each primary society, the members were required to buy one share worth 10 rupees in their village cooperative each year. Once a year, the primary cooperatives were granted shares in the central cooperative association in proportion to the number of shares individual members had purchased in each primary society. East Pakistan cooperative law required that share purchases cover at least one tenth of the value of loans. In the Comilla cooperatives, this coverage requirement was raised, so that one fifth of the value of loans had to be matched by the combined total of share purchases and savings. The cooperative association sometimes raised this coverage requirement to as high as 33% for cooperatives whose management was suspect or whose loan repayment record was poor.

As with savings, the cooperative association was dilatory in according monetary rewards to its shareholders. The first cash dividend on shares was declared only in 1965-66. Shares, moreover, were not saleable, so once money had been invested in them it could not be withdrawn.

While savings deposits could be withdrawn, the procedures for doing so were strewn with obstacles. A cooperative member desiring to make a savings withdrawal had to justify his plan to his fellow cooperative members, and have his request incorporated in a written resolution of the society. The resolution would be approved by the society's inspector only if the requested withdrawal amount was not pledged as coverage for an outstanding loan.

The field research team in which the author participated in 1966 found that cooperative savings had acquired no appeal as a way of investing surplus funds in the villages. Farmer after farmer, when asked what he would do with any extra money that might come to hand, said that he would first of all buy land, and secondly would stock paddy to resell it at higher prices. The farmers were aware of the high profit investment opportunities in the village economy, and were reluctant to put their money into no-interest blockable savings accounts, or into the purchase of shares which paid no dividends.

As can be seen from Table 5-4, the Agricultural Cooperatives Federation scored some success in raising equity capital from the members of the village cooperatives. The rate of capital formation per member tripled between 1966-67 and 1967-68.

Despite the explanation of the newly-discovered financial incentives in the ACF, the data in Figure 5-4 is puzzling. The very year in which the rate of capital formation per member tripled, 1967-68, was the year when the Green Revolution swept the thana. Despite the fact that the Agricultural Cooperatives Federation was finally offering interest on savings and dividends on shares, the new rice growing technology had opened up investment opportunities in the villages which were much more

Table 5-4: Capital formation in the agricultural cooperatives in Kotwali thana.

Year	Members[a]	Savings Rate[b]	Share purchase rate[b]	Capital formation rate[c]	Capital formation/member[d]
1961-62	1860	28	14	42	22.58
1962-63	3156	54	27	81	25.66
1963-64	3833	69	28	97	25.30
1964-65	4910	19	66	85	17.31
1965-66	5161	32	79	111	21.50
1966-67	8462	85	50	135	15.95
1967-68	11518	267	285	552	47.92
1968-69	11673	277	139	416	35.63
1969-70	11151	144	182	326	29.24

[a] As of the end of the fiscal year.

[b] Net change in total savings of shares during the fiscal year.

[c] Sum of savings rate and share purchase rate. Thousands of rupees per year.

[d] Capital formation rate x 1,000 ÷ members.

Source: Annual reports of the KTCCA.

lucrative than cooperative savings accounts yielding 3.5% annual interest. Why, then, was there such a dramatic spurt in capital formation by the membership in 1967-68? To appreciate the cause of this phenomenon, one must understand the policies for loan issue which prevailed under the system of supervised management, which had replaced the system of supervised agricultural practices.

In order to obtain loans under the supervised management system, cooperative members would first have to participate in the determination of loan limits for each cooperative member individually and for their village cooperative collectively. Every six months the members met to discuss their loan needs for the coming half year. Each member would describe the crops he was going to grow, estimate his credit needs, and request a loan limit up to which he would be allowed to borrow in the next six months. If the other cooperative members thought that the farmer could not repay the requested amount, because he was poor, incompetent as a farmer, or had outstanding debts to the cooperative, they would reduce the requested limit. The manager would reduce the limit still further if he found that it exceeded five times the sum of the member's savings and shares. When loan limits had been agreed upon for all members, the manager submitted them to the cooperative inspector.

If the inspector discovered any mistakes in the individual loan limit requests, as of a member whose loan limit exceeded five times the sum of shares and savings, he would correct the irregularities. The inspector then prepared a loan ceiling proposal for each of the societies under his supervision. In his proposal were mentioned relevant facts about each society, including the rate of attendance of the members at weekly meetings, the rate of loan repayment, the total savings and shares pledged for the next six months as security against loans, and the loan limit which was approved for the previous six months.

The draft loan limit had to clear two more hurdles before it was officially published. It had to be reviewed first by a loan ceiling committee consisting of the ACF management and inspectors, and then by a loan committee comprised of ACF management and elected members of the ACF managing committee. After passing all these stages of review, the six month loan ceilings for all primary cooperatives were published as a loan gazette.

Akhter Hameed Khan, who sat on the KTCCA loan committee before the credit operations were transferred to the ACF, recalled that the committee would "go through five or more societies in a day to set the loan ceilings. Those were open meetings. You could tell whether a society was active or not by seeing how many of the members came. The manager and the society's managing committee were supposed to attend, but in many cases they didn't."[28]

At each stage of review, the proposed loan ceiling for each society could be raised or lowered. In practice, the society ceilings were usually reduced. The manager and the inspector were likely to shave the limit so that it would accord with the regulation that total loans to a cooperative society must not exceed five times the sum of pledged savings plus shares. At later stages of review, the ACF management was likely to cut the limit if they thought the society was a poor loan risk. The percentages of attendance and of loan repayment indicated to them whether the cooperative manager was able to discipline his members and meet his society's obligations. To these indications of the quality of a society's management, the members of the loan committees would add their own considerable knowledge of the society's history and current situation.

As a guideline for setting loan limits, the ACF management categorized the primary cooperatives into classes A, B, and C. An "A" class society could borrow up to five times its total of shares and savings, a "B" class society could borrow four times this total, and a "C" class society only three times. The quality of a society's management, as assessed by the indicators described above, was the primary determinant of its classification.[29]

By controlling the supply of agricultural credit through the loan limit policy, the Agricultural Cooperatives Federation created a strong incentive for the deposit of savings and the purchase of shares by the cooperative members. This incentive was much stronger and more effective, I contend, than the attractions of interest from savings accounts or dividends from shares. When the cooperative members deposited more funds, they could borrow more money.

A Systems Interpretation

The explicit relationship which the loan limit policy enforced between loans and the sum of savings and share purchases suggests that that relationship may be susceptible to mathematical formulation. Since the loan limit was based on the sum of savings deposits and share purchases, that sum can be treated as one variable in the model. Let us call it C, for capital. C represents a level, not a rate. A second major variable in the model would be OL, outstanding loans, which would also be a level variable. The loan limit policy was based on the relationship between C and OL. For an A class society OL could grow to 5C, whereas for a C class society OL was not allowed to exceed 3C.

Since they carried a lower interest rate than loans from the money-lenders, cooperative loans were always in high demand. After the advent of the Green Revolution, low interest cooperative loans to finance agricultural inputs were sought more vigorously than ever. To obtain more loans through their local cooperative, members could: a) deposit more savings and buy more shares, thereby raising their cooperative society's loan limit, b) repay outstanding loans, thereby lowering their society's total of loans outstanding below the society's loan limit, or c) improve their society's record in attendance, repayment of overdue loans and overall management, thereby obtaining a better credit rating. (Note that all three of these options have to do with a village cooperative society, suggesting that the appropriate level of analysis is not the aggregate relationship between OL and C in the thana as a whole, but the relationship between OL and C in an average village cooperative. To bring the variables OL and C into a scale appropriate to a single local cooperative, we will measure these variables in rupees, rather than in thousands of rupees.)

Let us concentrate on the first of the three behavioral options mentioned above, and construct a model of the change in C, savings deposits plus share purchases. If the mixture of A, B and C class societies were fairly constant,[30] it would be sensible to discuss an average village cooperative for which the loan limit was a fixed multiple of C. We will call this factor of multiplication β. Suppose, now, that OL was greater than βC. Loans outstanding would then be in excess of the loan limit, and the village cooperative would be cut off from further borrowing. What to do? Deposit savings and buy shares. If, on the other hand, OL was less than βC, the members of the cooperative could withdraw some of their savings. (The cooperative members could also, in this latter situation, take out more loans. But the present discussion focuses on the change in C, not in OL. In building mathematical models, it is standard practice to look at the determinants of change in one variable at a time, pretending that all other variables in the system are constant while each differential or difference equation is being built.)

Restating these observations mathematically, we can postulate that if the quantity $(OL - \beta C)$ were greater than zero then C would rise, whereas if $(OL - \beta C)$ were less than zero C would fall. When C rises the change in capital, ΔC, is positive, and when C falls ΔC is negative. So we have the model equation

$$\Delta C = \alpha \, (OL_n - \beta C_n) \qquad (5.1)$$

in which the parameter α indicates the responsiveness of ΔC to the discrepancy $(OL - \beta C)$.

While the model summarized in equation 5.1 is a good beginning, it is not wholly realistic. Every village cooperative was required to purchase a certain minimum number of shares in its central association each year, and at the next level down every cooperative member was required to purchase an annual minimum number of shares in his local cooperative. Also, some savings may have been deposited and some shares may have been purchased for reasons other than the desire to deposit more money. Peer pressure to deposit money, loyalty to the local cooperative and its needs, and even the attraction of collecting three and a half percent annual interest could all have influenced villagers to buy shares or deposit savings. Such additional factors can be incorporated in a constant term, R, which can be appended to the model equation. The complete equation for the generation of capital in the local cooperatives thus becomes

$$\Delta C = \alpha(OL_n - \beta\, C_n) + R, \qquad (5.2)$$

or equivalently,

$$C_{n+1} = \alpha OL_n + (1 - \alpha\beta\,)\, C_n + R. \qquad (5.3)$$

From the preceeding discussion we can surmise that the value of would be 5 or less. The assumptions of the model, according to which C adjusts to a discrepancy between OL and a multiple of C (not a fraction of C), would seem to be violated if β were less than unity. So we may hypothesize that β would be greater than one. Since R represents additional capital formation not ascribable to the feedback adjustment between OL and C, we would expect R to be positive. What about α , the responsiveness parameter? The theory of capital generation outlined above would lead us to expect that α would be positive. Beyond that, there is not much that can be said with confidence about the expected value of α. It might be surprising if α were greater than unity, since this would indicate that the villagers compensated in less than one year for the discrepancy $(OL_n - \quad C_n)$, but if the villagers were very eager to obtain more loans they might deposit savings and buy shares at a very rapid rate.[31]

Equation 5.2 was used as an estimating equation in a regression analysis of financial data from Kotwali thana and the 1966 projects.[32] Since the model summarized in equation 5.2 concerns the behavior of an average local cooperative, the ideal data set against which to test the model would have been collected from the hundreds of local cooperatives in each of the experimental thanas in the nineteen sixties. Such cooperative by cooperative data was unavailable. As a substitute, the aggregate financial data for each thana and each year was divided by the number of local cooperatives then extant in the thana, to yield yearly averages of loans outstanding per cooperative, of savings plus shares per cooperative, and of the change in capital per cooperative.[33]

Because the variable C_n enters into both sides of equation 5.2, directly on the right hand side and indirectly on the left in $\Delta C = C_{n+1} - C_n$, the coefficient of determination, r^2, in regressions based on equation 5.2 tends to be low. The F ratios and their significance also appear poor. A more reliable measure of the accuracy of the regressions can be obtained by testing 5.3, which is algebraically equivalent to 5.2. (To obtain 5.3 from 5.2, simply add C_n to both sides.) The values of r^2, F, and the significance of F in Table 5-5 were obtained, accordingly, from regressions of the form of equation 5.3; it was reassuring to discover that in these regressions the values of α and R were identical to those based on the ΔC regressions, while the coefficient of C differed by exactly 1. The values of β in Table 5-5 were obtained by dividing the regression coefficient for OL into the regression coefficient for C.

Table 5-5. Regression estimates for the capital generation equation in Kotwali thana and in the 1966 projects.

$\Delta C = \alpha (OL_n - \beta C_n) + R$	N	r^2	Overall F	Significance of F
Kotwali thana				
$\Delta C = .16 (OL_n - 2.91 C_n) + 1187$	8	.90	21.79	.003
1966 projects				
$\Delta C = .27 (OL_n - 4.17 C_n) + 2245$	28	.60	39.15	.000

In Kotwali thana and in the 1966 projects the coefficients of the capital generation equation came out as expected. The values of β were in the range $1 < \beta \leq 5$, and the coefficients R and α were positive. The estimated values of α, moreover, seem intuitively reasonable, since they indicate that the villagers adjusted gradually to the discrepancy $(OL_n - \beta C_n)$.

I was surprised to find that even with as few as four cases (data for 1966, 1967, 1968 and 1969) in one thana, the capital generation equation still applied, with most parameter values in the range expected. Only in Chandina thana were the results of a stepwise regression based on equation 5.2 inconsistent with the stepwise regression results based on equation 5.3 -- in that case only loans outstanding per cooperative entered one equation, and only total capital (savings and shares) per cooperative entered the other regression equation. In the other six thanas the ΔC regression results corresponded to the C_{n+1} regression results. Three parameter values were larger than anticipated -- the β parameter in Laksam and Sarail and the α parameter in Brahman Baria -- but otherwise the parameter estimates conformed to expectations.

Of the two state variables, OL and C, in our elementary model of cooperative finance, we have so far accounted for the change in one of them. What is needed next is a method for modeling the change in OL, total loans outstanding per cooperative. It may occur to the reader that the same sort of cybernetic feedback equation which was used to estimate ΔC could be used to estimate ΔOL. Such an equation would have the form

$$\Delta OL = \theta \ (\varepsilon C_n - OL_n) + R, \tag{5.4}$$

in which θ would be a sensitivity parameter comparable to α in

Table 5-6. Regression estimates for the capital generation equation in seven thanas.

$\Delta C = \alpha\ (OL_n - \beta\ C_n) + R$	N	r^2	Overall F	Significance of F
Laksam				
$\Delta C = .22\ (OL_n - 7.62\ C_n) + 3737$	4	.87	3.37	.360
Chandina				
5.2 and 5.3 inconsistent				
Sarail				
$\Delta C = .4\ (OL_n - 5.07\ C_n) + 3613$	4	.25	0.17	.866
Hajiganj				
$\Delta C = .84\ (OL_n - 4.11\ C_n) + 3156$	4	.95	8.82	.232
Quasba				
$\Delta C = .90\ (OL_n - 2.40\ C_n) + 1255$	4	.65	.92	.594
Brahman Baria				
$\Delta C = 3.27\ (OL_n - 2.74\ C_n) + 2416$	4	.99	50.53	.099
Chandpur				
$\Delta C = .77\ (OL_n - 3.68\ C_n) + 3918$	4	.97	18.85	.161

equation 5.3, and ε would be a factor of multiplication determined by the loan limit policy, as was β in 5.3. There are several reasons, though, why this is not a suitable mathematical model of the change in OL.

First of all, local capital generation really was determined within the village cooperatives, which is where the savings deposits and share purchases originated. A village-level model for ΔC was therefore appropriate. On the other hand, even though loan demand originated in the villages, loan funds were dispensed by the cooperative associations at the thana tier. Since decisions on loan issue were made by officials of the thana cooperative associations, a thana-level mathematical model would be more appropriate for loans.

Secondly, there was a fundamental difference between the change in local capital, ΔC, and the change in loans outstanding. Because savings could be either deposited or withdrawn, the level of local capital could go up or down. (In most thanas in most years C went up, but in a few cases, as in Gaibandha thana in 1966, it declined.) Positive and negative changes in C were explicable in the same terms, and could be modelled as one process.

The positive and negative components of the change in outstanding loans were different from one another, and therefore cannot be modelled as one process. If we designate TVLOAN as the amount of loans outstanding at the thana tier (measured in thousands of rupees), then TVLOAN will go up when loans are issued to village cooperatives, and TVLOAN will go down when loans are repaid by village cooperatives. Let us call the rate at which loans are issued to village cooperatives VLI, and the rate at which village cooperatives repay their loans VLR; both of these rate variables would be measured in thousands of rupees per year. There is a lag between VLI and VLR, so over time the positive influence on TVLOAN, which is VLI, determines the negative influence on TVLOAN, which is VLR. Such is not the case with local capital generation. Savings deposits do not determine savings withdrawals. What is needed, therefore, is a pair of models: one for VLI and one for VLR. First the model of loan issue.

Suppose for the sake of discussion that all loans issued to village cooperatives were repaid in exactly one year. And suppose further that the officers of the thana cooperative association always issued loans right up to the maximum loan limit of five times the total of savings and shares. Although that loan limitation was applied to particular cooperatives, its influence across all the local cooperatives in the thana should still be evident in the aggregate data. Let us designate the thana-wide sum of savings and shares as TSAV. Then if the thana cooperative officials behaved as described, the ratio of TVLOAN to TSAV would always be 5. The ratio of loan issue to total capital (VLI/TSAV) would also be 5. If the delay in repaying village loans increased to more than a year, the ratio TVLOAN/TSAV would remain at 5 but the ratio VLI/TSAV would decrease. And conversely, if the delay in repayment were shortened to less than a year, loans equal to more than 5 times total savings and shares could be issued during the year without violating the loan limit defined by the ratio TVLOAN/TSAV = 5.

Reasonable as the preceding argument may appear, it contains one flaw. In actuality all loan requests by the village cooperatives were not granted, even when they fell within the loan limit guidelines. Also, there were some cases of village cooperatives which did not request the loans to which they were entitled by virtue of their accumulated savings and shares. There were, consequently, some savings and shares which were not balanced either against loans outstanding or against loan issue. Instead of a simple ratio, therefore, a more complete model of the relationship of VLI to TSAV would have the form

$$\text{VLI} = \beta' \text{ TSAV} - R'. \tag{5.5}$$

In this equation β' is a parameter with an expected value in the range $1 < \beta' \leq 5$, similar to the parameter β in the capital generation equation. R' is a constant which represents village capital not used as coverage for loans.

In a test of equation 5.5 against the financial data from the thana cooperative associations, the model held up poorly for Kotwali thana, and excellently for the seven expansion projects founded in 1965-66. For Kotwali thana, the estimating equation was VLI = 1.25 TSAV + 879.14 (r^2 = .27, F = 1.88, significance of F = .229, N = 7). Although the β' parameter was in the anticipated range between 1 and 5, the sign of the constant was contrary to predictions. A look at the raw data on loan issue in Kotwali thana (see Table 5-3) reveals that there were fluctuations in loan issue from year to year. These irregularities, which were unmatched by fluctuations in total savings and shares, probably are the cause of the poor fit of the loan issue model in Kotwali thana. For the 1966 projects, the estimating equation for VLI obtained through regression analysis was VLI = 4.74 TSAV - 174.65. The coefficient of determination for the equation, r^2, was .95. The overall F ratio for the equation was 210.36, which was significant at the .000 level.[34]

The last component of our basic model of cooperative finance which needs to be put in place is a means of estimating VLR, the rate of repayment of village loans. This is, as it happens, a classic problem in dynamic systems analysis, and it can be solved by standard methods. The solution methods employed here are those described by Jay W. Forrester, of the Massachusetts Institute of Technology, in his book Industrial Dynamics. I am endebted to Douglas Franco, a doctoral candidate in systems science at Michigan State University, for pointing out to me the relevance to the cooperative credit problem of Forrester's approach to the mathematical representation of delay processes.

There are two basic approaches to take in the mathematical modeling of delays, depending upon whether the delay is being described in discrete time or in continuous time. For reasons which will become apparent, I chose to model the financial operations of the thana cooperative associations in continuous time. Although the sub-model of capital generation embodied in equation 5.2 is founded in discrete time, that equation can be enfolded, as I shall show, in a larger continuous time model. An estimation technique appropriate to continuous time was employed in deriving the coefficients of the loan issue equation, 5.5. Loan issue during the full course of a year was regressed against an estimate of total savings and shares in the middle of the year. The implication of this procedure is that the prediction of VLI can be continuously adjusted during the year as TSAV changes. If the model of VLI had been constructed in discrete time, the appropriate regression would have been of loan issue during the year against local capital at the beginning of the year, a procedure which would have allowed for a single annual readjustment in the prediction for loan issue at the start of each year.

The loan delay model is most easily explained by reference to the diagram in Figure 5-1. There are two stages to the basic delay, plus an additional stage for the repayment of overdue loans.[35] Storage

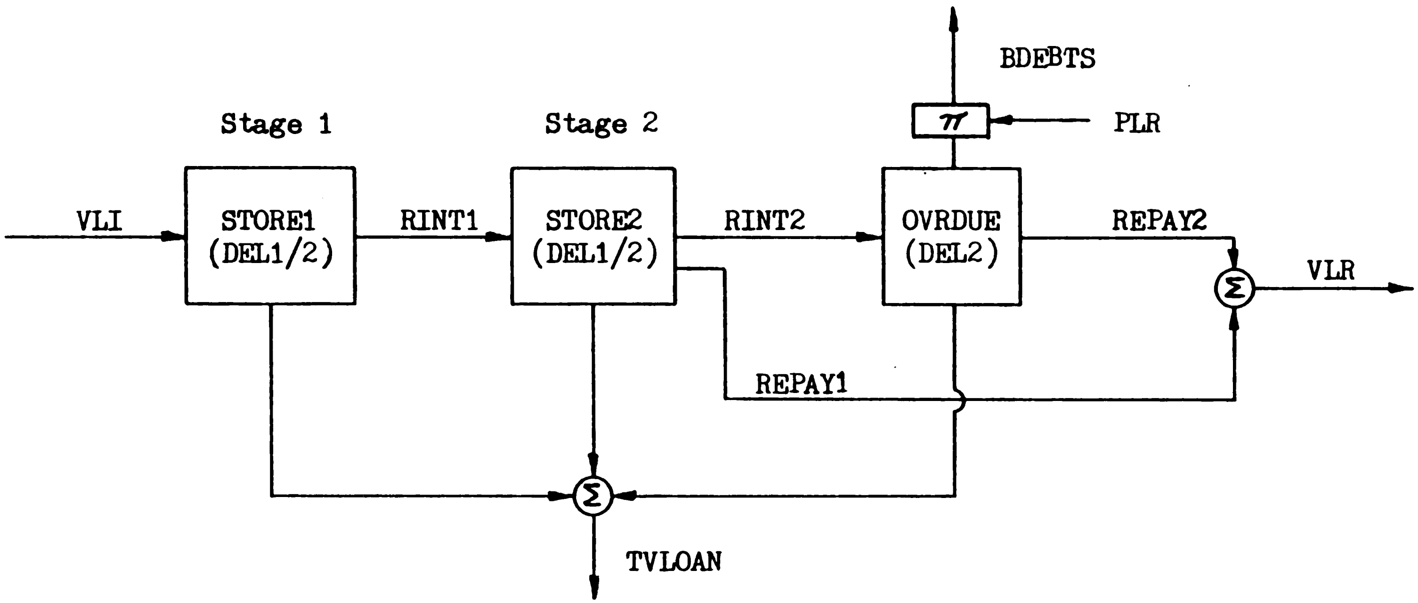

Figure 5-1. Block diagram of the loan repayment delay.

within the first two stages of the delay is labelled STORE1 and STORE2, while storage in the overdue stage is called OVRDUE. (The reader who is schooled in computer languages doubtless recognizes that these variable names have a maximum of 6 characters, and anticipates, correctly, that a FORTRAN program is in the offing.) The sum of these three components of storage within the delay is TVLOAN, total village loans outstanding. There is some leakage from the delay. A proportion of the overdue loans, represented by the multiplicative parameter PLR, are written off each year as bad debts. From the evidence available there was no way of ascertaining the proportionate loss rate empirically, so I set PLR at what seemed to me a reasonable value of .33.

For the entire two stage basic delay there is an average delay time of DEL1. Following Forrester's example,[36] this is split evenly between the two stages. Another average delay time, DEL2, characterizes the repayment of loans which fall overdue. Judging from what I know of the slowness of the cooperative inspectorate and the East Pakistan courts in pursuing and prosecuting loan defaulters, I set the value of DEL2 at 2 years. Through experimentation with the computer program which I shall explain shortly, I determined that the most appropriate value for DEL1 was 1.25 years. Subsequently, I confirmed this experimental estimate when I discovered a table in one of the annual reports of the Comilla cooperative experiment[37] from which the average term of loans issued in Kotwali thana could be calculated as 1.23 years.

Loans which are repaid on time are indicated by the variable REPAY1, while loans which enter the overdue delay are indicated by RINT2. The relationship of these two rates is governed by the parameter PRLATE, the proportion of loans which are late. The main output of the overdue delay is another repayment rate, REPAY2, which together with REPAY1 sums to VLR, the rate of loan repayment.

An algebraically simple relationship can be used to determine the delay output rates, RINT1, RINT2, REPAY1 and REPAY2. This relationship can be expressed as

$$\text{OUT}\ (t) = \frac{\text{STORE}(t)}{\text{DEL}}\ , \tag{5.6}$$

in which OUT(t) is the rate of output of the delay, STORE(t) is the storage in the delay, and DEL is the average length of the delay.[38] This delay-output relationship can be rephrased into the following FORTRAN equations, in which the asterisks indicate multiplication, and the slashes indicate division:

```
RINT1 = STORE1/(.5*DEL1)
RINT2 = PRLATE * STORE2/(.5*DEL1)
REPAY1 = (1 - PRLATE) * STORE2/(.5*DEL1)          (5.7)
REPAY2 = OVRDUE/DEL2.
```

Once these internal delay rate equations have been written, all that remains in order to complete the sub-model of village loan repayment (VLR) is to specify how the values of the internal storage variables, STORE1, STORE2 and OVRDUE, change over time. Over a time interval DT, the following equation clearly applies

$$\text{STORE}\ (T + DT) = \text{STORE}\ (T) + \int_{T}^{T + DT} \frac{d\text{STORE}(t)}{dt} \tag{5.8}$$

To estimate the value of the integral on the right hand side of 5.8 we will use the technique of Eulerian integration. Despite its crudeness, this numerical estimation technique is surprisingly accurate when DT is small. In Figure 5-2, the Eulerian integral of the function f (t) over the interval from T to T + DT is shown by the shaded area. It is a rectangle obtained by multiplying the value of f (t) at time T by DT. This extraordinarily simple numerical integration technique is used throughout Forrester's Industrial Dynamics. It is also fundamental to Forrester's famous DYNAMO compiler, and to all of the simulation studies which have been based on DYNAMO, such as Dennis Meadow's book, The Limits to Growth.

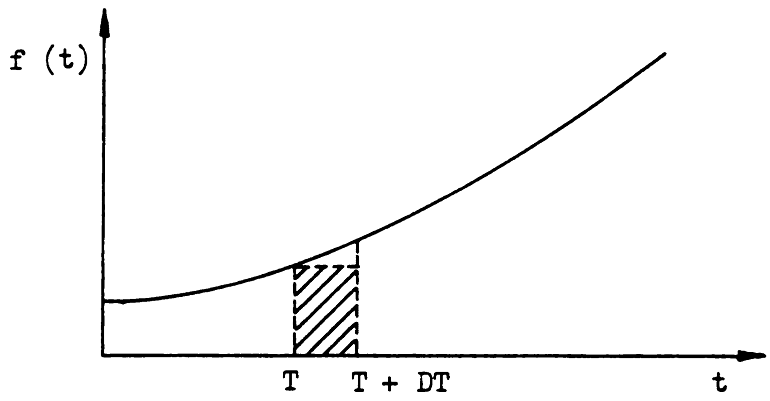

Figure 5-2. Eulerian integral of the function f (t).

The rate of change of storage, $\frac{dSTORE(t)}{dt}$, is determined by the law of conservation of flow, which stipulates that

$$\frac{dSTORE(t)}{dt} = IN\ (t) - OUT\ (t). \tag{5.9}$$

The rate of change of storage, in other words, equals the input rate minus the output rate.[39] Following the convention employed previously, in Chapters 3 and 4, I have designated $\frac{dx}{dt}$ as $\dot{x}$. The rate of change of STORE1 would thus be designated ST1DOT, and so forth. So we have

$$\begin{aligned}
&ST1DOT = VLI - RINT1 \\
&ST2DOT = RINT1 - RINT2 - REPAY2 \\
&BDEBTS = PLR * OVRDUE \\
&OVRDOT = RINT2 - BDEBTS - REPAY2.
\end{aligned} \tag{5.10}$$

The corresponding integral equations are, in FORTRAN format,

$$\begin{aligned}
&STORE1 = STORE1 + DT * ST1DOT \\
&STORE2 = STORE2 + DT * ST2DOT \\
&OVRDUE = OVRDUE + DT * OVRDOT.
\end{aligned} \tag{5.11}$$

Taken altogether, the financial equations which have been developed so far in this chapter describe a nearly closed system, as can be seen from the causal loop diagram in Figure 5-3. The only "input" to the system is the number of village cooperatives, NCOOPS. In the simulation model constructed from these financial equations (see Appendix C) the number of cooperatives enters the savings function, XSAV, where it mediates between the thana and the village levels of analysis. First NCOOPS divides TSAV and TVLOANS to bring them into the proper units for the capital generation equation to act upon. The annual rate of capital generation per cooperative is calculated as $\Delta C = \alpha \ (OL_n - \beta C_n)$, after which NCOOPS multiplies the result to bring it back to the aggregate scale appropriate to the other thana level financial equations. The actual FORTRAN statements are given in Figure 5-4. It should be apparent that NCOOPS does not influence the model in the classic sense of an input variable. NCOOPS cannot be identified as an element of an input vector U in a model of the form $\dot{X} = AX + GU$. The influence of NCOOPS upon the system is more like that of a variable parameter.

If it is accepted that NCOOPS does not really represent an input

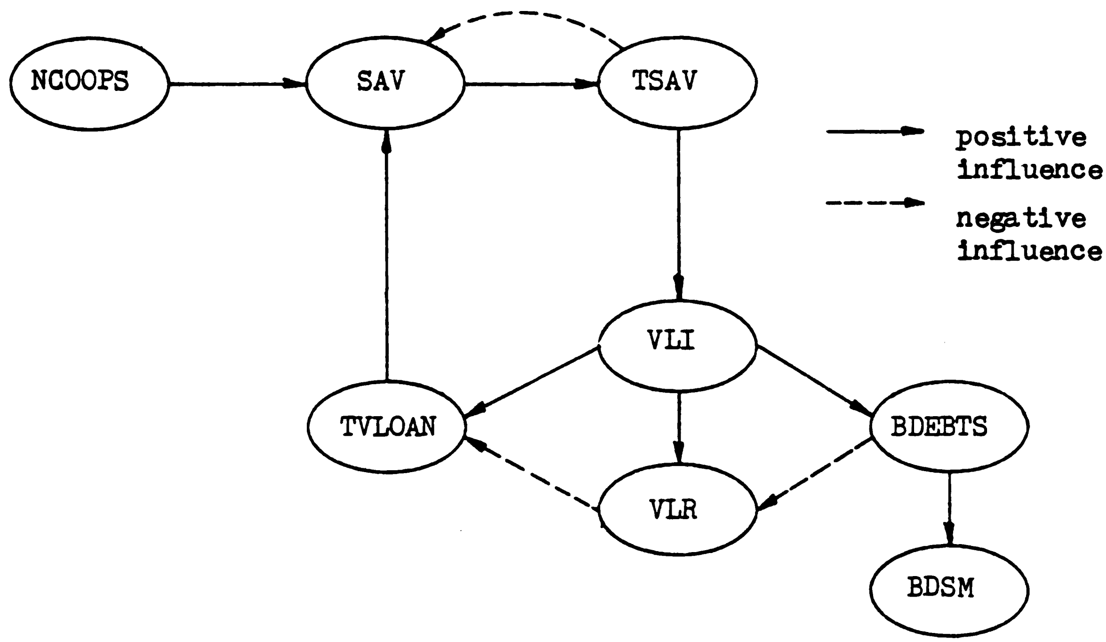

Figure 5-3. Causal loop diagram of the financial equations.

NCOOPS - Number of village cooperatives.

SAV - Rate of accumulation of savings and shares.[a]

TSAV - Total accumulation of savings and shares.

VLI - Village loans issue rate.

VLR - Village loans repayment rate.

TVLOAN - Total village loans outstanding

BDEBTS - Rate of accumulation of bad debts.

BDSM - Integral of bad debts.

[a] SAV = C * NCOOPS/1000.

```
C     FUNCTION XSAV (TSAV, TVLOAN, NCOOPS, ALPHA, BETA)

C     THIS FUNCTION DETERMINES THE RATE OF CAPITAL
C     FORMATION (SAVINGS PLUS SHARE PURCHASE) BY
C     THE VILLAGE COOPERATIVES.  XSAV ASSIGNS A
C     VALUE TO SAV ONCE EACH YEAR.  THE UNITS OF
C     XSAV ARE THOUSANDS OF RUPEES PER YEAR.

      C = (TSAV/NCOOPS) * 1000.
      OL = (TVLOAN/NCOOPS) * 1000.
      R = 2245.
      XSAV = (ALPHA * (OL - BETA * C) + R) * NCOOPS/1000.
      RETURN
      END
```

Figure 5-4. The capital generation function, XSAV.

variable, then the system shown in the causal loop diagram in Figure 5-3 is truly closed. I would argue that this causal loop diagram and its accompanying equations constitute a minimally acceptable description of the credit operations of a thana cooperative association. Within the technical subsystem of these organizations, cooperative credit operations were the dominant component. Consequently, it does seem sensible to classify the T for technical subsystem in the category of closed systems, above the dotted line in the typological matrix at the head of this chapter.

While the mathematical model of cooperative credit described so far suffices as a minimally acceptable representation of the dynamics of the system, it is far from complete. A look at the complete computer program of the cooperative credit simulation in Appendix C will reveal that the equations which have been explained so far comprise only a portion of the total model. Other model components which are explained below do include input variables. So even within the special universe of cooperative credit, I am not contending that the closed system perspective is sufficient to explain all of the dynamics of the technical subsystem. In most organizations, though, a lot can be learned about the essential dynamics of the technical subsystem through closed system analysis. Mathematically, such an analysis may consist of supposing that the inputs to the system remain zero, and examining how the system evolves in response to its initial conditions.

The main deficiency of the credit model depicted in Figure 5-3 is that it ignores one very real constraint: whether the thana cooperative association has enough money on hand to authorize all the loans called for by the loan issue equation, VLI = β' TSAV - R'. It was a shock to me, when I started probing the credit operations of the cooperative association in Kotwali thana, to discover that every rupee loaned to the village cooperatives had been borrowed from the United Bank, the commercial bank which located a branch office on the grounds of the Thana Training and Development Center at Abhoy Ashram.[40] I had thought that all the money loaned out had come from savings and share purchases, and from loan repayments. That preconception, which corresponds to the causal loop diagram in Figure 5-3, was incomplete.

In November and December of 1965 I visited several of the cooperative expansion projects in Comilla district. Of the seven thana cooperative associations that were founded in 1965-66, my tour took me to four: those in Chandina, Laksam, Hajigang, and Brahman Baria thanas. In my interviews with the directors of these thana cooperative associations, I concentrated on achieving an understanding of their financial operations.

The thana cooperative associations maintained, typically, two major accounts with the local branch of the United Bank, a current account and a fixed deposit account. In the simulation model, these two accounts are designated CACCT and FIXDEP. The project directors said that they conducted almost all their business, including payroll and cooperative credit transactions, through the current account. Abdul Mannan, the project director of the Laksam Thana Central Cooperative Association, explained that money in the fixed deposit account could not be withdrawn for four years. The main purpose of the fixed deposit account, he said, was to serve as a security against which the central association could borrow an equal amount at six percent interest, one percent more than the United Bank paid for the amount on fixed deposits. The bank's loans against the fixed deposit security took the simple form of an overdraft on the current account.[41]

Although it was possible for an overdraft to swell beyond the size of the fixed deposit, this practice was discouraged, both as a matter of policy and by a higher loan interest charge by the United Bank. In the simulation model, therefore, the issuance of loans to village cooperatives is halted whenever the overdraft in the current account exceeds the amount on fixed deposit. While loan issue is suspended the current account replenishes itself, through sources such as loan repayments, savings deposits and interest earnings, until the overdraft on current account is once again less than the fixed deposit. To represent this loan issue decision process, I created a dummy variable, RLOANS, which was set equal to the ideal loan issue rate defined by the expression β' TSAV - R'. So long as the current account overdraft was not excessive, VLI, the actual loan issue rate, was equated to RLOANS. Whenever the overdraft exceeded the fixed deposit, VLI was set at zero. The FORTRAN equations representing this procedure are in Figure 5-5.

```
      RLOANS = 4.74 * TSAV - 174.15
      VLI = XISSUE (RLOANS, CACCT, FIXDEP)

      FUNCTION XISSUE (RLOANS, CACCT, FIXDEP)
C
C     THIS FUNCTION DETERMINES THE RATE AT
C     WHICH LOANS ARE ISSUED TO THE VILLAGE
C     COOPERATIVES.  THE UNITS OF XISSUE ARE
C     THOUSANDS OF RUPEES PER YEAR.
C
      XISSUE = RLOANS
      IF (XISSUE .LT. 0.) XISSUE = 0.
      IF (CACCT .LE. - FIXDEP) XISSUE = 0.
      RETURN
      END
```

Figure 5-5. The loan issue equations.

The advantages of a continuous time simulation are particularly evident when it comes to implementing this loan issue procedure. In reality, a digital computer can simulate continuous time only by taking many small steps in discrete time, but those steps can be made frequent enough to approximate a continuous testing of the relationship of CACCT and FIXDEP. By contrast, in a discrete time model in which the increment of time was one year there would be no way to test during the year for the size of overdrafts on current account. Another advantage of a continuous as against a discrete time simulation is that the continuous time approach allows for more accurate computation of interest charges and interest income.

The scheme for financing the expansion projects in other thanas of Comilla district was set forth in a report issued in 1964 by A. Z. M. Obaidullah Khan, a member of the elite Civil Service of Pakistan -- the inheritor in Pakistan of the Indian Civil Service of British days. During a year which he spent at the Comilla academy Obaidullah Khan had studied the costs and financial requirements of the Kotwali Thana Central Cooperative Association. In his plan for spreading the Comilla approach to all of the thanas of Comilla district, he stipulated that each new project should receive a capital loan of 200 thousand rupees per year for each of five years, after which no more capital loans were to be issued and the amount loaned was to be repaid at the rate of 50 thousand rupees per year. Twenty-five years after the expansion projects began, all the capital loan funds were to be repaid. These long term government loans, which were interest free, were to be used as equity capital, providing a source of loanable funds for the cooperative credit program.

An unstated hypothesis was implicit in Obaidullah Khan's financial projections. He assumed that after a five year period of start up funding, the new cooperative projects would be generating enough funds, in the form of interest earnings and local capital, so as to be able not only to continue their credit operations but to repay the government as well. In actuality Obaidullah Khan's hypothesis was not tested, because political agitation and the war for independence from Pakistan interrupted the course of events in the fifth year of the twenty-five year period. The computerized simulation of cooperative credit allows us to test Obaidullah Khan's projection without disruption. Through the simulation, we can freeze the background conditions -- such as interest rates, wage rates, and political stability -- which prevailed in East Pakistan in the mid nineteen sixties. The feasibility of Obaidullah Khan's long run proposal can then be examined within these constant conditions.

In addition to capital loans for each new thana cooperative association, Obaidullah Khan anticipated that a grant of 50 thousand rupees per project per year would be required to defray salaries and other administrative costs. No cut off date for the issuance of these grants was specified.[42]

Obaidullah Khan's overall proposal was accepted by the Pakistan government, with the limitation that it be implemented to start with in only seven of the 21 thanas in Comilla district. Those seven projects, which began business in 1965-66, are the ones I have referred to as the 1966 projects.

In the simulation program, I have called the annual rate at which capital loans were issued to the thana cooperative associations CLI, and the rate at which capital loans were repaid CLR. The annual subsidy for operating costs is called GRANT.

When I visited the new expansion projects in Comilla district in the last months of 1965, I found that the project directors had placed half of their first year's capital loan of 200 thousand rupees on fixed deposit in the local branch of the United Bank. The initial value of FIXDEP is therefore set at 100 in the simulation program, which begins running at the end of the start up year for the 1966 projects.

To estimate what the annual operating costs of a thana cooperative association might be, I relied upon three sources of information: a copy of the 1968-69 budget of the Agricultural Cooperatives Federation,[43] a cost study of the field supervision section of the Kotwali Thana Central Cooperatives Federation which I completed in 1966,[44] and the research findings on the structural dynamics of the thana cooperative associations which were reported in Chapter 4.

Breaking down the employees budgeted for the Agricultural Cooperatives Federation in 1968-69 into workers and supervisors, according to the same classification criteria employed in the structural research described in Chapter 4, I ascertained that the budgeted salary costs of the ACF could be summarized, in thousands of rupees per year, by the expression 1.4 * WORKRS + 5.4 * SUPVIS. Supervisors' salaries, in other words, were nearly four times the level of workers' salaries. While I was stationed in Comilla in 1965-66 I looked into the administrative costs of the cooperative credit program, and determined that over the period 1962-63 to 1965-66 personnel costs comprised an average of 86.2% of total administrative costs.[45] The administrative cost equation, thus, is

$$\text{OPCOST} = (1.4 * \text{WORKRS} + 5.4 * \text{SUPVIS})/.862 \qquad (5.12)$$

To project the number of workers and supervisors in an average thana cooperative association, the findings of the structural research discussed in the last chapter were incorporated into the simulation via the two equations

$$\begin{aligned} \text{WORKRS} &= .766 * \text{WORKRS} + 15.374 \\ \text{SUPVIS} &= .894 * \text{SUPVIS} + 1.316. \end{aligned} \qquad (5.13)$$

These FORTRAN equations correspond to the equations for W_{n+1} and S_{n+1} for the 1966 projects in Table 4-4 in the last chapter. Like the discrete time equation for SAV, the rate of local capital formation, these equations for WORKRS and SUPVIS are evaluated in the simulation once each year, at the beginning of the year.

In the collections of Comilla documents at Michigan State University, I could not find a complete series of data on the actual administrative costs of the seven thana cooperative projects founded in 1965-66. The only evidence of actual costs is in a report published in 1967, which gives the administrative costs of each of the seven expansion projects for two years, 1965-66 and 1966-67.[46] In Table 5-7 I have compared these figures to the cost estimates derived from the simulation

Table 5-7. Comparison of actual and estimated operating costs of an average thana cooperative association.

	1965-66	1966-67
Actual		
Mean	64	73
(Standard deviation)	(14)	(12.7)
N	5[a]	7
Estimated		
OPCOST	61	83
(Standard error of estimate)	(19.0)	(18.6)
Percent error	-4.7	13.7

[a] Data from Sarail and Chandpur projects excluded.

equations 5.12 and 5.13. The approximation is good for 1965-66, and reasonable for 1966-67. (In the calculation of the statistics in the first column of the table, the cost figures for Sarail and Chandpur were omitted. Each of these thana cooperative associations incurred over one hundred thousand rupees in administrative expenses in 1965-66, and cut back substantially in 1966-67. It appears that they spent at an exaggerated rate in the start up year, and were called to task for their excesses.)

Since all financial transactions were handled through the current account in the United Bank, a great many factors came into play in determining the rate of change of the account. These factors included interest collection and payment, administrative expenses, the operating cost subsidy from the government, loan issue and loan repayment (*vis a vis* the government's central bank, and *vis a vis* the village cooperatives), and savings deposits and share purchases. This variety of influences is summarized in the following three equations:

$$FMARG = VLIP - CIP - SAVIP + CACTIP + FIXDIP \quad (5.14)$$

$$PROFIT = FMARG - OPCOST + GRANT \quad (5.15)$$

$$CACDOT = (1 - DEP) * CLI - CLR - VLI + VLR + SAV + PROFIT. \quad (5.16)$$

The financial margin, FMARG, of the thana cooperative association is determined by 5.14 to be related to collections of interest on village loans (VLIP), payments of interest on capital loans (CIP), interest payments on savings deposits and dividends on shares (SAVIP), interest collections or payments on the current account (CACTIP), and interest collections from the fixed deposit account (FIXDIP).

PROFIT is the difference between interest income of the thana cooperative association and its operating costs, plus the annual grant subsidy. In keeping with the non-profit character of the cooperative, any positive profit is deposited in the current account, where it adds to the funds available for loan issue. In case the cooperative association is losing money (as would be the case if PROFIT were negative), the deficiency is withdrawn from the current account.

With the exception of the parameter DEP, equation 5.16 describing the rate of change of the capital account is self-explanatory. DEP is the proportion of capital loans issued each year which is placed in the fixed deposit account.

Further details of the simulation program, such as initialization procedures and the method of calculation of interest collections and payments, are described in Appendix C. The simulation program itself, which is reproduced in Appendix C, also contains explanations of the meaning of all of the program variables.

To test the fidelity of the model to the actual dynamics of the credit cooperatives, the program was run for a simulated period of four years. Initial conditions were calibrated to average variable values for June of 1966, when the seven expansion projects in Comilla thana had been in operation for one year. Program parameters, such as ALPHA and BETA in the capital generation equation, were set to values determined to be suitable for the 1966 projects, as reported above in this chapter. By making adjustments in the parameter PRLATE, the proportion of loans which are not repaid on time, I forced one set of variables, the sum of loans overdue (OVRDUE) and of loans which had been written off (BDSM), to come out just about on target in each of the four years. Through experimentation, I discovered that the appropriate values for PRLATE in 1966-67, 1967-68, 1968-69, and 1969-70 were 0, .08, .09, and .3. The sharp increase in PRLATE in 1969-70 is reflective of the widespread political agitation which preceded the war for independence. In an interview in 1975, Akhter Hameed Khan told me that "political defaults" had become quite numerous in 1969-70, and he was helpless to counteract them. "The political parties were saying that the loans had been given by an oppressive government and should not be repaid. The politicians said that if they came to power they would write off the loans," Akhter Hameed Khan said.

Results of the four year fidelity test run of the simulation are given in Table 5-8. While the model proves itself adept at imitating the average performance of the 1966 projects, the high values for some of the standard errors of estimate (particularly for total village loans outstanding) indicate that the model would not be likely to track the financial history of a particular thana cooperative association with great fidelity. The variation in financial data among the thana

Table 5-8. Comparison of actual and estimated values for the fidelity run.

	Total savings and shares (TSAV)			Village loans issued (VLISM)		
Year	Actual	Estimated	Pct. Error	Actual	Estimated	Pct. Error
1967	102	108	5.9	216	203	-6.0
1968	236	229	-3.0	599	619	3.3
1969	475	418	-12.0	1179	1142	-3.1
1970	632	642	1.6	1205	1196	-0.7
	Standard error of estimate: 134.1 (N=28)			Standard error of estimate: 249.5 (N=14)		

	Village loans repaid (VLRSM)			Vil. loans outstanding(TVLOAN+BDSM)		
	Actual	Estimated	Pct. Error	Actual	Estimated	Pct. Error
1967	87	83	-4.6	220	211	-4.1
1968	225	211	-6.2	594	619	4.2
1969	480	547	14.0	1293	1213	-6.2
1970	786	727	-7.5	1712	1663	-2.9
	Standard error of estimate: 260.4 (N=14)			Standard error of estimate: 446.1 (N=28)		

	Overdues and bad debts(OVRDUE+BDSM)			Loan interest collected (VLINT)		
	Actual	Estimated	Pct. Error	Actual	Estimated	Pct. Error
1967	0	0	0	12	12	0
1968	15	15	0	31	34	9.7
1969	53	54	1.9	89	84	-5.6
1970	264	269	1.9	140	127	-9.3

cooperative associations was sizeable. When it comes to predicting average values, though, the model earns good marks for accuracy. With the exception of only 2 out of the 24 predictions tabulated, the percentage errors are below ten percent.[47]

In the fidelity run the value of VLIR, the rate of interest collected on village loans, was set at .09. This was three percent lower than the official interest rate of twelve percent. The thana cooperative associations actually collected less interest on loans than was due to them. Against all unrepaid village loans, including overdues and bad debts, the actual rate of interest collections in the four fiscal years from 1966-67 to 1969-70 can be calculated as 7.6%, 7.6%, 9.5%, and 9.3%. (For details of these calculations, see Appendix A.) The under collection of loan interest probably resulted from the practice of forgiving the interest but collecting the principle in hardship cases arising from flood damage, insect infestation, or other disasters.

At a nine percent effective loan interest rate, the model predicts that the average thana cooperative association which is the subject of the simulation would lose money in the first two years, and would make a profit on its credit operations in the second two years. This pattern of initial losses and later profits is traced in Figure 5-6. The implication of this trend is that in the initial years of the project expenses would have been covered by drawing down the current account, whereas in the later period the profit from credit operations would have contributed to the current account, making more money available for loan issue.

While there is no published data on the actual profitability of the credit operations of the 1966 projects, the shape of the profit

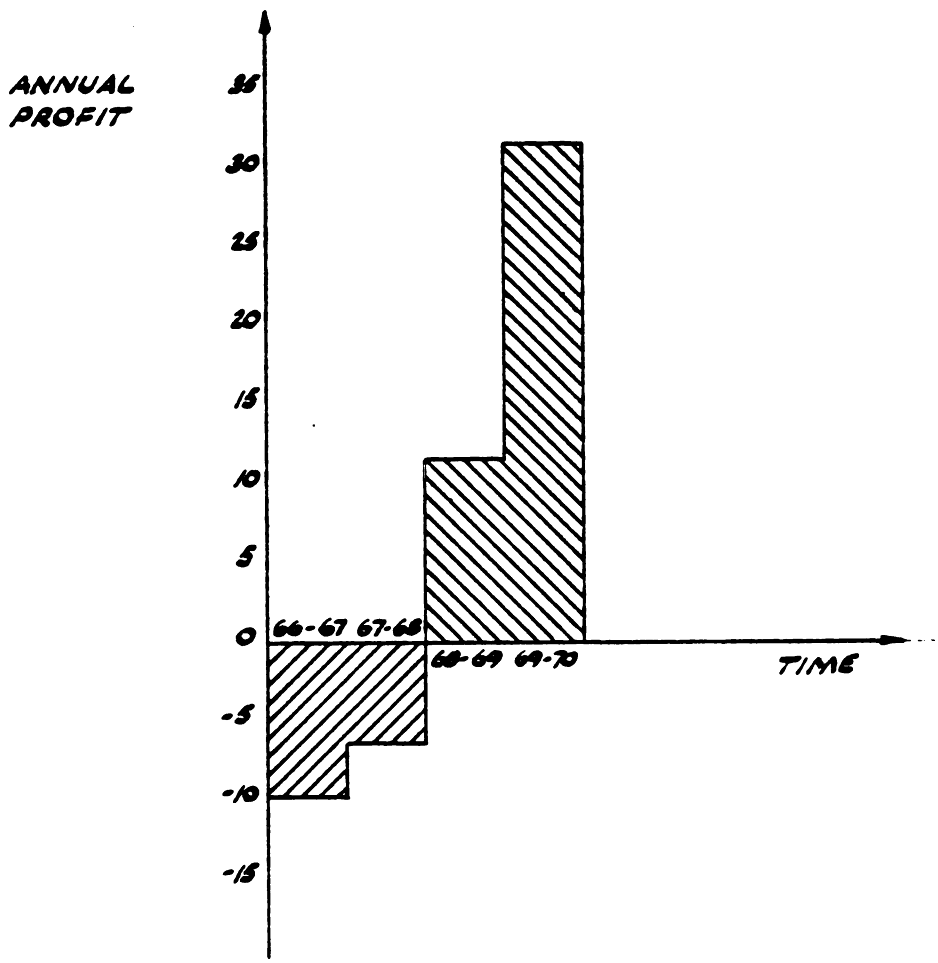

FIGURE 5-6 SHORT RUN PROFIT PROJECTION FOR THE SIMULATED THANA COOPERATIVE ASSOCIATION.

graph does correspond to what is known about profit trends in the Agricultural Cooperatives Federation in Kotwali thana. My own previous research into the income and expenses of the field supervision section of the Kotwali Thana Central Cooperative Association (the predecessor of the ACF) showed that the deficit of interest income against administrative costs narrowed each year, until in 1965-66 the section very nearly broke even. If an annual grant of fifty thousand rupees had been factored in, as it was in the expansion projects, the field supervision section of the KTCCA would have shifted from the red to the black in 1963-64, two years after it started operations. Even without such a subsidy, the Agricultural Cooperatives Federation recorded its first annual profit of 41 thousand rupees in 1967-68.

The trends that are evident in Table 5-8 and in Figure 5-6 appear quite favorable. Local capital, loans to village cooperatives, and the profitability of the simulated cooperative association are all on an upward course. A simple extrapolation of these trends might lead to the supposition that the financial prospects of the simulated cooperative association were good, and that the scheme for the expansion projects proposed by Obaidullah Khan in 1964 was feasible over the long run. Was it?

In order to test Obaidullah Khan's assumptions over the full 25 years stipulated in his plan, the simulation program had to be changed in one respect. For each of the four years of the fidelity run, a value of PRLATE was experimentally determined which would yield the same amount of overdues and bad debts as were actually reported. For the extended run, a fixed value of .08 was chosen for the percentage of loans not repaid on time.

Of the many variables which the simulation tracks to the end of the

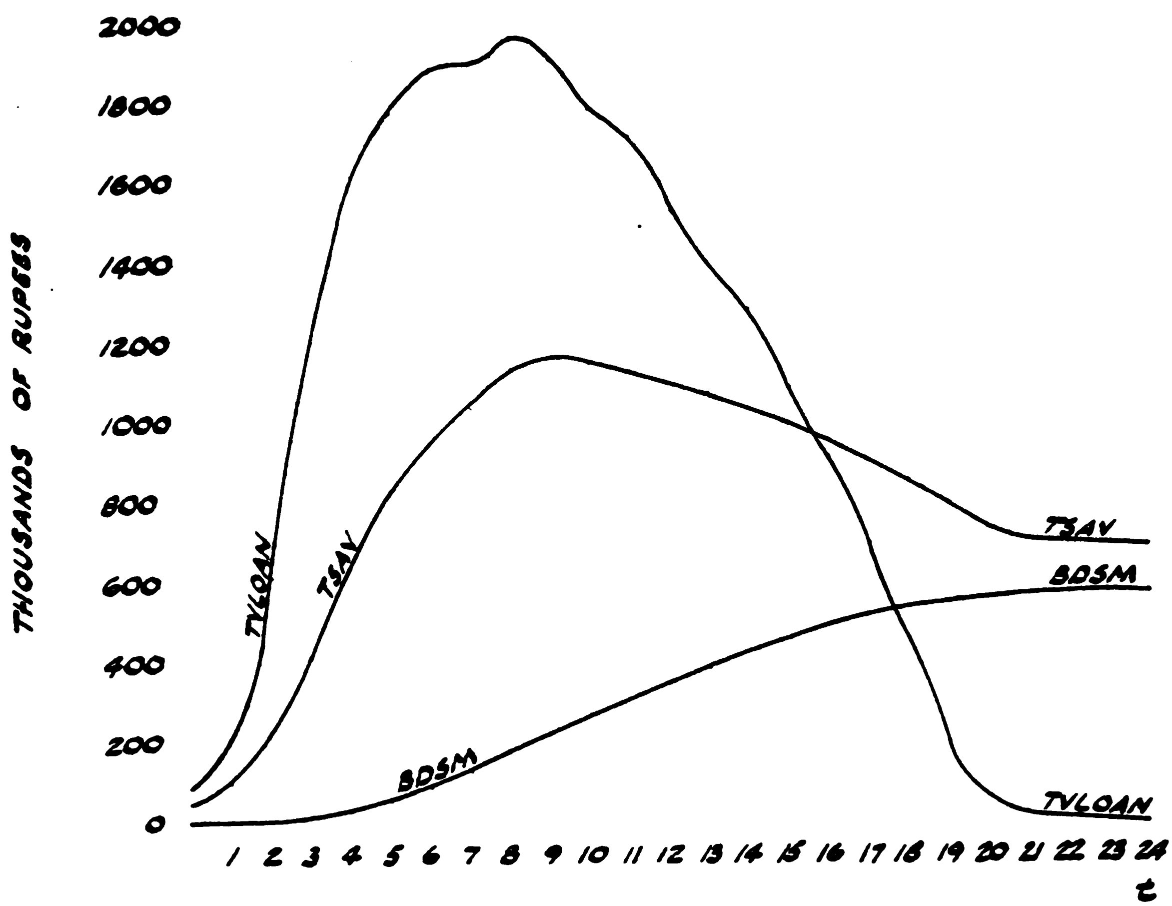

FIGURE 5-7 PROJECTIONS OF LOANS OUTSTANDING (TVLOAN), BAD DEBTS (BDSM) AND VILLAGE CAPITAL (TSAV) FROM THE EXTENDED RUN.

25 year period projected by Obaidullah Khan, four have been selected for display. Total loans outstanding, TVLOAN, bad debts, BDSM, and the stock of local capital, TSAV, are shown as curves in Figure 5-7. Annual profits, PROFSM, is displayed as a bar graph in Figure 5-8. Because this long run simulation is a fanciful exercise, the time axis in these graphs has been numbered with values of t, rather than specific years. For the sake of the literal reader, it may be noted that t = 0 corresponds to June 30, 1966, when the seven expansion projects in Comilla district were a year old, and that t = 24, the end of the 25 year period, corresponds to June 30, 1990.

The long run prediction of financial disaster for the thana cooperative association is obvious. Annual losses became so great that after t = 20 they would have extended below the bottom of the graph in Figure 5-8. By the time the final 50 thousand rupees of the capital loan are repaid to the government in the twenty fifth year (when t = 24, because t = 0 corresponds in this simulation to the end of the first actual year), the cooperative association is running an annual loss of 213 thousand rupees, and is getting by through massive overdrafts on the current account in the local bank. At the end of the extended run, when t = 24, the bank overdraft exceeds a million rupees. In the real world, either the United Bank, or the cooperative association or the government would intervene to prevent the financial catastrophe predicted by the simulation. The predictions do merit attention, though, if only because they do not correspond to what any of the local planners or American economic advisors anticipated when they advocated the expansion of the Comilla cooperative model to other thanas in East Pakistan.

To provide more insight into the simulation predictions, I have plotted them as a phase plane in Figure 5-9. The variable on the horizontal axis, TSAV, is the same as one of the variables in Figure 5-7. But to make an appropriate comparison of predictions with actual data, bad debts have been added to loans outstanding to form TOTLON = TVLOAN + BDSM, the variable for the vertical axis. This adjustment is required because the actual data reported do not distinguish bad debts from overdues.

The actual data for TOTLON and TSAV plot a curve on the phase plane which is so close to a straight line that when a ruler is laid along the points the deviation is hardly perceptible. The actual data conform closely to the equation TOTLON = 2.82 TSAV - 62.46. The coefficient of determination, r^2, for this regression equation through the five actual data points is .999. It could be said that the actual system was in a state of moving equilibrium from 1965-66 to 1969-70.[48]

The extended run of the simulation tracks the straight line trajectory of moving equilibrium until t = 4, after which the simulation trajectory bends to the right. In a phase plane in which bad debts are not included in the variable on the vertical axis, as in Figure 5-10, a very similar pattern can be seen to prevail.

From the causal loop diagram of the credit system, Figure 5-3, we know that total village loans outstanding exerts a positive influence on the rate of local capital generation, SAV, and thus indirectly on the stock of local capital, TSAV. We also know that TSAV has a positive influence on VLI, and thus indirectly on total village loans outstanding, TVLOAN. This relationship of mutual reinforcement appears to prevail over the range in which the system is in a condition of moving equilibrium. But after four years or so the cycle of mutual

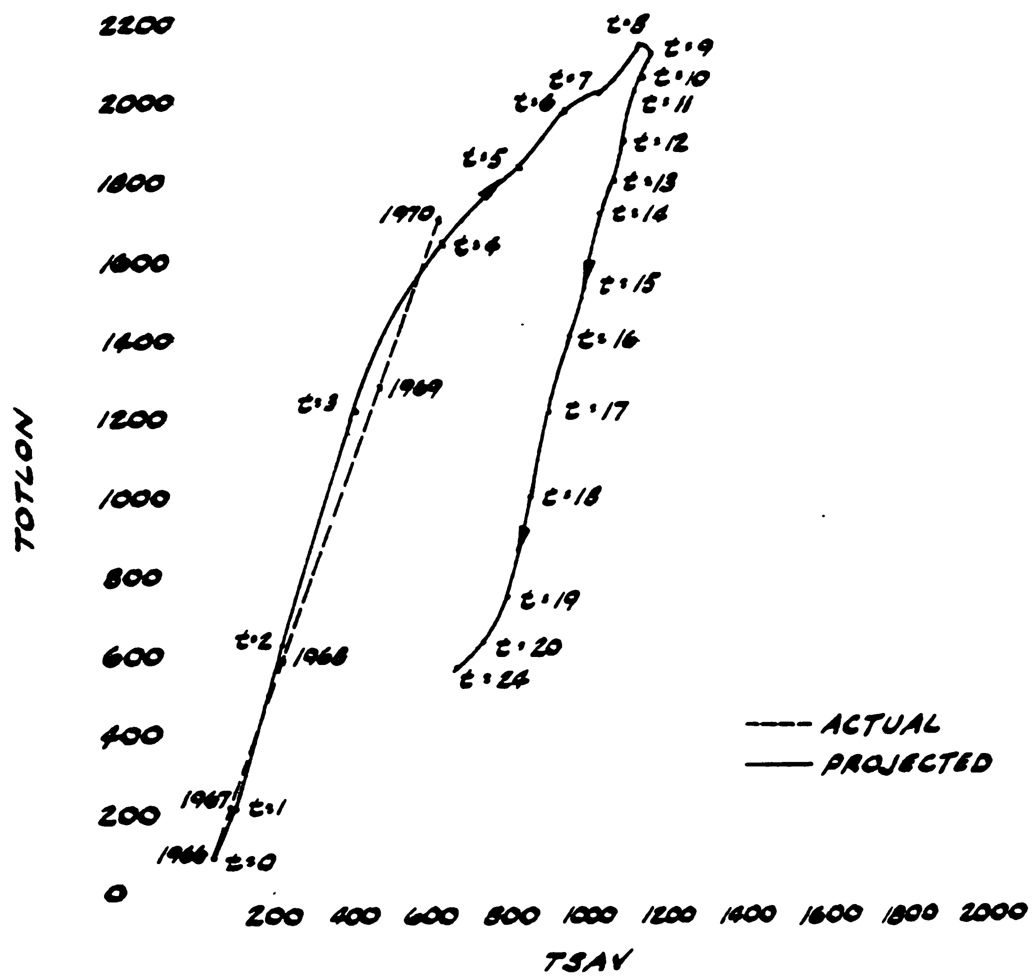

FIGURE 5-9 PHASE PLANE OF VILLAGE LOANS OUTSTANDING PLUS BAD DEBTS (TOTLON) VERSUS VILLAGE CAPITAL (TSAV) FROM THE EXTENDED RUN.

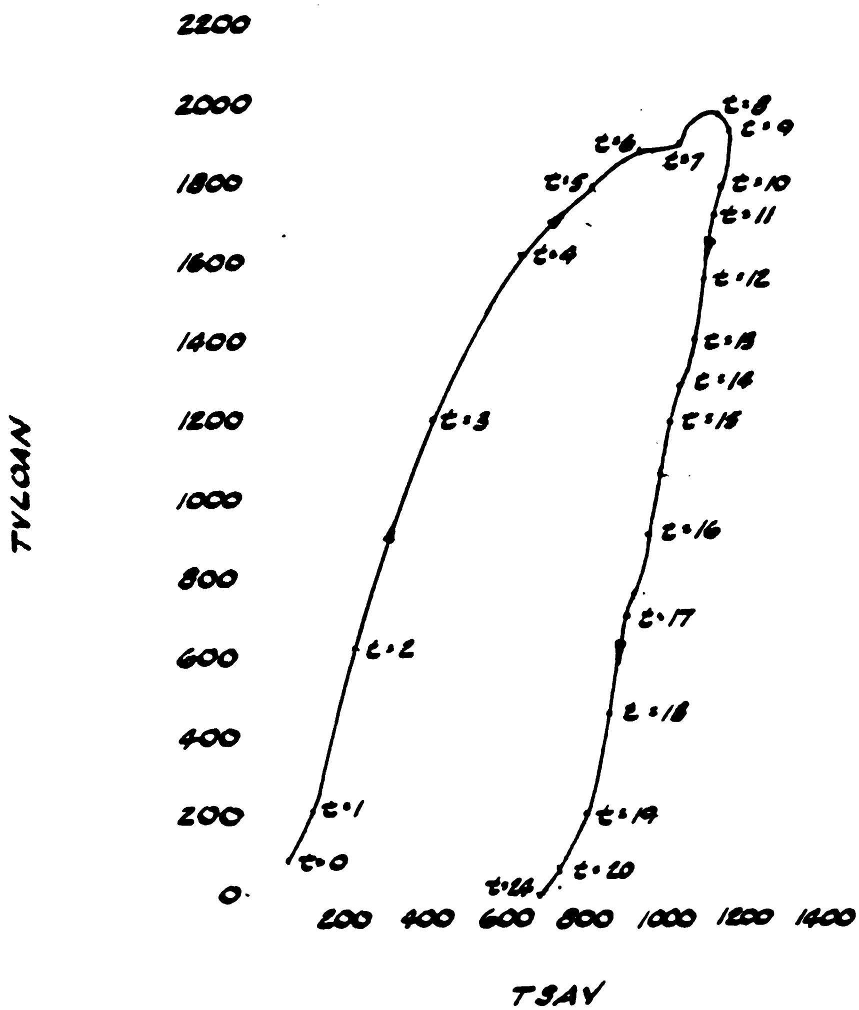

FIGURE 5-10 PHASE PORTRAIT OF TVLOAN VERSUS TSAV FROM THE EXTENDED RUN.

reinforcement (or positive feedback) is interrupted. An increase in village capital, such as is observed from t = 4 to t = 5 in Figure 5-10, still yields an increase in loans outstanding, but not in the same degree as before.

The reason that the system trajectory departs from moving equilibrium after t = 4 is that the simulated cooperative association runs out of loanable funds. There is no longer enough money in the current account to issue loans at the annual rate defined by the loan issue equation RLOANS = 4.74 * TSAV - 174.65. That equation was determined from a linear regression on data from June 1967 and June 1968, when the shortage of loanable funds had not yet shown up. The simulation model shows that the current account becomes negative, indicating an overdraft, between t = 2 and t = 3, an interval which corresponds to the fiscal year 1968-69. Even when the balance on current account is negative, loans can still be issued at the prescribed rate so long as the overdraft does not exceed the amount on fixed deposit. The simulation hits the loan shut-off switch in the XISSUE function with increasing frequency after t = 4. Loans are issued less and less frequently each year, until after t = 19 not a single new loan is issued by the thana cooperative association.

When farmers find that they can no longer obtain as many loans as they think themselves entitled to because of their savings and share purchases, they lose interest in the cooperative association. They withdraw their savings and purchase only the minimal number of shares. The rate of local capital formation slows, and eventually becomes negative after t = 9. In the more complete version of the system causal loop diagram shown as Figure 5-11, the decline of TSAV after t = 9 can be interpreted as due to the dominance of the dotted arrow

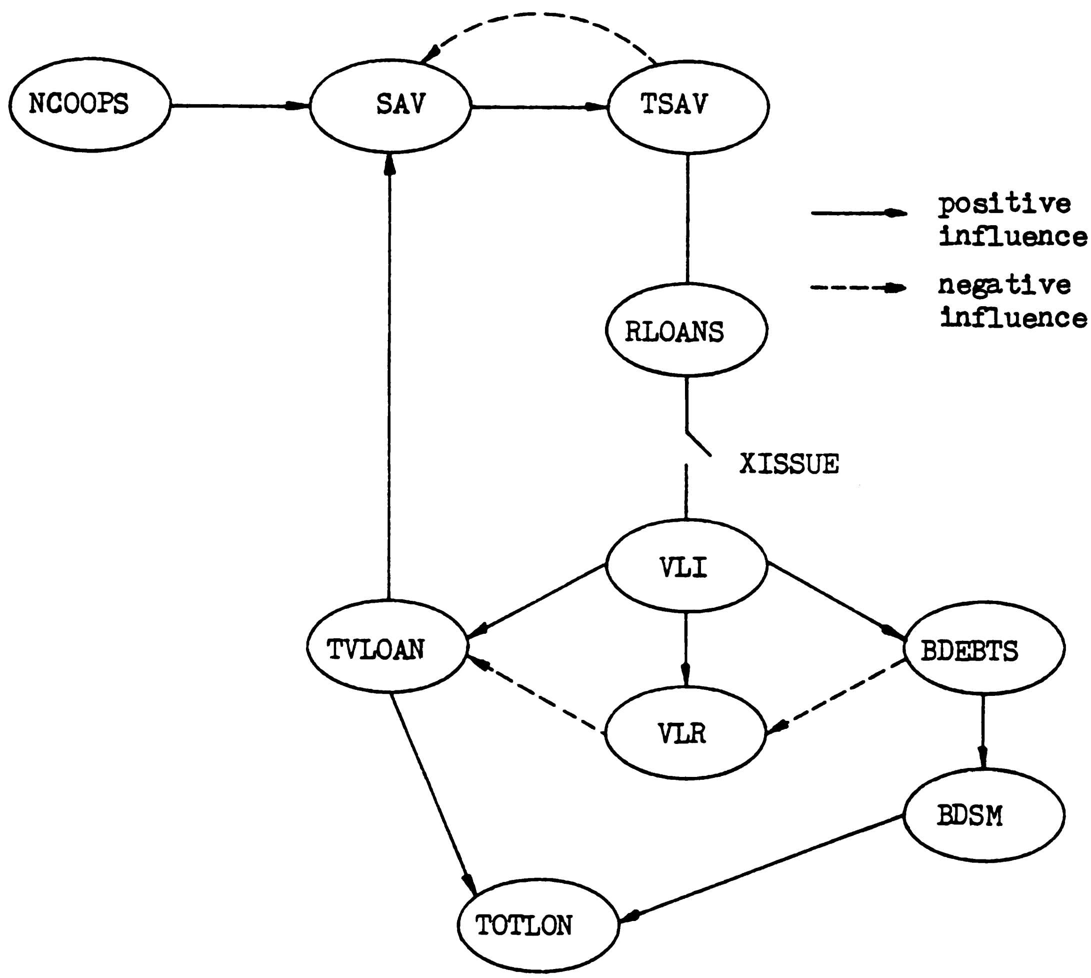

Figure 5-11. A more complete causal loop diagram for the cooperative credit system.

(indicating negative feedback) leading from TSAV to SAV.

The shift of the state variables TOTLON and TSAV away from the trajectory of moving equilibrium after $t = 4$ is also explicable for a related reason. The last 200 thousand rupees of capital loan is received by the cooperative association during the fiscal year which ends at $t = 4$. Thereafter, the cooperative association starts repaying 50 thousand rupees a year to the government. Since the underlying financial conditions change at $t = 4$, the system might be expected to respond differently than it had before it passed the dividing line between receipt and repayment of capital loans.

Should we be led to conclude, therefore, that the financial scheme proposed by Obaidullah Khan in 1964 was unrealistic, and that the only way to support a viable thana cooperative association was to subsidize it in perpetuity with annual infusions of loanable funds? Even at a zero interest rate, was it impractical for the government to expect that the capital loans made to the cooperative association in its early years could later be repaid?

Before giving up on the scheme proposed in Obaidullah Khan's report, let us explore some policy alternatives, to see if there might be something the model cooperative association could do to avert the financial degeneration predicted in the extended run of the simulation. To investigate such corrective policies, one change was made in the simulation program that was used for the extended run. For the policy experiments, it was assumed that the beta values of the capital generation and loan issue equations were identical. The value chosen for the two betas was 4.46, the average of the β and β' coefficients that had been determined through linear regression.[49] As a result of this modification, the long run simulation results could more readily

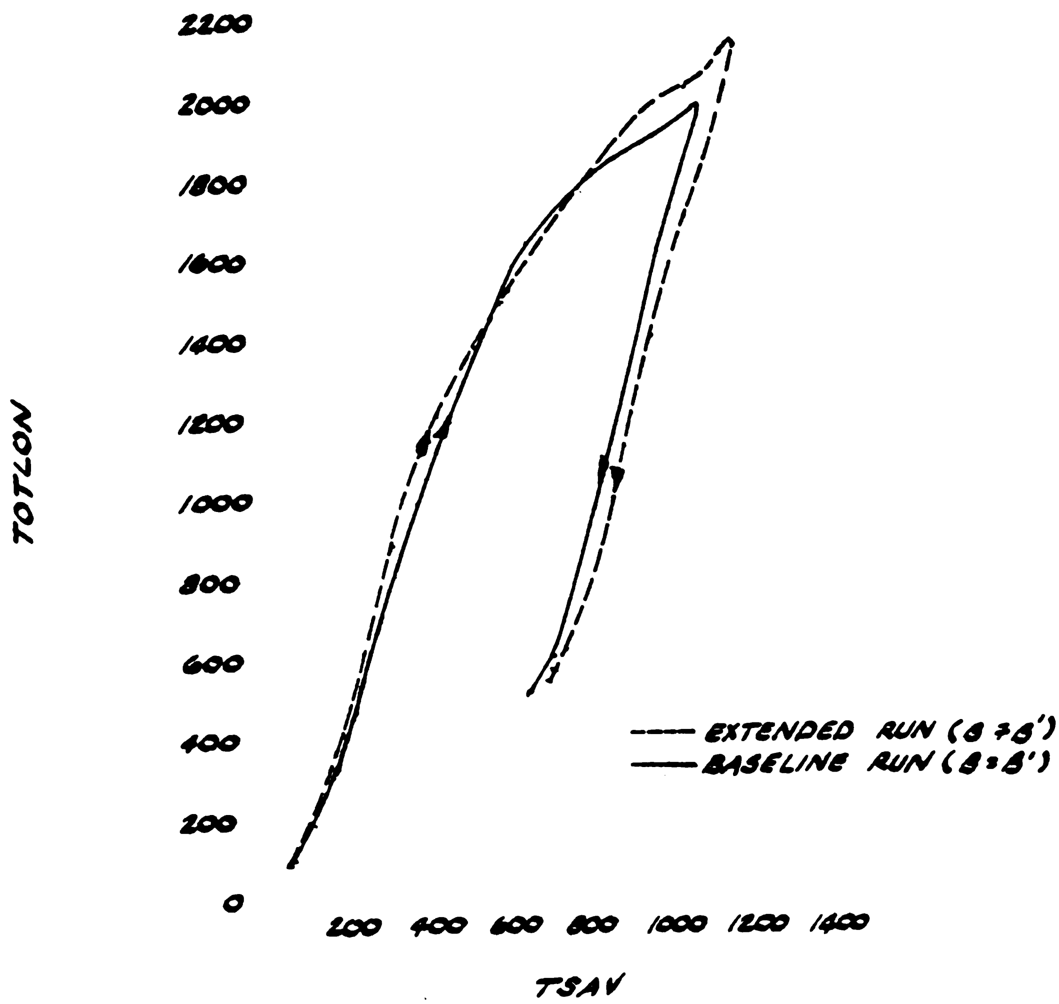

FIGURE 5-12 COMPARISON OF TRAJECTORIES FOR THE EXTENDED RUN AND THE BASELINE RUN.

be used as a baseline against which policy changes could be tested. It is evident from the comparison of phase plane trajectories in Figure 5-12 that the assumption $\beta = \beta'$ does not substantially alter the overall dynamics of the system.

To set the stage for a review of policy options for improving the long run financial performance of the simulated thana cooperative association, let us first take a look at a situation which is much worse than the baseline run -- the closed system condition in which the organization operates with no inputs. The system trajectory for the closed system seen plotted in Figure 5-13 proceeds from initial conditions alone. The number of cooperatives (NCOOPS) is held constant at the initial level, and there is no infusion or repayment of capital loans. The closed system run was made under the baseline assumption that $\beta = \beta'$. The resultant numbers are small, so Figure 5-13 was plotted on a scale magnified 10 times from that used in the other phase planes in this chapter. Direct comparison of the closed system and baseline runs on the same graph is precluded by the change of scale. However, the shapes of the trajectories in Figure 5-12 and 5-13 show some similarities in the general behavior of the system.

With only the funds initially available in the current account, the cooperative association manages to issue loans and to raise capital in the villages. The rally is short lived, though. The loan shut-off switch in the XISSUE function restricts loan issue as early as the second year, and by the end of that year loans outstanding have reached their maximum. Village capital reaches its peak the year after. The last loan is issued by the cooperative association in the fourth year.

An interesting finding which is evident in Figure 5-13 is that the

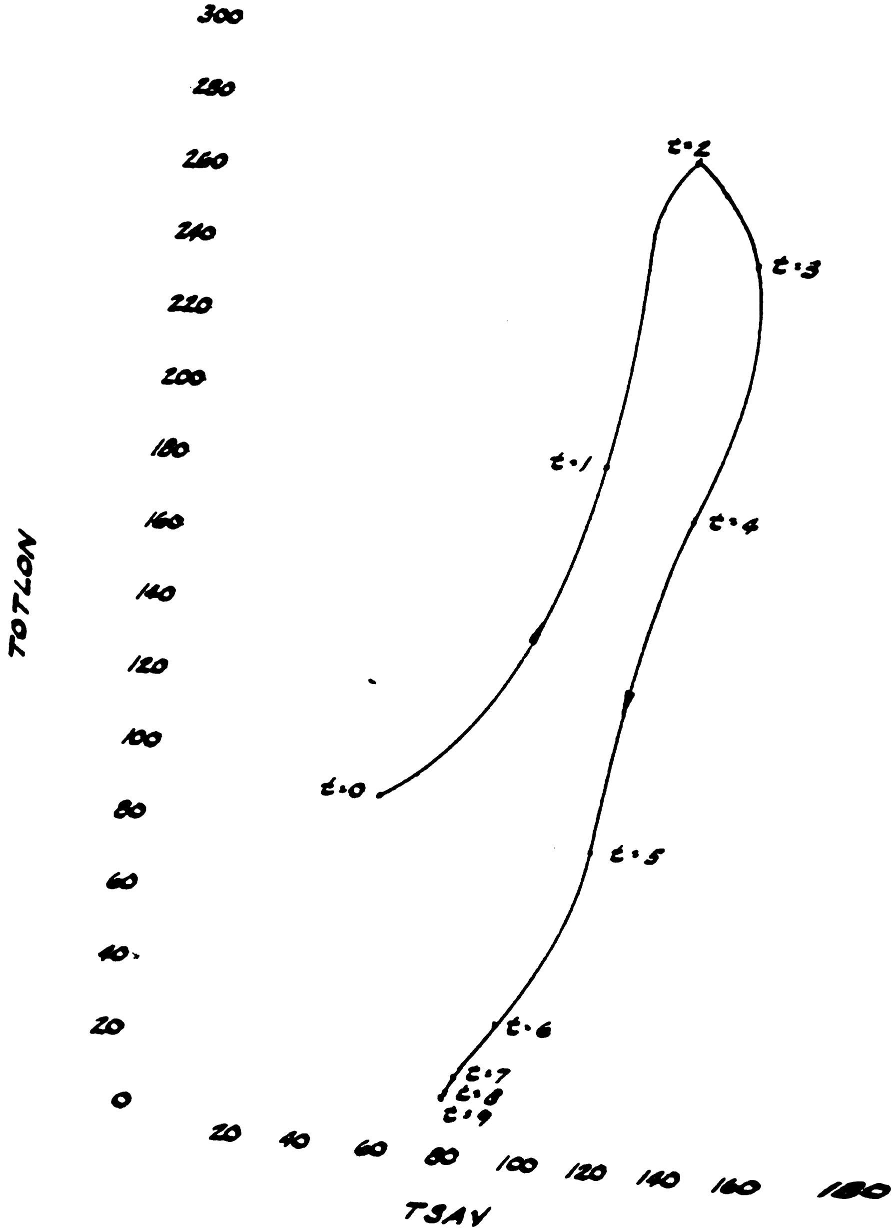

FIGURE 5-13 PHASE PLANE OF TSAV VERSUS TOTLON FROM THE CLOSED SYSTEM RUN.

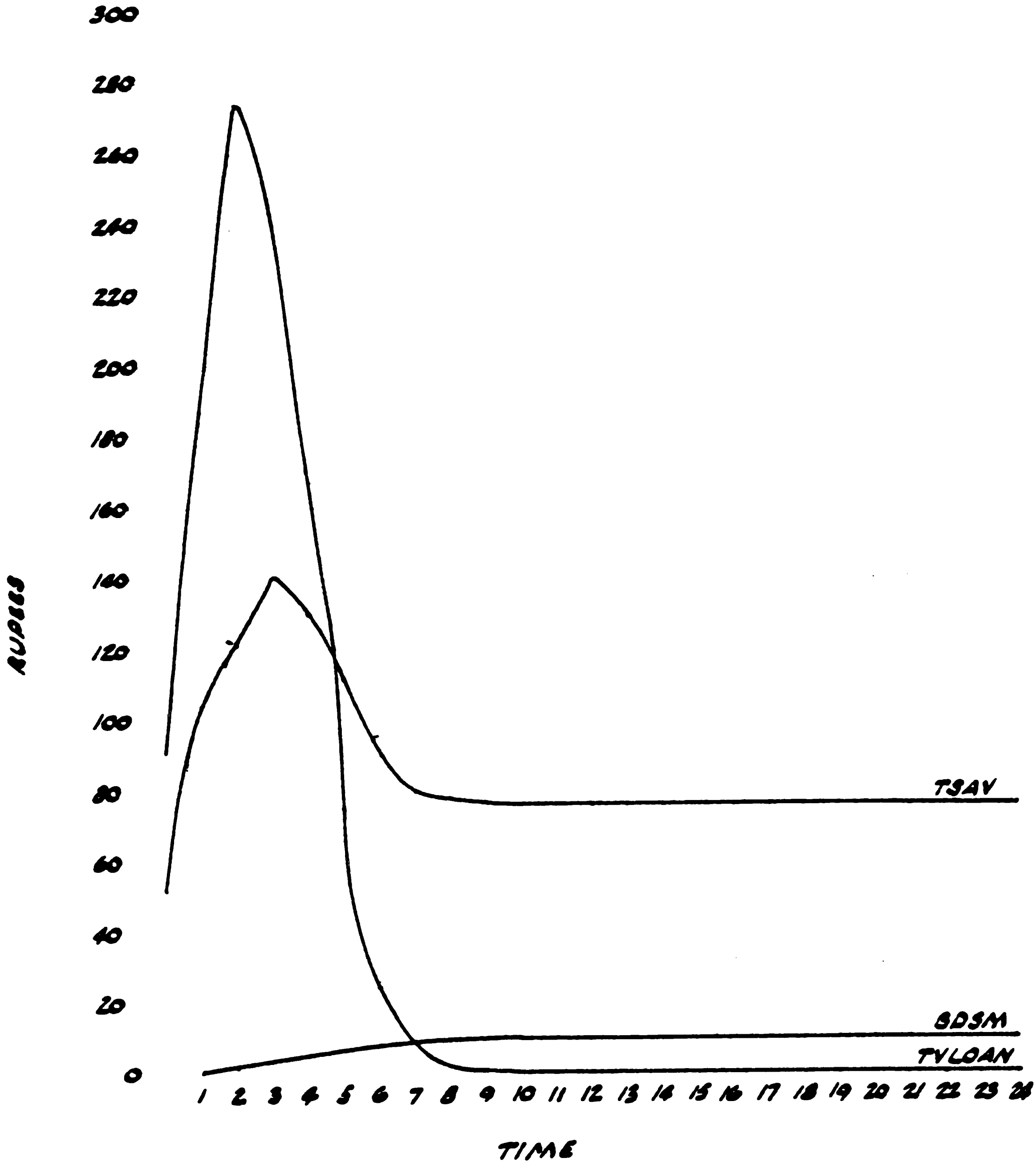

FIGURE 5-14 PROJECTIONS OF LOANS OUTSTANDING, BAD DEBTS, AND VILLAGE CAPITAL FROM THE CLOSED SYSTEM RUN.

cooperative credit system has a stationary equilibrium point. In terms of the variables in Figure 5-13, the equilibrium is located at TSAV = 76, TOTLON = 10. After t = 9 the system solution approaches indistinguishably close to that equilibrium point. From the curves in Figure 5-14, it is apparent that virtually all of the unrepaid loans after t = 9 consist of bad debts.

A glance back at some of the other graphs in this chapter reveals that the extended and the baseline runs of the simulation also approach a stationary equilibrium near the end of the 24 year period. For the extended run, the stationary equilibrium is at TSAV = 698, BDSM = 576, TVLOAN = 0, while the baseline run reaches a stationary equilibrium at TSAV = 653, BDSM = 520, TVLOAN = 0. In all three cases, then -- in the extended, baseline and closed system runs -- these state variables come to rest when there are no more village loans outstanding.

Although the exercise has something of the flavor of a beauty contest among cadavers, a comparison of the stationary equilibria of the closed and open systems permits some inferences to be made about the contribution of inputs to system growth. The closed system comes to rest with a stock of village capital valued at 76 thousand rupees. In the baseline run, the final value of TSAV is 653 thousand. The entire difference of 577 thousand rupees is due to two factors: growth in the number of village cooperatives, and capital infusions. To separate these influences, the simulation was run a) with the regular schedule of capital infusions and repayments, but with no growth in village cooperatives, and b) with the no capital loans, but with the standard growth pattern for the village cooperatives. The resultant three-way comparison among the no-growth run, the no-capital-loans run, and the baseline run is shown in Figure 5-15. All three runs were

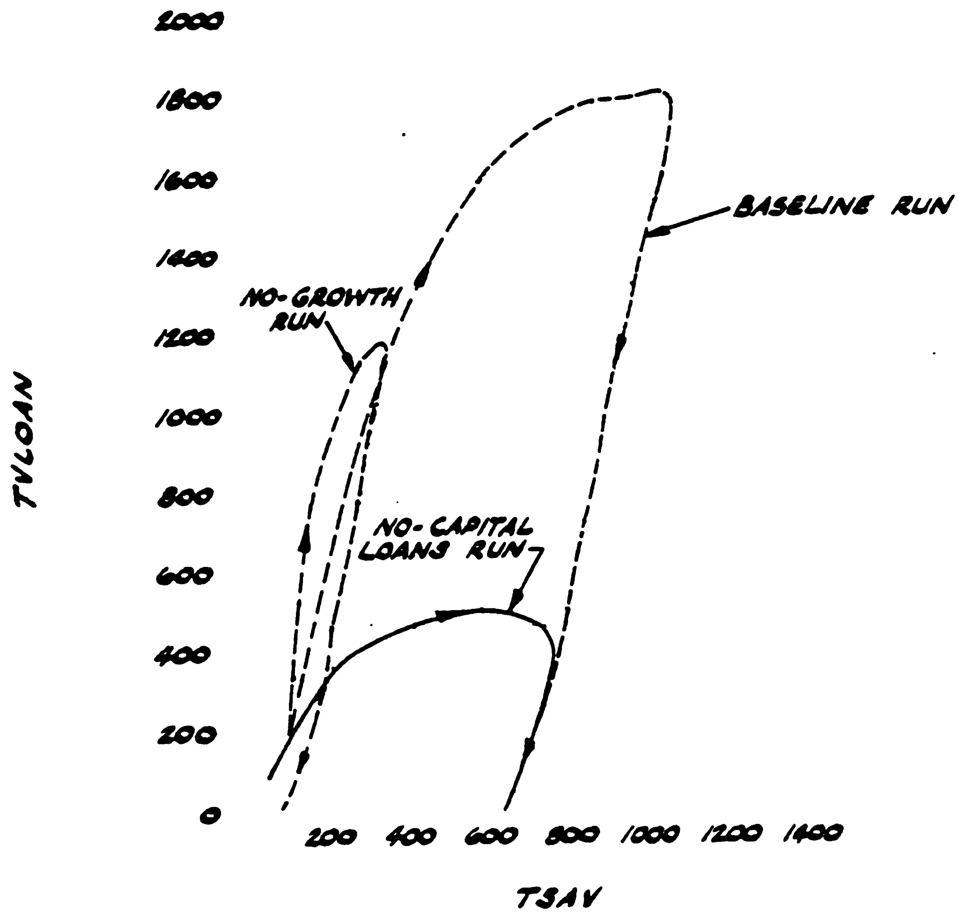

FIGURE 5-15 TRAJECTORIES FOR THE NO-GROWTH RUN, THE NO-CAPITAL LOANS RUN, AND THE BASELINE RUN.

made under the baseline assumption that $\beta = \beta'$.

Without any growth in the number of village cooperatives, the system trajectory spurts upward, and then plummets to the same stationary equilibrium point on the TSAV axis as was reached by the closed system run.[50] The effect of organizational growth at the village tier without capital infusions to the thana cooperative association is to swing the trajectory over toward the same resting point at TSAV = 653, TVLOAN = 0 as was the target of the trajectory of the baseline run. After a while the two trajectories even follow the same path toward that stationary equilibrium point.[51] As with the comparison between the closed system and the baseline runs, we may note that the difference in the final level of village capital between the no-growth and the no-capital run is 577 thousand rupees. All of that difference, we now know, is ascribable to the increase in the number of village cooperatives.

If growth in the number of village cooperatives is a force for financial expansion in the thana cooperative association, perhaps a policy of stimulating growth would boost village capital and loan volume, and pull the thana cooperative association out of its long run depression. This possibility was investigated, with results to be described shortly.

During the period from 1966 to 1970, the growth in the number of village cooperatives in the seven expansion projects in Comilla district was nearly a linear function of time. A regression of local cooperatives against the simulation variable t, which has a value of zero in 1966, yielded the equation NCOOPS = 42 * T + 41 ($N = 35$, $r^2 = .75$, overall $F = 98.66$, significance of $F = .000$). With two modifications, this equation was incorporated into the simulation program in the XCOOPS function. First, the parameter RGROW was substituted for 42, so as to allow for variation in the rate of growth of village cooperatives. Second, a cap of 350 cooperatives was inserted in the XCOOPS function. Roughly 75% of the villages in an average thana would have been organized by the time 350 local cooperatives had been established. The remaining 25% would represent those villages which declined, for reasons of their own, to join the cooperative program by organizing a local cooperative society. The way that these considerations are written into the simulation program is shown in Figure 5-16.

```
      RGROW = 42.
      MCOOPS = 350.
C     NCOOPS = XCOOPS (T, RGROW, MCOOPS)
C
      FUNCTION XCOOPS (T, RGROW, MCOOPS)
C
C     THIS FUNCTION DETERMINES THE NUMBER OF VILLAGE
           COOPERATIVES.
C
      XCOOPS = RGROW * T + 41.
      IF (XCOOPS .GE. MCOOPS) XCOOPS = MCOOPS
      RETURN
      END
```

Figure 5-16. The XCOOPS function.

The documented experience of the cooperative movement in Comilla Kotwali Thana indicates that there is a price to be paid for rapid growth in the number of village cooperatives. The faster new local cooperatives are organized and registered, the greater is the proportion of their members who are insincere. In the rush for expansion, marginal members will be picked up who will not follow through in repaying their loans, or who may intend to subvert the organization by corrupting it. Moreover, the more attention the inspectors pay to the enrollment of new cooperatives, the less attention they can pay to

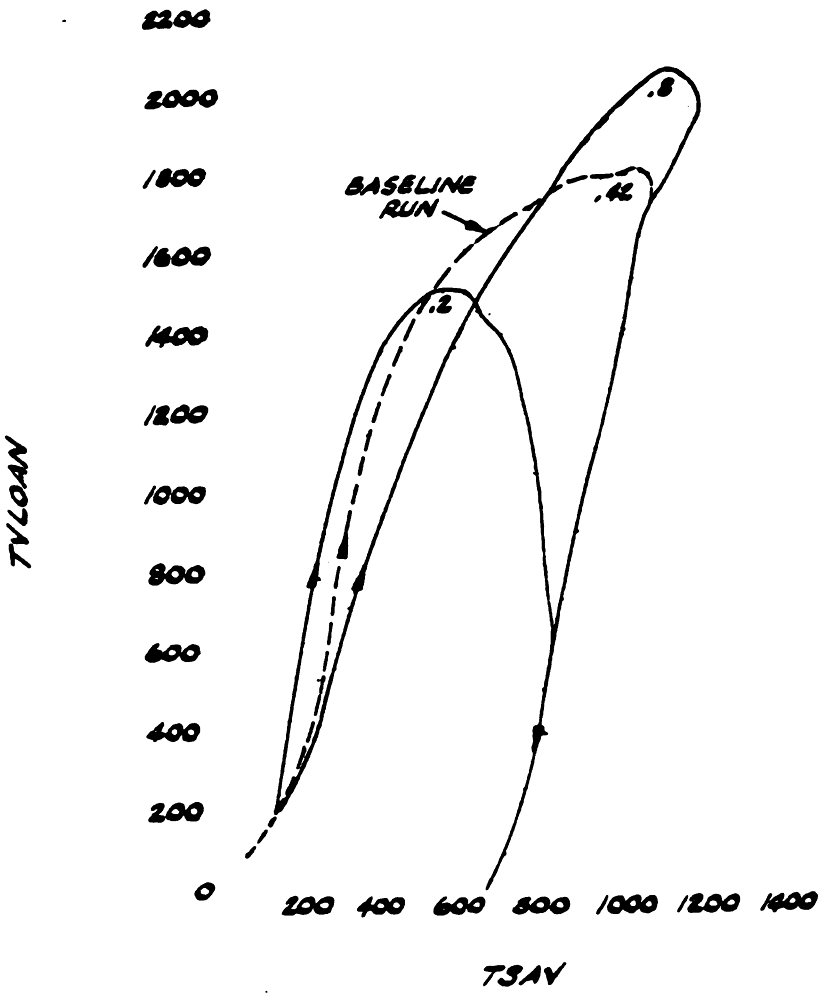

FIGURE 5-17 PHASE PORTRAIT OF SYSTEM RESPONSE TO THREE RATES OF GROWTH IN VILLAGE COOPERATIVES.

supervising the management of those already registered. As a consequence of these factors, the proportion of loans not repaid on time increases with the rate of growth of cooperative societies.

To give mathematical form to this assertion, two representative cases were chosen. When the rate of growth of the local cooperatives is zero, the inspectors can concentrate all their attention on maintaining management standards among the existing set of cooperatives. In that instance, I presumed that the proportion of loans not repaid on time, PRLATE, would have a minimum value of .03. For the baseline run, in which the rate of growth, RGROW, is 42, I presumed that PRLATE would equal .08. Matching up these cases, I derived the relationship PRLATE = .0019 * RGROW + .03. This equation was used in the baseline run, the closed system run, the no-growth run, the no-capital loans run, and in most of the runs reported hereafter in this chapter.

In Figure 5-17 we see the system response to rates of village cooperative growth about one half and about double the rate in the baseline run. A faster rate of growth does indeed allow for a higher maximum volume of loans, but the denoument is identical for all rates of growth. The faster the system grows, the faster it reaches the ceiling of 350 local cooperatives, and thereafter the faster it falls toward the stationary equilibrium point at TSAV = 653, TVLOAN = 0. Forcing the rate of growth through a crash program to register village cooperatives amounts to a quick fix for the thana cooperative association. For a short while profits glisten, but the final ruin is precipitous. The sins of fevered expansion are punished swiftly.

Is there an optimum rate of growth for the village cooperatives? To investigate this question, measures of the successfulness of different growth policies are required. For such measures I chose the

Table 5-9. Year 10 values of village capital, loans outstanding, and annual profits for different rates of growth in the number of village cooperatives.

RGROW	TSAV	TVLOAN	PROFSM
0	277	780	-46
10	506	1085	-30
20	728	1347	-15
30	950	1563	- 3
40	1046	1660	5
50	1049	1647	5
60	1041	1635	1
70	1035	1598	- 2
80	1026	1547	- 5
90	1016	1498	- 9
100	1001	1423	-14

values of TSAV, TVLOAN and PROFSM at the end of the tenth year of the simulation run. According to these measures, which are presented in Table 5-9, the optimal rate of growth lay in the range of 40 to 50 new local cooperatives per year. It was exactly in this range that the actual average rate of growth of 42 was located. We may conclude that there would have been no grounds for a policy of decelerating or accelerating the average rate of growth of the number of village cooperatives in the seven expansion projects in Comilla district.[52]

If it were not for the loan shut-off switch in the XISSUE function, the trajectory of the baseline run of the cooperative credit simulation would continue its upward course without end. The trajectory bends downwards because the thana cooperative association runs out of loanable funds. Loans are shut off whenever overdrafts on the current account exceed fixed deposits. It occured to me, as perhaps it has occured to the directors of the thana cooperative associations, that a remedy might be to increase the amount of money in the fixed deposit account, so as to allow more loans to be issued before the XISSUE function trips the loan shut-off switch. To increase fixed deposits, part of the annual capital loan of 200 thousand rupees was diverted from the current account to the fixed deposit account. The value assigned to the parameter DEP defines the proportion of capital loans diverted to fixed deposits. In the baseline run DEP has a value of zero. To test the hypothesis that long run financial performance would improve if fixed deposits were increased, the simulation program was run with DEP = .1, DEP = .2 and DEP = .3. The results of this experiment, as measured by the year 10 values of the state variables representing village capital, loans outstanding, and annual profits, are displayed in Table 5-10.

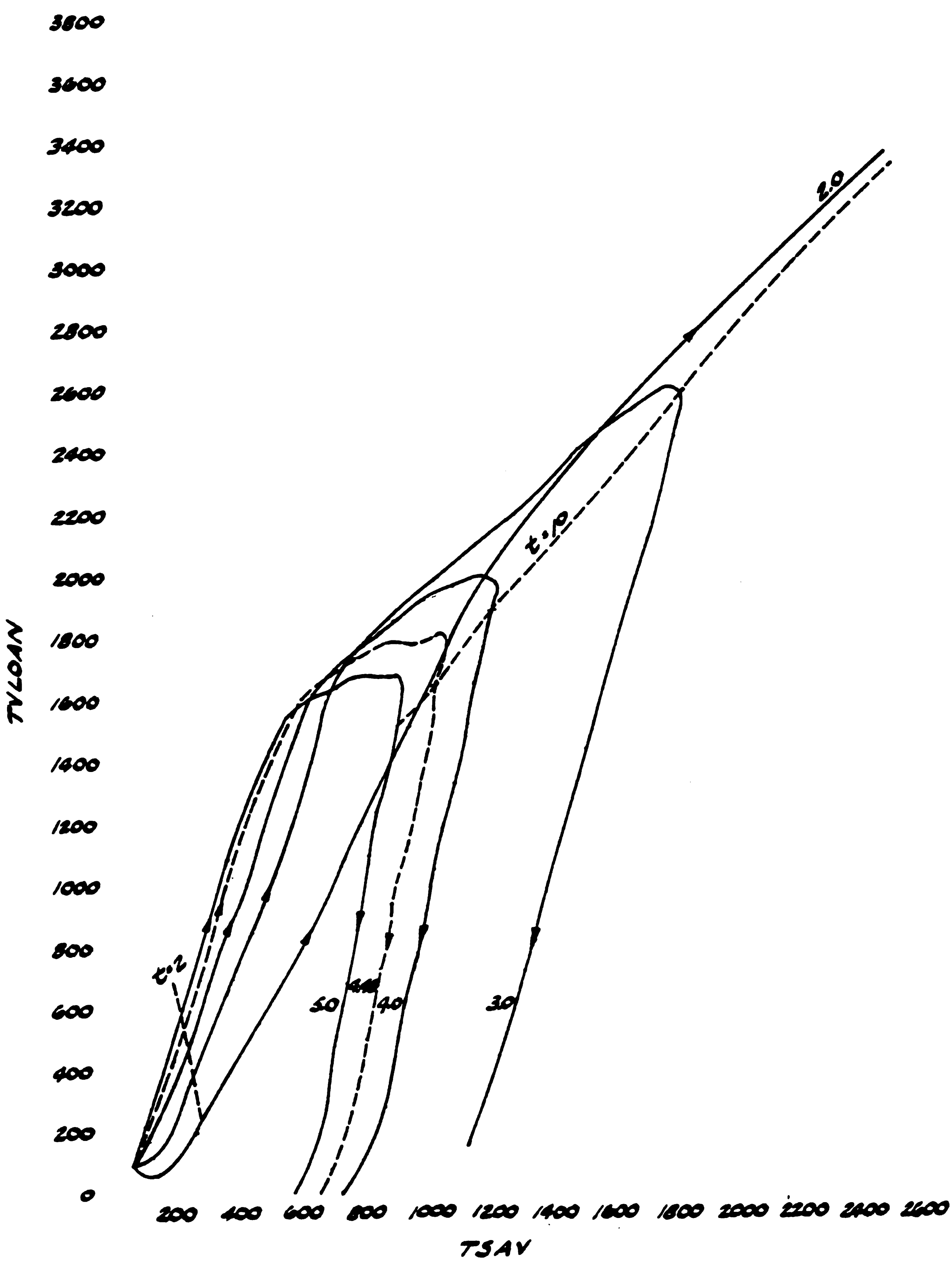

FIGURE 5-18 PHASE PORTRAIT OF SYSTEM RESPONSE TO DIFFERENT VALUES OF BETA

Table 5-10. Year 10 state variable values for different rates of deposit in the fixed deposit account.

DEP	TSAV	TVLOAN	PROFSM
0	1045	1659	5
.1	1050	1679	4
.2	1042	1653	2
.3	1037	1634	0

Between the baseline policy of no diversion of capital loans into the fixed deposit account (DEP = 0) and the policy of diverting 10% of each year's capital loan, the simulation yields an ambiguous comparison. Whatever advantage there may be in such minimal diversion is small. When larger proportions of the capital loan are entered in the fixed deposit account the long run financial performance of the cooperative association deteriorates, but not drastically.

More substantial changes in system behavior are observed when the BETA parameter is altered. The BETA parameter influences the credit system in two opposing ways. In the equation for the annual rate of loan issue BETA has a positive influence: the larger the value of BETA the more loans will be issued, so long as loanable funds are available. In the capital generation equation BETA exerts a negative influence: the larger the value of BETA the less capital will be raised in the villages through savings deposits and share purchases. Figure 5-18 shows how these counteracting influences play themselves out for different values of the BETA parameter.

The dashed lines in Figure 5-18 demonstrate that the net effect of BETA on outstanding loans reverses as the thana cooperative association matures. At t = 2 a change from a larger to a smaller value of BETA causes the system trajectory to shift downward. Eight years later, at t = 10, a similar shift in BETA causes the system trajectory to rise. What is happening is that the greater rate of local capital formation caused by a smaller BETA allows the current account to replenish itself faster at t = 10, resulting in less frequent cancellations of loan issue.

For the first time, a long term remedy for the financial difficulties of the thana cooperative association is apparent. At a BETA value of 2.0, the system trajectory escapes the downward pull of declining loan issue, and holds to a steady upward course. A more detailed check of BETA values than is shown in Figure 5-17 reveals that 2.0 is indeed the critical value for BETA, at which the trajectory breaks away. At BETA = 2.25 the trajectory begins a gradual descent after t = 15. BETA equals 2 is like the escape velocity of a rocket; it is the parameter value at which there is no evidence of a tendancy to descend throughout the entire 24 year course of a simulation run. Let us call this critical value of the BETA parameter the "breakaway value."

Even though the simulation has revealed a long-term financial solution for the thana cooperative association, it is unlikely that the corresponding policy would be adopted. The BETA parameter is determined by the coverage requirements for loans which are imposed by the thana cooperative association. The most liberal loan policy of the thana cooperative associations allowed total loans outstanding to attain five times the sum of savings and shares. Often times the credit rating of a village cooperative would be reduced, so that the ceiling on loans outstanding would be three or four times the accumulation of local capital. Regression analyses reported earlier disclosed that the β parameter in the capital generation equation for seven expansion projects was 4.17, whereas for Kotwali Thana it was 2.91. My interpretation of the difference between these two beta values is that average credit ratings were lower in Kotwali Thana, due to a stricter adherence there to the policy of supervised management. In Kotwali Thana, it will be recalled, the least credit worthy local societies (the C class societies) were permitted to borrow only 3 times their capital contribution.[53]

From the evidence of the regression analyses of financial data from Kotwali Thana and the 1966 projects, it seems that the parameters β and β' typically assume values which are slightly less than the average multiple of local capital defined by the loan issue policy of the thana cooperative association. A joint BETA value of 2.0, which was determined above to be the breakaway value for the simulated thana cooperative association, would correspond to a policy in which loans outstanding were not allowed to exceed about two and a half times local capital. That would be a strict policy indeed, and one which the farmers in the local cooperatives might not be willing to accept.

Certainly such a stringent policy would be at the opposite extreme from the loan policy of the network of Union Multipurpose Cooperatives in East Pakistan; these chronically bankrupt cooperatives required that only one tenth of loans outstanding be covered by local capital contributions. Such an easy-going policy would yield a BETA value of about nine. Extrapolation of the trends charted for BETA values up to 5 in Figure 5-18 would indicate that a cooperative which operated with such a slim coverage requirement would quickly run out of loanable funds, and could only continue its operations through massive and unremitting injections of capital from the government. Such was, in reality, the experience of the Union Multipurpose Cooperatives.

In his report on his <u>Tour of Twenty Thanas</u> Akhter Hameed Khan reflected on the ideology of self-sufficiency which was drummed into the leaders and members of the Comilla-type cooperatives. As the preceding analysis has made clear, this ideology and its accompanying loan issue policies were pivotal to the financial success of the cooperatives.

> The cooperative programme is a hard programme. It demands discipline and self-sacrifice. It is not a programme which temptingly offers facilities without insisting on any reciprocal effort.... The cooperative project promises release from the money lenders if the members would learn the habits of thrift and honest repayment and bear the expense of the organization. Not otherwise.[54]

Rather than raising loan coverage requirements to the austere levels indicated by Figure 5-18, the thana cooperative associations had another and more palatable policy option available. They could have collected the interest which was due to them at their stipulated rate of twelve percent. As can be seen in Figure 5-19, an effective village loan interest rate of VLIR = .12 would have allowed the simulated cooperative association to break away to a permanently ascending trajectory.

Figure 5-19 vindicates the financial plan for the new cooperative projects which Obaidullah Khan prepared in 1964. If only the expansion projects had collected the total amount of loan interest which was their due, they would have prospered to the end of the century and beyond.

From the viewpoint of systems theory, the phase portrait in Figure 5-19 is of interest because of the straight line which all the system trajectories eventually follow, either downward if the value of VLIR is low, or upward if VLIR is set at the breakaway value of .12 or

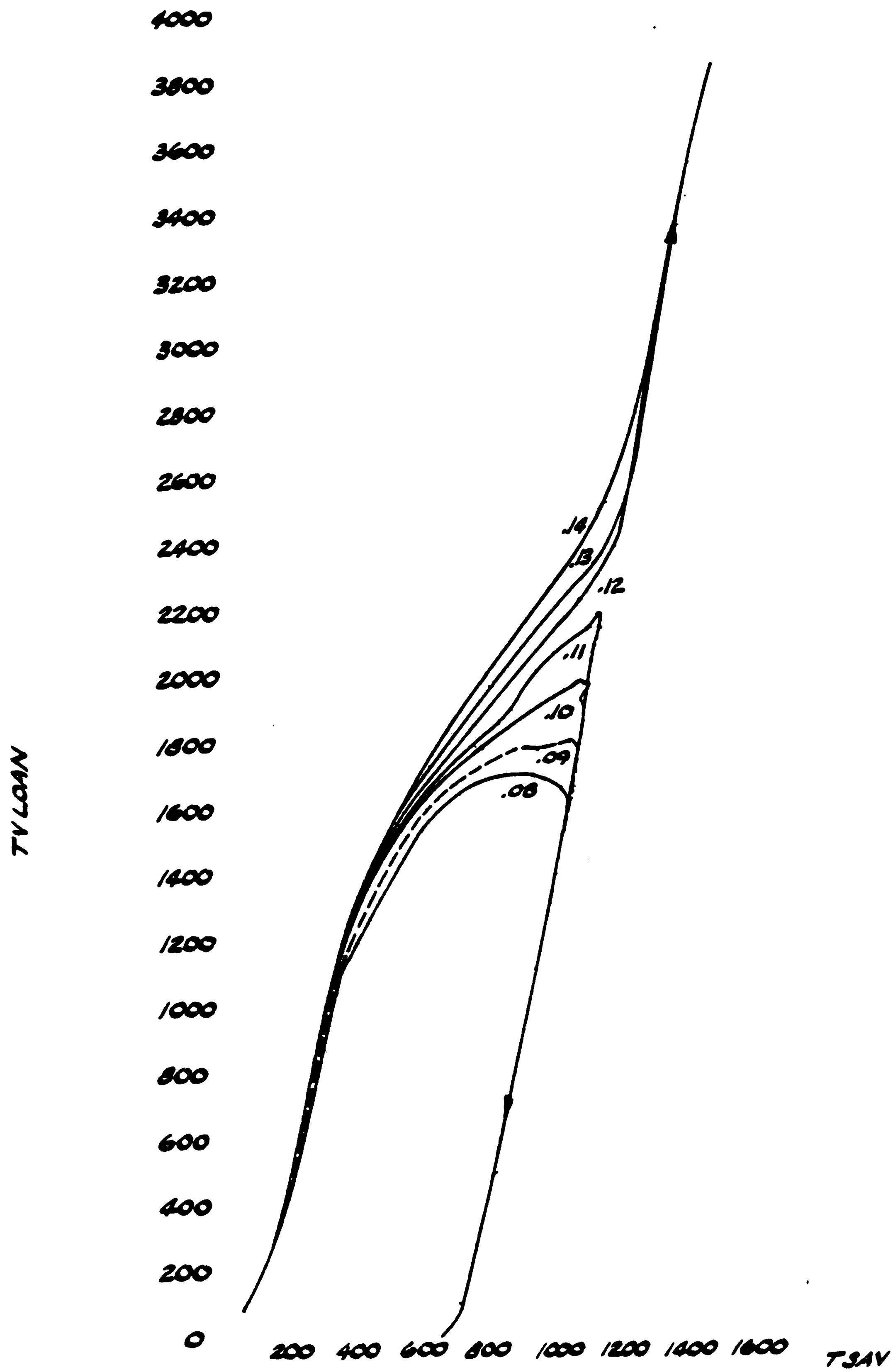

FIGURE 5-19 PHASE PORTRAIT OF SYSTEM RESPONSE TO DIFFERENT VALUES OF VLIR, THE VILLAGE LOAN INTEREST RATE.

above. Somewhere between the eleven and twelve percent rates of interest there must be a value of VLIR at which the system trajectory comes to rest along the slightly tilted straight line of moving equilibrium. If the breakaway value of twelve percent interest is comparable to the escape velocity of a rocket leaving the earth, then that special interest rate between eleven and twelve percent is analogous to the velocity required to launch a satellite into orbit. Like a satellite circling the earth, the cooperative association which collected the right rate of interest between eleven and twelve percent would end up in a stationary condition, with neither village capital nor loans outstanding changing from year to year.

Up to this point we have examined the response of the cooperative credit system to variations in one parameter at a time. We have reviewed the way that the system reacts to unilateral alterations in the rate of growth of village cooperatives (RGROW), to the proportion of capital loans diverted to the fixed deposit account (DEP), to the loan coverage requirements (BETA), and to the rate of interest on cooperative loans (VLIR).

The simulation program can just as well be used to look at the implications of variation in more than one parameter. The interaction of parameter variation can thereby be demonstrated. Without having the explicit intention of doing so, we have already uncovered one such parameter interaction. From Figures 5-18 and 5-19 we know that the breakaway value for the village loan interest rate, VLIR, is .09 when BETA is set at 2, and is .12 when BETA has a value of 4.46. A more formal parameter interaction study can readily be executed by the simulation program. The appropriate FORTRAN commands can be written in a few lines as instructions for a set of nested DO loops. One such parameter interaction study is reported here. Many others could be devised.

To obtain a more complete view of the relationship between loan limit policies, as reflected in the value of the parameter BETA, and the breakaway value for the village loan interest rate, VLIR, a third parameter was incorporated in the study. The percentage of loans not repaid on time, PRLATE, should have a bearing on the relationship between BETA and the breakaway value for VLIR. The greater the proportion of loans which fall overdue, the higher the interest rate that would have to be charged (for any constant value of BETA) so as to sustain the financial health of the thana cooperative association. The findings of this study of the interaction between loan coverage requirements (BETA), the percentage of loans not repaid on time (PRLATE), and the breakaway values of village loan interest rates (VLIR) are reported in Table 5-11. As a point of incidental information, it may be noted that the simulation program was run 126 times, for 24 years each time, during the course of this investigation. Thanks to the simplicity of FORTRAN instructions, this massive amount of computing was all reported in one printout. To control the cost of the study, the increment of time, DT, was changed to .05 from the regular value of .01.

Two technologies, or methods, of providing rural credit were discussed earlier in this chapter: supervised agricultural credit and supervised cooperative management. The case for supervised management could hardly be made more clearly than by the information presented in Table 5-11. Under the supervised management policy, those local cooperative societies which had few overdue loans were rewarded with higher loan limits. As can be seen from the table, such a trade off could be accomplished without sacrificing the financial health of the

Table 5-11: Breakaway values of VLIR for different settings of PRLATE and BETA.

	BETA		
	2.5	3.5	4.5
PRLATE			
.00	.08	.10	.10
.05	.10	.12	.12
.10	.12	.12	.14
.15	.12	.14	.14
.20	.14	.14	.16
.25	.14	.16	.16

thana cooperative association. At an effective interest collection rate of twelve percent, for example, the cooperative association could afford to offer a loan limit of 5 times village capital (corresponding to a BETA value of about 4.5) to those local cooperatives having five percent overdues. Village cooperatives in which ten percent of the loans fell overdue should be allowed a loan limit of no more than 4 times their accumulation of savings and shares; the BETA value for such cooperative societies would be about 3.5. Finally, a loan limit of 3 times village capital, corresponding to BETA = 2.5, should be imposed on local societies in which 15% of the loans fell overdue. These three recommended policies match up well with the loan limits for A, B, and C class societies which were enforced in the mid-nineteen sixties in Comilla Kotwali Thana.

To their subsequent regret, the cooperative officials in Kotwali thana abandoned these strict loan limit policies in 1967, when they launched a drive for the issuance of a huge volume of cooperative loans. The impact of that change of policy is apparent in Figure 5-20. During the period from 1963 to 1966, the cooperative credit system in Kotwali thana had followed a straight line trajectory of moving equilibrium. The four data points for those years all lie close to the equation TOTLON = 1.85 TSAV + 147.[55] The coefficient of determination, r^2, for this regression through the 1963 to 1966 data points is .98. When the loan drive was launched, the phase plane trajectory of TOTLON versus TSAV for Kotwali Thana departed from its established course. The campaign of retrenchment, begun in 1969, turned the trajectory back toward the course that it had followed in the early years.

In the Comilla cooperative system the thana and the village tiers of organization were interdependent. The thana association depended on

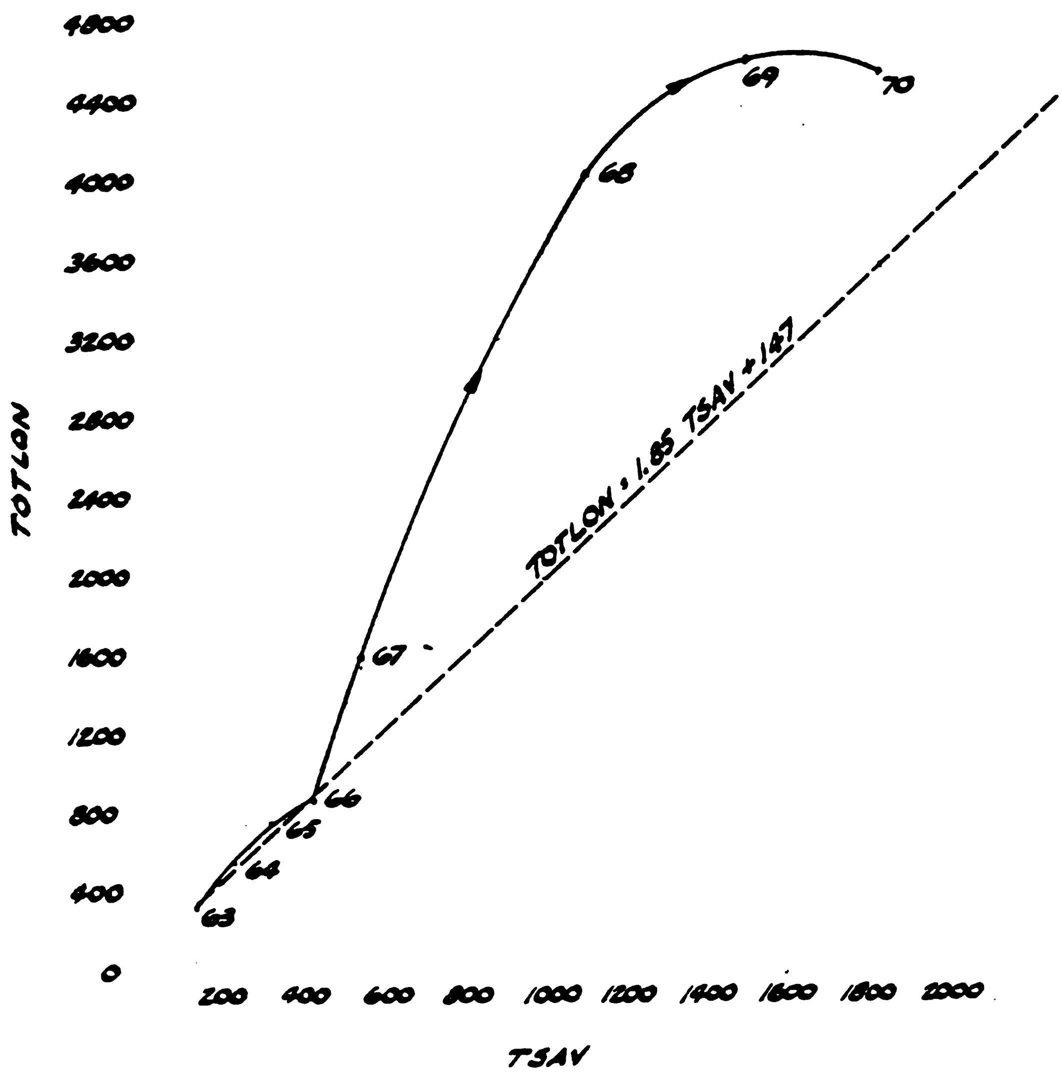

FIGURE 5-20 PHASE PORTRAIT OF VILLAGE CAPITAL VERSUS LOANS OUTSTANDING FOR THE KOTWALI THANA COOPERATIVES.

the village cooperatives to generate equity capital through savings and shares, and to cover part of operating costs through the payment of loan interest. The village societies depended upon the thana association for much more: for loans, for training, for marketing, for the installation and maintenance of tubewells, for tractors, and for many other services. Without the thana association the village cooperatives would have withered and expired. Within the administrative and political context of East Pakistan, or of contemporary Bangladesh, it would have been impossible for villagers to start or to regenerate a thana cooperative association. So despite the interdependence of the two tiers, I would say that the thana cooperative association, rather than the village cooperatives, was in the long run the more important institution, the one whose health should be most carefully safeguarded.

The supervised management policy protected the financial well-being of the thana cooperative association. The policy of supervised agricultural credit did not. The supervised management policy may therefore be judged the superior of the two, both for the special case of the Comilla cooperatives and for cooperative institutions in other less-developed countries.

Notes for Chapter 5

The Technical Subsystem

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6 Fremont E. Kast and James F. Rosenzweig, Organization and Management: A Systems Approach, McGraw Hill, New York, 1974.

7 Ibid., p. 181.

8 Frederick Taylor, Scientific Management, Harper, New York, 1947. Mr. Gilbreth's fame as the father of 12 children, one of whom wrote Cheaper by the Dozen, has been more durable.

9 William H. Whyte, Jr., The Organization Man, Simon and Schuster, New York, 1956.

10 David J. Hickson, D. S. Pugh, and Diana C. Pheysey, "Operations Technology and Organization Structure: An Empirical Reappraisal," Administrative Science Quarterly, 1969, V. 14, p. 395. Reprinted with permission.

11 One of the more insightful reviews of the discrepancies among these studies is to be found in Bernard C. Reimann's article, "Dimensions of Organizational Technology and Structure: An Exploratory Study," in Human Relations, V. 30, No. 6, 1977, pp. 545-566.

12 Joan Woodward, Industrial Organization: Theory and Practice, Oxford University Press, London, 1965.

13 Edward Harvey, "Technology and the Structure of Organizations," American Sociological Review, V. 33, 1968, pp. 247-259.

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[22] Levern W. Faidley, Computer Simulation of the Cooperative Approach to Tractor Mechanization in a Developing Country, Ph.D. Thesis, Michigan State University, 1974, p. 11.

[23] Ibid., pp. 18, 61, 69.

[24] Ibid., pp. 57, 136.

[25] Nazmul Ashan, Loan Utilization by the Cooperative Members of Comilla, Pakistan Academy for Rural Development, Comilla, 1966.

[26] Conversation with the author, 1975.

[27] The findings of the field research team, of which I was a member, were reported in Zaker Hussain, A Field Investigation into the Management of Village Cooperatives in Comilla Experimental Area, Pakistan Academy for Rural Development, Comilla, 1966.

[28] Conversation with the author, 1975.

[29] After the gazette of loan limits was published, cooperative members had to go through a similar multi-staged procedure to obtain their money. Like the procedures for saving, share purchase, and setting loan limits, the loan issue procedure required the individual cooperative member to negotiate with the ACF through his village

cooperative. Except when it prosecuted defaulters, the ACF conducted transactions only with its member cooperative societies, not with individual farmers. For a description of the loan issue procedure, the reader is referred to Ali Akhter Khan, Rural Credit Program of the Agricultural Cooperatives Federation, Bangladesh Academy for Rural Development, 1971, pp. 9-17. Much of the text on those pages is plagarized verbatim, and without attribution, from the author's unpublished manuscript, written in 1966, on The Comilla System of Supervised Credit.

[30] No copies of the loan gazettes could be found among the collections of Comilla documents at MSU, so I cannot estimate trends in the proportions of primary cooperatives in the A, B and C categories.

[31] Mathematically, the important issue is not the value of α by itself, but the value of the product $\alpha\beta$ and the behavior over time of the variable OL. If OL were constant (which it was not), then a value of $\alpha\beta$ greater than one would result in oscillations of increasing amplitude in the value of C.

[32] Financial data for the 1964 projects (Nator, Gaibandha, and Gouripur) is unreliable. The figures on total loans outstanding presented in different annual reports of the Comilla cooperative experiment are inconsistent for these projects.

[33] In case anyone is intent on replicating this research, or on applying these analytic methods to present day cooperative projects in Bangladesh, let me warn against a trap in which I became ensnared during several weeks and many computer runs. The cooperative projects routinely report the rate of savings and the rate of share purchase during the year. I mistook this as Δ C, and regressed it against loans outstanding (OL) and total savings and shares (C) at the close of the fiscal year. But if OL and C are given the index n for the end of the fiscal year, then the Δ C in the annual reports represents $C_n - C_{n-1}$. Equation 5.2 is not an historical equation, but a predictive equation. What is needed is a value for Δ C which represents $C_{n+1} - C_n$. The adjustment was easy to make, once I recognized the need for it.

[34] Assuring the comparability of data on the two sides of the regression equation was important. Figures on yearly loan issue in the annual reports represent loans issued during the fiscal year. Figures on savings and shares are given as of the end of the fiscal year. The local capital (savings and shares) figures for the end of the last fiscal year and the end of the current fiscal year were averaged to derive an estimate for TSAV which could properly be regressed against loan issue during the fiscal year. Because I did not have reliable data on loan issue in each of the expansion projects in 1968-69 and in 1969-70, I had to eliminate those years from the data base. 1965-66 was also eliminated, because it was the start-up year. The regression was run, then, on only 14 cases in the years 1966-67 and 1967-68. Despite the slim data base, I have confidence in the regression results for the loan issue equation in the 1966 projects for several reasons. First, the statistical indicators r^2 and F were exceptionally high. Second, the model given in 5.5 came out much better than some reasonable competitors. An alternative explanation for loan issue is that it

is related to the number of borrowers, or to the number of local cooperatives. The more borrowers or cooperatives, the more loans issued. Neither of these variables entered the regression equation on the first step. When TSAV and cooperative members were tested as independent variables, members entered after TSAV, and with an F value which was significant at the .662 level. The change in r^2 which resulted from adding members to the regression was only .00097, which is tiny by anyone's standards. In a separate test in which TSAV and the number of local cooperatives were given the opportunity to enter the regression, cooperatives also entered on the second step, and contributed only .00064 to the change in r^2. My third reason for having faith in the loan issue equation VLI = 4.74 TSAV - 174.65 was that it performed excellently in the simulation model which is explained somewhat later in the text.

35 The two stage basic delay model is known technically as a second order delay. The order of the delay is the same as the order of a corresponding linear differential equation. For the two stage loan delay, the corresponding equation is

$$a_2 \frac{d^2 y (t)}{dt^2} + a_1 \frac{d y (t)}{dt} + y (t) = x (t),$$

in which y (t) is the lagged output, VLR, and x (t) is the unlagged input, VLI. In accordance with Forrester's approach, I have sidestepped calculus in this presentation.

36 Jay W. Forrester, Industrial Dynamics, John Wiley and Sons, New York, 1961, p. 88.

37 Badaruddin Ahmed, A New Rural Cooperative System for Comilla Thana, Ninth Annual Report, 1968-69, Pakistan Academy for Rural Development, Comilla, 1970, p. 27.

38 Forrester, op. cit., p. 87.

39 To see how equation 5.9 demonstrates the conservation of flow, take the integral of both sides. The equation would then state that the amount in storage equals the amount put into storage less the amount taken out of storage.

40 My notes of an interview in 1965 with Mr. Shubash, loan accountant for the Kotwali Thana Central Cooperative Association, have a large question mark next to the statement that the KTCCA was "paying 5½% to United Bank to obtain money in order to loan it to primary societies."

41 Interview with Abdul Mannan, Project Director, Laksam Thana Cooperative Association, November, 1965. For overdrafts in excess of fixed deposits, interest charges rose to 7½%. This subtlety is ignored in my simulation model.

42 A.Z.M. Obaidullah Khan, The Comilla District Development Project, Pakistan Academy for Rural Development, Comilla, 1964. In addition to the capital loan of 200 thousand per year and the grant of 50 thousand per year, the projects were to receive a loan of 200 thousand a year

for each of five years for the purchase of tractors, pumps, and other agricultural machinery. I have ignored this additional loan, since it was unrelated to credit activities.

[43] Included in The Kotwali Thana Central Cooperative Association, Ltd, Old Abhoy Ashram, Comilla, Budget for the Year 1968-69, pp. 77-92.

[44] From my unpublished monograph on The Comilla System of Supervised Credit.

[45] The category of administrative costs covers all staff salaries of the thana cooperative association, including the salaries of village accountants. Travel allowances for the inspectors are included under the category of non-personnel expenses. Other non-personnel expenses would be items such as court fees for prosecuting loan defaulters, and office supplies. In the standard accounting terminology for the cooperative projects there was an additional category of costs for the credit program, termed expenditures for training and extension. These were reported separately from administrative expenditures. Expenses of training and extension would include costs such as local travel allowances for managers, chairmen and model farmers from village cooperatives, who attended classes at the thana training and development center. The OPCOST equation, 5.12, does not estimate these training and extension expenses.

[46] Md. I. H. Khan and others, An Evaluation Report on the Progress of the Seven Thana Projects Under the Comilla District Integrated Rural Development Programme, Pakistan Academy for Rural Development, Comilla, 1967, Table 20.

[47] Only 14 cases could be included in the calculation of the standard error of estimate for VLISM and VLRSM because of the lack of reliable thana by thana data on loan issue and loan repayment in 1968-69 and in 1970. The actual figures cited for these two variables for these years were calculated by dividing aggregate figures, culled from the eleventh annual report of the cooperative experiment, by seven. The entire series of actual figures for overdues and bad debts, and for loan interest collected, was calculated in the same way. The eleventh annual report does not distinguish between overdues and bad debts; the report groups both into the category of "overdues." Since the simulation separated out bad debts, these had to be added back in to match the reported figures or overdues and on total village loans outstanding. Hence, the variable additions indicated in the table by (TVLOAN + BDSM) and (OVRDUE + BDSM).

[48] The constancy of the relationship between outstanding loans and village capital has been noted by cooperative officials in East Pakistan and Bangladesh. In the Eleventh Annual Report of the Rural Cooperative Pilot Experiment, A. K. M. Obaidullah commented that the percentage of outstanding loan to own capital was similar across the years from 1966-67 to 1969-70 in the seven expansion projects in Comilla district. Akhter Hameed Khan also called attention to this ratio in his report on the Tour of Twenty Thanas. These commentators did not recognize that what they thought of as a ratio relationship could be more precisely explained through an equation including a

constant term.

[49] This revision in the parameters of the model was statistically defensible, since the average value of 4.46 lies within the 95% confidence interval for β', the coefficient in the loan issue equation. The lower limit of the confidence interval is 4.03.

[50] Probably because of the approximations involved in Eulerian integration, the system trajectory actually comes to rest at the stationary equilibrium points. An analytic solution to the equations of the system would show that the trajectory approaches the stationary equilibrium, but does not ever reach it within any finite span of time.

[51] The trajectories of the closed system and no-growth runs also lie on top of one another in their final stages, but that effect is not apparent in Figure 5-15, which does not show the trajectory of the closed system run. Such overlapping of trajectories is proscribed in true phase planes. A graph such as Figure 5-15 is not a true phase plane. In a phase plane, all system parameters and inputs are held constant and the different trajectories show the effect of varying the initial conditions of the system. In Figure 5-15 the initial conditions are held constant and the different trajectories show the effects of varying the parameters and inputs. An appropriate term for such a graph might be a phase portrait. That term was used in labelling many of the figures in this chapter.

[52] As with many another assertion in social science, this conclusion holds under *ceteris paribus* conditions. The optimum rate of growth might be different for other values of key parameters such as the village loan interest rate (VLIR), or the proportion of overdue loans which are written off as bad debts (PLR). In the runs reported, VLIR was .09 and PLR was .33. An alteration in the equation relating RGROW and PRLATE could also change the results.

[53] In 1964-65 the Kotwali Thana Central Cooperative Association experimented with a much stricter policy. Several primary societies which had not repaid their loans were black-listed. These black-listed societies were denied further loans or tubewell water until they repaid their debt to the central association. Such a harshly punitive policy was not attempted again. The experiment with black-listing was never voluntarily mentioned by the cooperative officials in Comilla. Perhaps the black-listing policy was a crude progenitor of the supervised management policy, with its gradations of A, B and C class societies.

[54] Akhter Hameed Khan, *Tour of Twenty Thanas*, Pakistan Academy for Rural Development, Comilla, 1971, p. 20.

[55] The slope of this regression line for the early Kotwali Thana data, 1.85, is markedly less than the slope of the equation TOTLON = 2.82 TSAV - 62.46, which was reported above to fit the average data series for the 1966 projects with a coefficient of determination of .999. The implication of the difference in slope is that the loan issue policies in Kotwali Thana prior to 1966 were stricter than the loan issue policies in the expansion projects in Comilla district after 1966.

Since the Agricultural Cooperatives Federation relaxed its own loan limit policies after 1966, the leaders of the pilot cooperative project in Kotwali thana were hardly in a position to reprimand the new project directors for their laxity.

CHAPTER 6

Linkage to the Environment

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static Systems	S			
Simple Machines	ST			
- - - - - -	- - -	- - -	- - -	- - -
Machines with Input	STE			
Organic Systems				

> Social organizations are flagrantly open systems in that the input of energies and the conversion of output into further energic input consists of transactions between the organization and its environment.[1]

Introduction

In an otherwise excellent text on a systems approach to organizations and management, Fremont Kast and James Rosenzweig refer to the setting of an organization as the "environmental suprasystem." They do not say, though, why it is that the organizational environment should, or always does, have systemic characteristics. They unfortunately use the term "suprasystem" as something of a trendy catchword.

In this susceptability to pretentious systems jargon they are certainly not alone. Many a social scientist these days will refer to phenomena of interest as comprising a system, and will make no attempt to specify the nature of that system in rigorous terms.

In previous chapters I have examined the rules governing established relationships among the components of the structural and technical subsystems of the Comilla cooperatives. In the case of the structural subsystem, those rules were found to be described in organization charts, and in the recursive equations of the structural control model. Rules for the technical subsystem were enbodied in the procedures for obtaining loans, and in the mathematical model of cooperative credit.

There are some precedents in the social sciences for describing the rules governing an organizational environment. Economists, for example, have built theories describing how many firms in competition, or a few firms in an oligopoly, will behave relative to one another. But in organization theory, the field of interorganizational ayalysis is conceptually much poorer. In the absence of theoretically sound guidelines for describing systemic characteristics of the environment of the Comilla cooperatives, I have foregone the attempt. So in contrast to previous chapters, this one does not pretend to be concerned with describing an organizational subsystem.

What distinguishes machines with input from simple machines is not the nature of the environment in which the system operates (i.e. whether the environment can be characterized as a system), but the existence of linkages which permit the system to receive inputs from the environment. Machines with input may also have linkages through which they can make outputs to their environment. The focus of this chapter, accordingly, is on the linkages through which the

Comilla cooperatives interacted with other groups and organizations in their environment.

Before the term "linkages" became popular among social scientists, conduits of interaction between a system and its environment were commonly described as "channels." The reference, obviously, was to communication theory. One of the basic theorems in communications is that the probability of a message being accurately received is higher when sender and receiver are united by several communication channels instead of one. This theorem reappeared in Norman Uphoff and Milton Esman's summary of the findings of the Cornell survey of rural local governments in Asia. "Local communities should be linked to higher level decision centers by <u>multiple channels</u>," Uphoff and Esman asserted, "both to achieve the benefits of specialization in communication and to enjoy alternative avenues of influence. One composite channel appears quite inadequate, being liable to overload or blockage or interruption if all village-center communication must be carried by it."[2] This was the second of Uphoff and Esman's seven prescriptions for effective rural development organization.

Relevant Research

In the years before he joined Norman Uphoff as the co-director of the Cornell study of rural local government in Asia, Milton Esman was the prime intellectual mover in the Inter-University Research Program in Institution Building, a project which began in the late sixties and incorporated the research of scholars at Michigan State University, Syracuse University, Indiana University, and the University of Pittsburgh. Neither Esman nor most of the other participating researchers was steeped in systems theory or in organization theory. Working from ill-defined premises, Esman patched together a schema for analyzing the imperatives of institution building. That schema was used by other scholars in the Inter-University Research Program as the framework for their case studies and deliberations. A central feature of Esman's conceptual schema was the importance of linkages between nascent institutions and their environments.

Esman's basic presumption was that significant change in developing countries must be accomplished mainly through institutions. As he put it: "Induced innovations require the vehicle of complex formal organizations. As societies modernize, the numbers of functionally specific formal organizations multiplies and only through such organizations and networks of organizations can complex modern technologies be managed and integrated."[3]

While the language may be more pallid, the assertion that formal organization is the vehicle of modernization is similar to V. I. Lenin's contention that communist organization is the vehicle of the revolution. The institution builders and the communist revolutionaries share, moreover, an activist stance toward social problems. Scholars of the institution-building school refer to their doctrine as social engineering. Instead of professional revolutionaries, the institution builders speak of change agents. In a passage which carries faint and distorted echoes of Lenin's "What is to be Done?" Milton Esman wrote, "The I B model is an elitist theory with an explicit social engineering bias. Changes occur from the top down, not from the bottom up, and they are guided by persons enjoying a measure of official authority or sanction. The vehicle of change is a formal and probably bureaucratic organization."[4] Change agents intent on social engineering, in other words, are helpless without an organizational vehicle in which to propel themselves and the society along.

The institution builders break with the Leninists at several points. In sketching those points, we can limn the borders of the institution-builders' philosophy of social change. First of all, the institution builders perceive themselves as consultants to the national authority structure. They do not see themselves as revolutionaries, or even as mild-mannered critics of existing social conditions. Hardly anywhere in their writings is their mention of class struggle. In this respect, the Inter-University Research Program in Institution Building, which was funded in part by the U.S. Agency for International Development (USAID), exhibits a characteristic deficiency which has been described by Akhter Hameed Khan:

> I would say that one of the main weaknesses of the development programs sponsored by the AID agencies for the excolonial countries is that they obstinately refused to take into account the class struggle. And the host governments were only too willing to go along. Neither agricultural extension nor community development takes the class struggle into account, and so these programs prescribe solutions which are supposed to apply to everybody.[5]

To Akhter Hameed Khan's list of USAID programs which are blind to social tension we may add institution building.

A second point at which institution building and Leninism diverge is in the acceptance of the use of force. Joseph Eaton, the editor of the principal book on institution building, remarks, "Members of the Inter-University Research Program in Institution Building consortium accepted the viewpoint that planners could use such powers as are inherent in the persuasiveness of data-related reasoning, economic incentives, political support, and national service ideals. Planners who think that the long run objectives of their effort justify the threat or use of banishment, imprisonment, and terror will find that these methodological alternatives are not considered.... The conceptual framework that was adopted had the function of facilitating comparative study of planful institution building within the restraints of a democratic political philosophy."[6]

For the most part, I accept these restraints as well in this book, just as Akhter Hameed Khan accepted them in building his rural development institutions in Comilla. When he was at Michigan State University in the late nineteen seventies, Akhter Hameed Khan was prone to look back in disillusionment on some of the projects which he fostered in Comilla; he toyed more and more with the idea of forceful retaliation against those who perverted the Comilla cooperatives for selfish ends. "There should have been a purge," he would mutter. He said that he wanted to carry the enforcement of cooperative debt collection to the stage of people's courts, in which the small farmers in the villages would take action into their own hands so as to force big farmers to repay their cooperative loans. But either because the political situation or his own philosophy did not warrant it, he seldom ventured in practice into the realm of brute enforcement.

The third major distinction between institution building and Leninism has to do with the purpose of the program. Lenin saw the communist party as nothing but a means toward his constant goal of revolution. The institution builders, on the other hand, tend to confuse the achievement of a state of institutionality with whatever the social purpose of the institution building project was in the first place. To quote Esman:

> The objective is to achieve <u>institutionality</u> - meaning that innovative norms and action patterns are valued within the organization and by the larger society and are incorporated into the behavior of linked organizations and groups. The environment becomes supportive of the innovations; the organization and the innovations it represents become valued and meaningful elements in the surrounding society.[7]

By the time he collaborated with Norman Uphoff in appraising the findings of the massive Cornell study of rural local governments in Asia, Milton Esman seemed to have overcome this confusion over whether the aim in view was to construct organizations or to change society. The Uphoff and Esman report states explicitly that the research task was "to examine and assess the contribution of <u>local organization</u> to rural development...."[8] Specific evaluative criteria for rural development are proposed in the report, and the effectiveness of rural local organization is assessed in terms of its influence in the accomplishment of those overall goals, such as increases in agricultural productivity, redistribution of income, and the enhancement of rural welfare. Organization, in Uphoff and Esman's terms, is viewed as an independent variable.

Of the major components of the original institution building schema, the one which was carried forward most fully into the Uphoff and Esman report was the concept of supportive organizational linkages. As Melvin G. Blase described it, Esman's initial institution building schema proposed that

> Every institution is dependent upon other organizations for its authority and resources; hence, its linkages with other entities are vitally important. These linkages also include an institution's dependency on complementary production of other institutions and on the ability of the environment to use these resources.

> Finally, linkages are also concerned with and subject to the norms of the society. Through these linkages the institution maintains exchange relationships with its environment, an interdependent complex of functionally related organizations.[9]

In the Uphoff and Esman report, the concept of linkage was defined in operational, scalable terms. Uphoff and Esman interpreted linkage as meaning "the extent and effectiveness of communication and influence between levels of organization (such as district and sub-district)."[10] They asked the members of their interdisciplinary working group on rural local government to assign ordinal weights from 0 to 5 to the linkage upwards from and downwards to the different levels of sub-national organization. The weightings were discussed among members of the working group, all of whom had expert knowledge of rural organizations derived from their professional backgrounds and their conduct of the case studies. Discussion continued until consensus weightings were arrived at for each case, and until there was agreement on weightings for similar cases. The case studies were then grouped into more-organized and less-organized cases in accordance with their total linkage weightings, plus another numerical estimate of the importance of various channels for serving the functions of rural development. The more organized cases, it turned out, had performed better on almost every indicator of rural development than had the less organized cases. Summarizing their findings, Uphoff and Esman wrote:

> Organization for rural development must be seen as a <u>system</u> of institutions performing various functions in the rural sector of a particular country. We found no case where only one institution was carrying the full responsibility for rural development or where <u>complementarities</u> among institutions were not as important as what the institutions themselves did. Of key

> significance was the extent and effectiveness of linkages between and among the institutions, horizontally with other organizations at the same level and especially vertically between local organizations and structures at the center of government which set policy and allocate resources essential to success in rural development.
>
> Local institutions which are separated and isolated from the other levels are likely to be impotent developmentally. Local autonomy by itself provides little leverage for development. What makes the most difference are systems or networks of organization that make local development more than an enclave phenomenon.[11]

In this chapter, I have sought to apply these principles to the analysis of the Comilla cooperatives. In the investigation of linkages to the environment at the village and thana tiers, I have looked especially at the patterns of horizontal and vertical ties between the cooperatives and other groups. Through these horizontal and vertical linkages, the Comilla cooperatives were joined to a social and organizational network in the rural areas, and in the government of East Pakistan.

Linkages With the Environment at the Village Tier

Within a village in Comilla the primary cooperative society did not stand alone. There was a preexisting social network -- a control system of ancient origin -- with which the village cooperative might compete, or, as Uphoff and Esman indicate is more desirable, with which it could develop a complementary relationship. It seems that in most villages, and particularly in those where the most successful cooperatives were to be found, the traditional social institutions and the modern cooperative were mutually supportive, with the leaders of each respecting the others' sphere of influence and authority. Yet quarreling and competition are always just beneath the surface in a Bengali village, and in some instances this took the form of strife between the leaders of the village cooperative and the leaders of the traditional social institutions.

The traditional social network was imperfectly understood by the westernized, often urban-reared faculty of the academy for rural development. The study of the clash and coalescence of traditionalism and modernity in the villages, moreover, was not easily cast into the survey methodology upon which most of the academy research publications were based. The standard technique for an academy research project was for a faculty member to create a questionnaire, and then issue it to a staff of village enumerators to take round to the villagers so as to gather the requested data. Questionnaire answers were then tabulated in the academy research section, and the faculty member wrote his report by examining and interpreting the tables. This methodology worked admirably for studies of the costs and returns of potatoes, watermelons and other crops, but it was ill suited to describing, for example, the rise and fall of a family's influence in a local cooperative.

Beyond the family itself, the fundamental social grouping in the Bengali villages was the Bari, a cluster of four to ten houses, together with kitchens and cow sheds, surrounding a rectangular compound. The architecture of the houses was indicative of the wealth of the occupants. Richer villagers, belonging perhaps to the class of surplus farmers described in Chapter 1, would have houses of dried mud covered with clay or cowdung. The only ventilation and illumination for the house, which might be 20 feet long by 10 feet wide, would be provided by two small heavily shuttered windows. Some of the bedrooms in the huts would have no windows at all. At the cost of what a westerner would consider unbearable stuffiness in the tropical night, the villagers thereby attained security from thieves who might try to break into their house through the windows, and from enemies who might hurl a spear into the house while they were sleeping.[12] The poorer villagers could not afford mud plaster houses, and slept in the breezy insecurity of houses walled with woven bamboo.

The social significance of the compound of houses comprising a _bari_ was lost on most of the men, whether Bengalis, Americans, or Europeans, who have written about the social structure of Muslim Bengali villagers. An American woman, Florence McCarthy, has portrayed the importance of the _bari_ vividly.[13] For the Comilla peasant women, the _bari_ of their husband in one village and the _bari_ of their father in another village comprised the perimeter of their universe. In accordance with the Islamic custom of _purdha_, the village women were not to be seen by strangers -- which in practice meant that they had to shield themselves from the view of everyone beyond their husbands' close relatives in the _bari_ compound. Women were not even to befriend other women in the village beyond their _bari_. They did not go to market to sell the produce of their husbands' farms or to shop for groceries or clothing; all marketing was done by the men. When they returned to their fathers' _bari_ for a once or twice yearly visit, strictest custom called for the women to be transported there at night.

Except in earliest girlhood, the female villagers were referred to as "so-and-so's sister," or "so-and-so's mother," or simply as "hey you" (_oh gou_). Many older women found it difficult to recall their given names, since their individual identity had been ignored for so long. The greatest decision affecting a woman's life -- the choice of her husband -- was entirely out of her hands. Parents arranged marriages for the girls when they attained puberty, usually selecting a man about ten years older as the husband. While the man's reaction to the proposed bride was sometimes taken into account, the girl's views of her prospective groom were not solicited.

The dearth of challenge and recognition in the women's world might be expected to stunt their intellectual and social development, and so it did. Florence McCarthy found that she had to coax her women interviewees along so as to teach them the simple skill of answering questions. When the Academy for Rural Development, acting via the KTTCA, sought to train village women as organizers of a cooperative women's program, similar difficulties were encountered. The village women who came to the Abhoy Ashram campus had to be taught, for example, how to sit in chairs. There was puzzlement at first as to why the village women came to the weekly training classes so early, until it was noted that the first to arrive could claim the corners of the classroom, where they could hunker down, covering their faces with a veil and hoping no one would speak with them.

In their training classes at Abhoy Ashram the peasant women were taught practical skills, such as how to read and write, cultivate a garden, spin cotton, or raise chickens. On returning to their villages, or more correctly to their baris, the organizers taught other women these same skills. Despite their instructors' admonition that they should involve women from throughout their village in the program, the female organizers usually taught first the women from their own baris, since the social injunction against befriending a woman in an adjacent bari was stronger than the censure resulting from taking a trip six miles or so to Abhoy Ashram.

Such censure was abundant. The women who accepted the proferred training at Abhoy Ashram were told that the thana training center was part of the end of the age, that it would destroy the custom of purdha (reclusion of women) and even the Islamic religion. The training center was a dangerous place where there were foreign sahibs. The women who travel there must be prostitutes. Most intimidating of all, neighbors told the women's program organizers that they would not be buried until three or four days after they died. In Islam it is mandatory that the dead should be buried within 24 hours.

In linking the cooperatives to the emancipation of village women, the leaders of the Comilla rural development experiment precipitated social turmoil. In the short run this was a hinderance to the cooperative movement. The support of some men in the villages diminished as a consequence of what they perceived as the radical implications of the women's program. Yet in the long run the cooperatives in the villages where the women's program took root were strengthened by the participation of the women. With encouragement from the women's program organizers, and from the less tradition-bound men who often gravitated to the leadership positions in the local cooperatives, the women joined the village cooperatives in rising numbers. Like the male cooperative members, the women made savings deposits and took out loans. By 1968, over a thousand women in 67 villages had joined cooperatives. They had invested, on the average, a fifth as much as the male members in the purchase of cooperative shares and in savings deposits, but their participation was still financially significant. Over five hundred village women attended the annual cooperative rally in 1969. A village midwife chaired the rally.

Resistance to the women's program slowly eroded in the villages, largely because of the perceptible impact it had on the financial condition of the women involved, and on their families. Florence McCarthy has described the process by which the program brought the organizers out of utter dependency in their dark houses and into the mainstream of the village economy. A similar process could be traced among the peasant women who were trained in turn by these organizers.

> Most of the organizers mentioned that support for their work developed as people saw the "improvement in their condition." This was crucial particularly for the organizers. Coming from economic conditions involving great need, and from generally lower social status positions in the village, any change in the conditions of these women was quite apparent. At first many of the women saved part of their travel allowance and with the extra money bought more rice for the family. Gradually through persistent savings, they saved enough to buy a goat. From the sale of the kids of that one goat, more food was purchased: such items as meat, fish, eggs and vegetables besides the main staple of rice. Chickens were acquired, and from the sale of eggs and chicks, more goats were purchased, or a cow. Small gardens near the _bari_ were planted, or as women become more ambitious, potatoes are grown in ricefields lying fallow. The income from the gardens or potatoes goes for additional items for the _bari_, usually food, then livestock, clothes, and finally the entering of a child in school, and the first down payment on land. When a woman, largely by her own actions, can bring this much improvement to her family, it is no surprise that opposition to her work diminishes in the village. This has been the experience for all of the organizers, not just the exceptional few.[14]

It is very much to Akhter Hameed Khan's credit that he understood the deadening injustice of the women's traditional status, and that he gave his vigorous endorsement to the women's program. Speaking in

Bengali in 1963, he said:

> One cause of our misery and poverty is that we keep our women-folk at home, guarded over constantly. We keep them indoors. We do not educate them, and because they are confined they cannot educate themselves; so they are nearly all illiterate; they are timid. And so long as the women are uneducated, development can hardly be expected in our country.
>
> If the mother is illiterate, if she has no courage, how can one expect courage in her children? The mother is the teacher....
>
> I think our country can never progress until we can emancipate the women.[15]

If the _bari_ was the well-defined place of confinement of the women in the traditional Muslim village in Bengal, there was no such clarity in the social world of the unconfined men. The world of the village men has been characterized as diffuse and atomized.[16]

The village as a unit was not a coherent focus of identification. Just what constitutes a village is a matter of contention, not only for the "villager" but also for the government official or anthropological observer. There are several words for village, and each corresponds to a different grouping of people, houses, ponds and ricefields. The Bengal plain is carved up into revenue villages (_mauza_), census villages, and what Peter Bertocci has labelled "native villages" (_gram_). Whatever loyalty the residents felt toward their village adhered to the _gram_. There were 463 such _gram_ in Comilla Kotwali Thana, averaging 135 acres in size and 340 persons in population.[17] The _gram_ was the social unit within which the primary cooperatives were organized, each cooperative taking the name of its _gram_. The village cooperative was the sole salient institution, whether traditional or imposed, which encompassed one _gram_. Family structures, traditional hierarchies of social authority, religious congregations and marketing patterns all were established without much attention to village borders. There was no village-level government, the lowest level of local government being the union council, which was responsible for an average of 36 villages.[18]

A significant social unit intermediate between the _gram_ and the _bari_ was the neighborhood, or _para_. Each _para_ in a village was geographically distinctive, being set off from the other parts of the village by paddy fields, bamboo groves, garden plots, or ponds (called tanks by the English-speaking Bengalis). In many villages local politics could be sorted out as the struggle for influence and prestige between the male residents of different _paras_.

An unusually tumultuous illustration of neighborhood politics was the conflict over cooperative leadership between residents of the north and the south _paras_ in Jangla village. The Jangla Agricultural Cooperative Society was established with its headquarters in the north _para_ of the village. However, within a few months of the cooperative's registration two of its leaders arranged to shift the headquarters to the south _para_, where they resided. A dispute over this and other matters arose. The inspector from the thana cooperative association arranged a public meeting in Jangla to resolve the issues. During the meeting some men in the audience jumped up and grabbed the records of the village cooperative from the table in front of the inspector. The meeting became chaotic and was dispersed. Leaders from the south _para_ filed a case with the police, who issued warrants against several of the north _para_ dissidents. The case was settled out of court with the north _para_ residents agreeing to take back their savings deposits and leave the cooperative. The north _para_ faction later sought to organize their own cooperative society, but their application was denied by the central association, which maintained that only one cooperative should be established in one village.[19]

Associated with the men's loyalty to their neighborhood, or _para_, was their loyalty to their class, or _reyai_. A large proportion of the members of a given clan typically lived in the same _para_ of the village. The _para_ may have had its origin, hundreds of years ago, as the locus of settlement of a kinship group. There remained some convergence, in the modern village, between kinship loyalty and neighborhood loyalty.

At the head of each _reyai_ was an elderly man known as a _sardar_ who was one of the most important leaders of the traditional social system in the Muslim Bengali villages. The _sardars_ of several adjacent villages comprised a council, known as the _samaj_. The most important function of the _samaj_ was to sit as a local court, to which the villagers could bring disputes of all kinds. The _samaj_ also maintained social discipline, offered advice on marriage proposals, and arranged village rites and feasts.[20] Such, at least, were among the ideal functions of the _samaj_. In actuality, as Peter Bertocci discovered when he took a close look at Hajipur and Tinpara villages in Comilla Kotwali Thana in 1967, the _samaj_ had lost much of its potency as an instrument for maintaining social order. During the year that Bertocci lived in these villages, the _samaj_ met only once to mediate a dispute, and this was dispite the prolific disputatiousness of the Hajipur and Tinpara villagers, who were forever battling one another for the crumbs of status or economic advancement that were to be found in that overcrowded landscape.[21]

Like much of anthropological research, Peter Bertocci's study of the two villages in which he resided for a year is at its best in the telling of tales. He recounts, for example, the story of Ershak Mia, a young man who invited his fellow members of the Hajipur cooperative to his wedding. Upon hearing that people from outside of their family lineage (reyai) had been asked to the wedding, Ershak Mia's father was incensed. The father asked for the advice of a counsin who was a sardar, a representative on the local samaj. The unanimous opinion of the members of the samaj was that Ershak Mia should withdraw those wedding invitations which had been sent to persons outside his own lineage. Chagrined but obedient, Ershak Mia retracted the offensive wedding invitations, and thereby affronted most of the members of the Hajipur cooperative. In the next election for officers of the cooperative, the candidates from Ershak Mia's lineage were defeated.[22]

The system of lineage leadership culminating in the samaj was the most important traditional social network with which the village cooperatives were impelled to establish a relationship. In Jangla village, for example, the sardars on the samaj enforced a social discipline of extreme conservatism. The older men in the village had long black beards. There was one mullah, or Islamic religious functionary, for every 32 persons in the village. Listening to radios was prohibited in Jangla. The leaders of the Jangla cooperative, who were younger by a generation than the sardars, were often at odds with these traditional social leaders. The opposite situation obtained in Monogram village. The two sardars in Monogram fully supported the modernizing efforts of the cooperative, and sometimes applied their influence to assure that cooperative loans were repaid. There was common acknowledgement of the responsibility of the sardars for the arrangement of ceremonies and festivals and for the settlement of disputes, and of the model farmer, for example, in matters of agricultural improvement.[23] The Jangla cooperative, whose relationships with the surrounding social system were full of friction, was among the least successful in promoting economic improvement or in repaying loans. The Monogram cooperative, on the other hand, was often cited by officers of the Agricultural Cooperatives Federation as one of the most progressive in the thana, tripling crop yields in a decade and repaying all its loans on time.

In addition to writing the case studies of Jangla and Monogram cooperatives, two faculty at the Academy for Rural Development in Comilla have attempted more systematic investigations of the relationship between the cooperatives and the traditional social leadership in the villages. Unfortunately, both of these studies are flawed.

With the support of a Ford Foundation grant, Abdul Muyeed sampled 35 agricultural and nonagricultural cooperatives in Comilla thana in 1968, and employed five enumerators and four research assistants for six months in filling out and tabulating a questionnaire administered to the manager and two members of each of these cooperatives. Muyeed obtained a 100% response rate from his sample of 35 x 3 = 105 villagers by employing the expedient of paying each of them five rupees to come to the academy campus to be interviewed. The researchers, it seems, barely bestirred themselves to go into the villages. Data in hand, Muyeed returned to Michigan State University in 1969 to write up his study as a doctoral dissertation.[24] The thesis was a methodological disaster. The bulk of it consists of a bombastic recitation of the literature on economic and community development, and an unconsequential presentation of a factor analysis of the relationships among 90 of the 183 variables extracted from the questionnaire. Simple statistical techniques such as cross-tabulation, correlation, and analysis of variance were ignored, much to the grief of anyone attempting to decipher the findings.

Seventy-seven of the respondents in Muyeed's survey said that the traditional leaders were still active in their villages, and only two said that they were not. The Jangla situation of hostility between the _sardars_ and the cooperative officers was apparently uncommon. Eleven of the respondents said that relations between the traditional leaders and the cooperative were aggressive, while 62 said that the relationship was very cordial. One of the most interesting questions which Muyeed posed -- "Has the cooperative given rise to a new power structure in the village?" -- was phrased, sadly enough, in the jargon of American social science, and was not explored in terms of the backgrounds of office holders, or the play of influence in arriving at important decisions. Forty-nine of the 105 respondents in Muyeed's sample said that a new power structure had been created, 55 said there had been no change, and only one was undecided. The respondents were about evenly divided on this key question.

A much less expensive and less pretentious study of the relationship between the leaders of the primary cooperative and the traditional social leaders was conducted in 1971 by Badruddin Ahmed of the faculty of the Bangladesh Academy for Rural Development. Ahmed took the class of traditional local leaders to include _sardars_ as well as _matabbars_, the latter being a non-hereditary and somewhat less prestigious category of traditional leader. He surveyed 250 farmers in 29 villages in Comilla Kotwali Thana, randomly selecting his samples of villages and farmers. He found that when it came to the selection of a pump driver for an irrigation well, 45% of his respondents said that the decision would be made by the general membership of the local cooperative, 8% said that the decision would be made by the cooperative's managing committee, 47% said it would be made by the chairman and manager of the cooperative, and the rest, most of whom were not cooperative members, didn't know how the decision would be made. None of the villagers said that the <u>sardars</u> and <u>matabbars</u> would participate in the selection of the pump driver. The survey revealed similar estimates of how decisions would be made to purchase rice mill shares, enroll new members in the cooperative, receive cooperative loans, distribute the loans, or select a site for an irrigation pump. The only cooperative decision in which the villagers surmised that the traditional leaders would play a part was whether the cooperative should participate in the women's program. Four percent of those surveyed thought that that decision would be made by the cooperative chairman, the cooperative manager, and the traditional leaders in concert, and another 4% thought the decision would be made by the traditional leaders alone.[25]

In addition to the insight which these responses give about the minimal influence of the <u>sardars</u> and <u>matabbars</u> on most decisions concerning the operation of the cooperatives, the answers also call attention to the real participatory democracy in the local cooperatives. Not only was the traditional elite excluded from vital decisions affecting the cooperatives, but the decision making power of the elected officers of the local cooperatives was restricted as well. Across the seven indicator decisions pertaining to cooperative affairs (selecting a pump driver, purchasing rice mill shares, enrolling new members, etc.) in his survey, Ahmed found that an average of 46% of the farmers surveyed thought that the general membership of the cooperatives would make the decisions.

A confusing aspect of Ahmed's monograph is that the influence of sardars and matabbars who joined the cooperatives is not differentiated from the influence of those who stayed aloof. Almost half of the 125 sardars and matabbars in the 29 villages in Ahmed's sample had joined a cooperative. And approximately half of those who had joined a cooperative had been elected to the managing committee of the organization. Eight of these had been chosen by their fellow directors as cooperative chairmen, five as vice chairmen, and four as managers. Another 10, for a total of 27, had remained as directors at large. While the wisdom of co-opting the traditional leaders into the cooperatives seems to have been widely recognized, the sardars and matabbars were generally shunted to the more ceremonial positions, such as chairman, rather than to the functionally critical position of manager. It seems that when Badruddin Ahmed reports that the traditional leadership took no part in decisions such as the distribution of cooperative loans, he was referring to the lack of influence of the traditional leaders who had not joined the cooperatives and been elected to their managing committees.

For four indicator decisions affecting village society (solution of disputes, punishment of culprits, prevention of an epidemic, and management of the maktab, or religious school), Ahmed reported a pattern of influence which was the reverse of that for decisions affecting the cooperatives. A majority of the villagers thought that these decisions would be made by the sardars and matabbars alone, while a quarter thought that the traditional leaders would be joined by the cooperative chairman and manager in making these decisions. The general membership of the local cooperative was expected to play hardly any role in these affairs.

Good relations between the cooperative leaders and the traditional leaders seemed to hinge on a mutual recognition of the sphere of influence of the other group. The division of responsibility was not complete, however, since some of the sardars and matabbars had assumed leading positions in the cooperatives, and since the cooperative leaders were sometimes consulted about social decisions. Badruddin Ahmed commented that another reason for the lack of apparent conflict between the two groups was that many of the kinsmen of the traditional leaders had been elected to leadership positions in the cooperatives. This observation squares with Peter Bertocci's findings in the villages of Hajipur and Tinpara, where electoral politics in the primary cooperatives was largely a matter of competition among locally prominent families. So if new leaders were brought forth as a consequence of the coming of the cooperatives, they may frequently have been younger relatives of persons of established influence. Like democratic institutions in most countries, the Comilla cooperatives mostly reflected, and only slightly reshaped, the status quo.

The linkages at the village tier which have been discussed so far -- linkages with the women's program, with the village neighborhoods, and with the traditional social leadership -- were horizontal in nature. Collaboration with groups such as these in the villages could be important to the success of the local cooperatives, but was not vital. The linkage that was essential led upwards, to the thana cooperative association. Anwarul Hoque put the matter well in his study of the Jangla cooperative:

> All of the respondents maintained that it would make a great difference if the village institution had not been a member of the Central Association for, in that case, the facilities

> provided by it could not be obtained elsewhere. They also maintained that if relations with the Central Association were broken, the Cooperative would not survive....
>
> The other government development agencies work along with the Central Association. Villagers cannot usually distinguish them as separate from the Central Association since the coordination is done at the thana level. The village societies receive services from these agencies mainly through the Central Association.[26]

The personal linkages enumerated by Hoque included the classes and meetings at the Abhoy Ashram campus which the chairman, manager and model farmer of the Jangla cooperative attended routinely. An inspector and a village accountant, both employees of the thana cooperative association, visited the village regularly. So five persons, three from the village cooperative and two from the thana association, served as dependable links between the two tiers of cooperative organization. They provided the multiple channels of vertical communication which Uphoff and Esman, it will be recalled, asserted were critical to an efficacious relationship.

Outside of the cooperative structure, vertical links to the village were feeble. Within the Basic Democracies system, there were fitful attempts to strengthen the electoral wards of the union councils as fundamental units of government which would be closer to the level at which the villagers actually lived. In some instances the union council representative from the ward served as an effective link to higher levels of government, but this was a matter of the personal style of the representative rather than an enforced requirement. Political parties did not reach down to the village level. The congregations and priesthood of Islam were not linked to one another in any formal hierarchy, such as is commonly found in Christian churches.

Summing up what has been said about the horizontal and vertical linkages of the village cooperatives, I would assert that with the partial exception of the link to the women horizontal relationships within the village were a matter of happenstance (though usually harmonious), and that vertical communication with the Thana Training and Development Center was typically constricted to the one channel of the cooperatives. The insufficiency of formal linkages in both directions placed limits on the extent to which the villagers could be mobilized for the purposes of rural development. I make this assertion not so much on the basis of the Cornell scriptures as on the basis of my own exposure to another example of the use of organization for the mobilization of the Asian masses.

When my year at Comilla was finished in the summer of 1966, I returned to the United States to study the language of a country where the political and military mobilization of the rural populace had become an issue of international significance. I was a young man, and the choice before me was evident: either go to Vietnam as a foot soldier, or go to Vietnam as a civilian. I chose the latter. For four years I worked as a refugee and local government advisor in the heart of the Mekong delta, as an advisor at a training camp on the Vung Tau peninsula, and as a correspondent based in Saigon. It has taken me a decade to rearrange in a sensible order the memories of the Pakistan Academy for Rural Development at Comilla. It will take a lifetime to sort through the exhileration, the terror, and the beauty of Vietnam.

The mechanism for mass mobilization which was employed by the ultimately victorious communists in South Vietnam was the National Liberation Front. The idea and the name of such a liberation front have been crudely copied by dissidents in many nations. Nowhere has a liberation front been so finely designed as was the NLF in rural South Vietnam in the nineteen sixties. The organizational experiment conducted during the same decade in the villages of Comilla, a thousand miles to the west, was a pallid venture by comparison.

When the great military force of the United States was thrown against it, and when the American shield provided a space for non-communist political and intelligence forces within Vietnamese society to muster themselves against it, the National Liberation Front of South Vietnam gradually unraveled. The civil war was won by the communists, in the end, through the might of their conventional army and through the spiritless incompetence of the army serving the Thieu regime. I came to Vietnam in 1967, when the National Liberation Front was past its heyday, and when it was preparing, in secret, to sacrifice the last of its best in the spasm of the 1968 Tet offensive.

For a description of the NLF at its peak in about 1964 or 1965, I have relied on a book which I read in 1966 in Honolulu, where I was then studying the Vietnamese language. Douglas Pike's Viet Cong[27] has been criticized as a mechanistic portrayal of the political struggle that was waged in the villages of Vietnam. But so also is organization theory a mechanistic abstraction, so the reference seems fitting for this volume.

There might, in an ideally organized Vietnamese village, be three functional liberation associations linked together into the village National Liberation Front Association. These were: the Farmers' Liberation Association, the Women's Liberation Association, and the Youth Liberation Association. Representatives of local religious groups and political parties would also be represented in the village associations. A central committee of the village National Liberation Front Association controlled the constituent liberation associations, and was in turn controlled, either overtly or covertly, by cadres who were members of the Peoples' Revolutionary Party. A platoon of guerillas might also be organized in the village.

From this thumbnail sketch of the organization of the National Liberation Front at the village tier one can properly infer that horizontal linkages to other groups in the village were more formal and more fully developed in the NLF than they were in the Comilla cooperatives. Like other totalitarian movements, the NLF sought the total mobilization of every segment of society. The NLF was distinctive in that it initiated that mobilization at a very low level of the organizational hierarchy, within the rural village.

Yet in the view of the leaders of the Vietnamese revolution the elaborate NLF network at the village tier was insignificant in and of itself. The dedicated revolutionaries in the Peoples' Revolutionary Party entertained no romanticism about village socialist republics comparable to the mysticism about village panchayats in India. The liberation associations provided what Douglas Pike has called an "organizational weapon" for the mobilization and control of the village people. The village level structure of the NLF was useful as a means for providing access to the villagers by higher level officials and military forces requiring the support of the village for the pursuit of the larger revolutionary war. Once horizontal linkages had been established within a village, the vertical linkages were developed. The vertical structure provided avenues of access to the village for agit-prop teams, tax collectors, cadres, and military forces -- for the whole panoply of revolutionary government at the district and provincial tiers. (The district and province in Vietnam are comparable to the thana and district in East Pakistan and Bangladesh.) Upon the horizontal foundation of the village-level National Liberation Front, a multi-channeled vertical structure was erected. All of the channels were controlled, to be sure, by the Peoples' Revolutionary Party. That probably was not the model which Norman Thomas Uphoff, who is a steadfast democratic pluralist, had in mind when he advocated a multiplicity of vertical linkages in rural development organizations. Yet it worked sufficiently well, after its fashion.

The relationship between the tiers of revolutionary organizations in Vietnam should not be misconstrued as having been that of a hierarchical bureaucratic structure of superiors and subordinates. In the revolutionary government of Vietnam there was great centralization of policy making, with the crucial directives coming from the central committee of the Peoples' Revolutionary Party or from COSVN, the Central Office for South Vietnam. This was accompanied by decentralization of implementation, so that units all the way down to the village tier had great flexibility in interpreting policy to fit their circumstances.

There was a connection between events in South Vietnam and in Comilla in the late fifties and early sixties, but it was not obvious. An apparent, but misleading, connection derived from Michigan State University's involvement in both places. From an acquaintance which an assistant professor of political science, Wesley Fishel, struck up in Tokyo in 1950 with a Vietnamese exile, Ngo Dinh Diem, there grew, after Diem became President of South Vietnam, the largest foreign technical assistance program undertaken in that era by any American university. The MSU group in Vietnam included, at its height, 51 members appointed by the University's Board of Trustees and 151 Vietnamese and other locally hired employees.[28] The MSU advisory project in Vietnam focused on strengthening public administration and police services. The project was sponsored jointly by the Government of the Republic of Vietnam and by the United States Operations Mission in Vietnam. MSU was phasing out of Vietnam by 1961, and at the same time was becoming heavily involved in the Ford Foundation funded project to assist the rural development academies at Peshawar and at Comilla. There was no transfer of personnel from the one project to the other, however. The MSU faculty who went to Vietnam came mainly from the departments of political science, criminal justice, and economics, whereas those involved in the Pakistan project held appointments in education, agricultural economics, and sociology. The two faculty empires for providing foreign assistance did not overlap.

One of the men who was appointed as MSU senior advisor at Comilla, Nicolaas Luykx, had been to Vietnam before he came to East Pakistan, but in the capacity of a graduate student doing field research for his doctoral thesis at Cornell University,[29] not as a faculty member at MSU.

The connection between the turmoil in South Vietnam and the rural development schemes in Comilla was not one of personnel going from one place to the other. It was, rather, a bond of anti-communist ideology which was shared by most Americans engaged in foreign assistance work in that era. The best exemplar of that ideology was one of the first advisors to the Comilla project, Henry W. Fairchild. He was stationed at Comilla as the senior advisor for four crucial years, from 1959 to 1963. Before coming to Comilla, he had worked as a rural development advisor in South Korea. Fairchild was one of a generation of messainic American anti-communists who saw their mission as arranging an alternative to radical revolution in post-colonial Asia. "Unfortunately...international communism has no compunctions at all about assisting or agitating in a nation outside of established government channels," Fairchild wrote. "The real problem faced by the United States Government and the responsible local politicians of the underdeveloped nation is this. Is there any better alternative for a people in this chaotic state than International Communism? As I have thought about the problem I have come to the conclusion that there is, but time is against it and International Communism has a well tested system. Nonetheless there is still a chance and that chance should not be lost."[30]

Fairchild has recorded a touching conversation which he had with Ali Akbar, his friend from the Comilla village of Lampur. Ali Akbar had learned English while serving the British military in Calcutta and in Comilla, where a major British headquarters had been located in World War II. One imagines Henry Fairchild and Ali Akbar sitting under a cocoanut tree in Lampur. After conversing about crops and cooperatives, Fairchild finally asks his wizened, English speaking friend about the spookish beings which inhabit the inner regions of his mind.

> I asked him once if he had ever heard of communism.
>
> Yes, he said, he had heard of it in Burma.
>
> "Are there any communists here?" I asked.
>
> "Not in this village," he said, "but there are some around."
>
> I asked him what he thought communism stood for. It stood for everyone being equal, ran

the answer. "What is being equal?" I asked.

He said, "The communists say this means taking land from the bigger farmers and giving it to those with no land."

"Do you want this?" I asked.

"I need more land," he said.

I asked him, "If you take land from the bigger farmers and give it to the ones without land would you get any land?"

"No," he said, "not in this village. There are about thirty families without land and only four or five families who have more than five acres."

I asked him then, "Do you know anything else about communism?"

"No," he said. "There was a man in Burma when I was there. He was a communist. Everybody said he was crazy. He was always trying to talk to us."

"What do other people of Lampur think of communism?" I asked.

"Moulana Ali Ashraf says its against Allah."

"Would you be against Allah?" I asked.

"No," he said, "I am a believer."[31]

Linkages With the Environment at the Thana Tier

The basic weakness of the pre-existant governmental structure in East Pakistan, in Akhter Hameed Khan's view, was its incapacity for productive collaboration with the villagers. The civil service worked efficiently at the provincial and district tiers, but between the district and village tiers good government plans were lost in implementation. "Good plans and poor implementation really indicate the absence of some links in the administrative chain," Akhter Hameed Khan observed.[32] "It was this weak link with the village which had to be forged. This new approach sets up powerful institutions at the thana level to support the village."

The concept of a Thana Training and Development Center, the aggregation of institutions which the rural development academy advocated establishing at the thana level, was introduced to the reader in Chapters 1 and 2. To review: its major components were a thana central cooperative association, a thana council, which was a part of the structure of Basic Democracies, and representatives of the nation building departments such as the Thana Agricultural Officer and the Thana Irrigation Officer. The complex was to include facilities for training many kinds of villagers, such as model farmers, managers and chairmen from the primary cooperatives, village accountants, midwives, and school teachers. Horizontal linkages of the thana cooperative association were to be established mainly within the framework of the Thana Training and Development Center (TTDC). Through the TTDC the thana cooperative association could call upon the Thana Agricultural Officer, for example, for assistance in training model farmers. Or, to take another example, the TTDC could facilitate the coordination of plans for low lift pump or tubewell irrigation among the thana cooperative association, the Thana Irrigation Officer, and the rural public works program conducted by the thana and union councils.

The departments, councils, and associations which were to be coordinated within the Thana Training and Development Center did not readily collaborate with one another. "Activating the departmental officers," A. K. M. Mohsen remarked, "seemed to be more difficult than mobilizing the people."[33] As late as 1969, when the Thana Training and Development Center at Comilla had been active for six years, there were reports of slack attendance by departmental officers in the meetings of the Kotwali Thana Council. Leadership of the institutional complex was a source of continuing disputes. The project director of the thana cooperative association and the Circle Officer of the thana (the lowest level officer in the system of general administration for the thanas, districts, and provinces of Pakistan) jockeyed for recognition as the commanding officer of the organizational complex. Not until 1970 was that contention officially resolved through the designation of the Circle Officer as the leader of the Thana Training and Development Center. His authority as the chief administrative officer of the thana was not automatically accepted. The provincial

Department of Agriculture, in particular, resisted the subordination of their staff to the Circle Officer. Senior officials in the Department of Agriculture were unsympathetic to the concept of a Thana Training and Development center, and sought to expand, instead, the standard type of centrally controlled extension system.

Ironically enough, the original model of an agricultural extension system was the Cooperative Extension Service of the first land grant college in the United States, Michigan State University. That model had been accepted as dogma by the midwestern schools which dominated American agricultural assistance to the less developed countries. American advisors and foreign graduates from these schools preached the dogma of extension, which fitted well with the paternalistic orientation of government leaders in post-colonial countries.[34] So when the MSU advisors in Comilla joined with the faculty of the Academy for Rural Development in advocating the training of model farmers as a more appropriate method of transmitting information to the farmers, they were doing battle with the ghost of their own university's success.

In the opinion of the Michigan State faculty who were associated with the Comilla project, the linkages which were most important to its eventual fruition were those which led from Comilla upwards to the power centers of the provincial and national governments. Professor Cole Brembeck, who was a member of the team of MSU faculty who recommended Akhter Hameed Khan for the directorship of the new academy in Comilla, recalls that Akhter Hameed Khan "had a peculiar power over the ministers of the national government. He would ring them up and say, ' That piece of paper is on your desk, is it not? We need your signature by 4 o'clock this afternoon.' and they would sign. The national leaders were afraid that Akhter Hameed Khan would enter national politics, and that he would be a winner. They were just as happy to keep him in office in Comilla rather than frustrate him into becoming active in national politics."[35]

Despite the academy director's prestige as a popular figure and as a former member of the revered elite of the Indian Civil Service, there were many occasions when his personal and ideological enemies nearly succeeded in conspiring to halt the experiment in Comilla. Richard O. Niehoff, a professor of education who was the chief MSU advisor for the Pakistan academies from 1962 to 1972, remembers the Deviationism Affair as "absolutely the most critical point in the evolution of the Comilla project."[36] The matter came to a climax at the first meeting of the Joint Board of Governors of the Pakistan Academies for Village Development. To comprehend the origins of the dispute which was resolved at that meeting, one must probe some of the very early history of the Comilla project.

According to a mimeographed pamphlet dated March, 1960, which was found in a box of Pakistan Project files in the MSU archives, "The beginnings of the academies can be traced to a conference on 14 October 1955 between Mr. Chaudhury Mohammad Ali, then Prime Minister of Pakistan, and Dr. George F. Gant, then representative of the Ford Foundation in Pakistan. The prime minister expressed particular interest in being advised as to ways in which officials and employees of the Government could be trained or retrained in concepts and techniques of modern administration in accordance with the aims of the government -- with particular reference to nation-building activities."[37]

Two years after this conversation between Chaudhury and Gant took place, the scheme for the academies which in the meantime had been developed, with Ford Foundation support, by Dr. Floyd Reeves and his team of Michigan State faculty was submitted to the Pakistan cabinet for its approval. In July of 1957 the cabinet passed a resolution endorsing the scheme for the academies. The dispute which was to baloon into the Deviationism Affair centered on the issue of whether the Comilla academy had adhered to or deviated from the intent of the July 1957 cabinet resolution. Several charges were made, such as that the academy was not training as many government officials as originally had been promised, and that the academy was overspending. The nub of the dispute, though, was that the Comilla Academy, under the leadership of Akhter Hameed Khan, was looking with a critical eye at the effectiveness of the government establishment in the field of rural development, and was seeking to invent new ways of solving rural development problems. The irreverence of this attitude did not sit well with several high-level Pakistani officials.

Richard Niehoff recalls that the leader of the clique of civil servants who were attempting to chastize the Comilla academy was Shafi Niaz, chief of the agriculture section of the Pakistan Planning Commission. One of Niaz's favorite complaints was that the Comilla academy was starting its own dairy, poultry farm, and agricultural demonstration plots, rather than relying on the demonstrations conducted by the technical departments of the Pakistan government. Niehoff prepared a voluminous report to defend the rural development experiments underway at the Comilla academy, in preparation for the decisive first meeting of the Joint Board of Governors for the Comilla and Peshawar (East and West Pakistan) academies which was held in the committee room of the Pakistan secretariat, building number one, in Rawalpindi on October 29, 1960. Niehoff and Akhter Hameed Khan attended the meeting, which was chaired by Lt. General W. A. Burki, Pakistan Minister of Health, Labor, and Social Welfare. After hearing some of the charges of deviationism at that meeting, Akhter Hameed Khan retorted angrily that if the Government of Pakistan was not prepared to support the sort of experiment that was underway in Comilla, then they could have his resignation. "I will give you gentlemen an annual report, and if at any time you disagree with it, you can have my resignation," Khan said.

General Burki, who had been listening silently to the argument, intervened at this point. If he had not done so, Richard Niehoff believes that the whole Comilla experiment would have collapsed at that very early stage. Burki said firmly, "If this is deviation, we have to have more of it." Burki told everyone present that the issue was closed, and that they should proceed with other business.

Niehoff and Burki became good friends thereafter. On each of his many subsequent trips to Pakistan, Niehoff tried to make a point of calling on General Burki. The general confided that he had been primed before the Rawalpindi meeting by the chief secretary of East Pakistan, who had sent him a note ahead of time saying that the new institution in Comilla was serving the needs of East Pakistan very well, thank you, and please don't change it.[38]

The sociology of the Deviationism Affair is intriguing. At the very top levels of the Pakistan government, among ministers such as General Burki and senior civil servants such as the chief secretary in Dacca, the Comilla experiment was strongly supported. The most influential supporter of all was the president of Pakistan, General Mohammad Ayub Khan. But among civil servants who were close to the center of power, but who were not members of the innermost circle, resentment of the Comilla academy and of its stiff-necked director, Akhter Hameed Khan, was often the predominant emotion.

The nature of the relationship between President Ayub Khan and Akhter Hameed Khan is subject to dispute. Lawrence Ziring, in his book on the Ayub era, goes so far as to characterize Akhter Hameed Khan as "President Ayub's closest advisor on village affairs and rural development."[39] When I asked Akhter Hameed Khan, in early 1977, for his assessment of Ziring's statement, he replied, "That is rubbish! I always kept my distance from Ayub Khan's regime. I consider Ayub Khan a good man, but I was always aware of his weaknesses. He was a kind of Colonel Blimp. Once I suggested to him that he should come to East Pakistan during the dry season and go to one of the rural works construction sites, to identify himself with the laborers. He asked me, 'But aren't these village people aware already that I am doing all this for them?' I told him that is not the way things go in politics. Ayub Khan asked me at one point to come to Rawalpindi and be his organizer for village affairs, but I refused." Akhter Hameed Khan disagreed with Ayub Khan's concept of using the union council members as an electoral college, but it seems that he did not make that disagreement known to the president.

Certainly the two men had a lot in common. They were both Pathans. They were of similar age, Ayub Khan being seven years older. Both had trained in England for service in the British imperial regime: Akhter Hameed Khan in Cambridge University in preparation for the Indian Civil Service and Ayub Khan at the Royal Military College at Sandhurst prior to his service in the British army in India. They both had held positions of significant responsibility under the

British: Ayub Khan as the commander of an army battalion in World War II, and Akhter Hameed Khan as a sub-divisional and debt settlement officer in Bengal in the nineteen thirties. They were, in essence, members of the same first generation of national leaders who had learned the skills of administration under British tutelage. Akhter Hameed Khan seems to have exploited this similarity in order to gain access to President Ayub Khan, thereby assuring top-level support for the experiments in Comilla. The best that can be said for the reciprocal relationship is that Akhter Hameed Khan made Ayub Khan's regime look good because it permitted a project which the villagers perceived as worthwhile to go forward.

Access to the higher levels of government in Pakistan was facilitated by Akhter Hameed Khan's status and connections, but another parallel channel was sometimes employed, and in the interest of historical accuracy deserves recognition. In Pakistan in the nineteen sixties there was a well established network of American advisors, some in the MSU Pakistan Project field staff, some in the Harvard Advisory Group, some directly connected to the Ford Foundation, and some in the U.S. Agency for International Development. These American advisors had counterparts and connections in the ministries and planning commissions of the central government and of the provinces of East and West Pakistan. Richard Patten, for example, was a member of the Harvard Advisory Group who was very well connected with the Department of Basic Democracies and Local Government in Dacca, and with its energetic and imaginative secretary, Musa Ahmed. Patten's intervention on behalf of the rural development concepts emerging from the Comilla experiment was crucial in several instances, as in the formulation of the Rural Public Works Program, and in the campaign for dry season irrigation with low lift pumps.

Richard Niehoff, the director of the MSU Pakistan project, had his home base in Pakistan in Rawalpindi, in West Pakistan. He campaigned vigorously to get the approval of the Pakistan government for the expansion of the Comilla project from a simple training academy to an experiment in rural development encompassing Comilla Kotwali Thana. In the course of that campaign, he recalled that he made so many trips over to Dacca that the government officials in the Dacca office of the Central Secretary of Agriculture came to call him Mr. Comilla. Finally he said, "Look, I will just get a sleeping bag and some K rations and camp out here until this thing is signed." The document authorizing the Academy to take control of Kotwali Thana was signed, due largely to the combined persuasion of Richard Niehoff and Akhter Hameed Khan.

The accomplishment which Niehoff recalls as being the most significant, especially in terms of the potential for replicating the rural development institutions in Comilla in other countries, was the formation of the Board of Governors of the Academy for Rural Development. Neihoff laid much of the foundation for the establishment of the Board, and wrote some of the government documents from which it took its charge. He argued that the academy should be accountable to its clients, the ministries which were to send their personnel to Comilla for training in the techniques of rural development. Accordingly, the membership of the academy's Board of Governors came to consist mainly of representatives of these client ministries. Because it was controlled by its clients, via the Board of Governors, the Comilla academy attained a degree of institutional acceptance within the Government of East Pakistan. The government came to embrace, one might say, its own gadfly.

The link to the Ford Foundation and its financial support provided the academy with much greater flexibility in experimentation than it would have had in dealing with the Pakistan government alone. In addition to the funds which it channeled to Michigan State University and to the Academy for Rural Development, the Ford Foundation provided a substantial grant of $810,000 to the Government of Pakistan for the agricultural modernization experiments being conducted by the Kotwali Thana Central Cooperative Association; much of this was to cover the foreign exchange costs of importing tractors and pumps, and furnishing them with spare parts.

The national politics of Pakistan and the provincial politics of East Pakistan had a definite influence on the course of events in Comilla. In an unusually candid interview in March of 1975, Akhter Hameed Khan discussed the political winds which had blown upon him during his tenure as the leader of the Comilla project. I have reconstructed his comments from my notes.

"The businessmen and the contractors were the financiers of the Muslim League. They financed almost an annual campaign against the cooperatives in Comilla. They organized demonstrations against me from 1965 onwards. Ayub Khan himself told me that the rightists had brought two deputations against me.

"The Muslim League leaders in the town of Comilla were the truckers and the contractors. Those were the most affluent groups. They used to use the butchers in Comilla as their muscle men, because the butchers were accustomed to bloodshed and could intimidate people by walking in front of a procession waving their knives. Then I organized the butchers into their own cooperative. The butchers were pacified; they no longer helped to terrorize the people. So the Muslim League leaders opposed me. They also resented my having organized the rickshaw drivers, who used to be the mainstay of their political demonstrations. Once they joined the cooperatives, the rickshaw drivers lost interest in the sham trade unions that had been set up for them by the Muslim League.

"The Maoist underground moved against me in 1967. They came to Comilla to urge the people to burn the irrigation pumps and tubewells. They attacked me as a non-Bengali, and threatened violence against me. But they couldn't make any progress in the villages at all. The only toehold they got was in the machine section of the KTTCA, where my organization was captured by the leftists. They agitated for the sheer joy of destruction. Parts were taken, and I finally had to dismiss several of the tractor station employees.

"The Awami League people also decided that they would destroy the Comilla project. They joined hands with the registrar of cooperatives in Dacca to oppose our cooperatives. When I was in Princeton in 1969, it came out in the Awami League newspaper that I had stolen 20 million rupees and had bought a hotel in Switzerland. When I returned from the United States I toured all the village cooperatives from the first of February to the first of May. I wrote a letter to the papers stating that the charges against me were false, and that I wanted to live in peace. There was a rally in Comilla of about 50,000 people in support of me. When the Awami Leaguers went out to the villages they learned that the line of attacking me and the cooperatives was not popular. In July of 1970 the Awami Leaguers switched their position, and thereafter they gave me their support.

"The disintegration of government became severe in the late sixties, during the long fall of Ayub Khan and afterwards. It got to the point that there was no government. The police, for example, would give us absolutely no help. When I fired the employees from the tractor station they came around to the creamery section and threatened to burn it. The creamery and cold storage staff asked me what they should do. I said we should not beg the police for help because the police were aware of the problem and did nothing about it. So I advised them that the next time those ruffians came around they should defend themselves. They did. They took iron reinforcing rods and threatened to beat the fellows up. After that there was no more trouble.

"During the early years we could impose discipline in the cooperatives because there was a government. Ayub Khan wanted this work done, so the administration supported us. After 1967 there was no government. From 1968 on all the politicians were saying that the loans issued by the cooperatives should not be repaid.

"It has been said that the Comilla program was not political, and mostly that is true. But to keep it alive I kept in touch with the national government, particularly under Ayub Khan, and with the opposition brain trusters of the Awami League. And if that is not politics I don't know what is. When the Awami League came into power in the new government of Bangladesh, their rural development program was essentially the Comilla program."

Notes for Chapter 6

Linkages to the Environment

[1] Daniel Katz and Robert L. Kahn, The Social Psychology of Organizations, John Wiley and Sons, New York, 1966, p. 17. Reprinted by permission of John Wiley and Sons.

[2] Norman T. Uphoff and Milton J. Esman, Local Organization for Rural Development: Analysis of the Asian Experience, Rural Development Committee, Cornell University, 1974, p. 100.

[3] Milton J. Esman, "The Elements of Institution-Building," in Joseph W. Eaton, ed., Institution Building and Development, From Concepts to Applications, Sage Publications, Beverly Hills, 1972, p. 25.

[4] Ibid., p. 26.

[5] Lecture notes, Agricultural Economics 865, Michigan State University, 1975.

[6] Joseph W. Eaton, "Institution Building as Planned Change," in Joseph W. Eaton, op cit, p. 13. Reprinted with permission.

[7] Esman, op cit, p. 25.

[8] Uphoff and Esman, op cit, p. 3. Italics in the original.

[9] Melvin G. Blase, Institution Building: A Source Book, Midwest Universities Consortium, East Lansing, 1973, pp. 6, 7. Reprinted with permission.

[10] Uphoff and Esman, op cit, p. 111.

[11] Ibid., pp. XI, XII.

[12] Ramakrishna Mukherjee, Six Villages of Bengal, Popular Prakoshan, Bombay, 1971, p. 31.

[13] Florence E. McCarthy, Bengali Village Women: Mediators Between Tradition and Development, Masters Thesis, Michigan State University, 1967.

[14] Ibid., pp. 132, 133.

[15] Akhter Hameed Khan, The Role of Women in a Country's Development, Pakistan Academy for Rural Development, Comilla, 1963, pp. 2, 3.

[16] Elliot L. Tepper, "The Administration of Rural Reform: Structural Constraints and Political Dilemmas," in Robert D. Stevens and Peter J. Bertocci, eds., Rural Development in Bangladesh and Pakistan, The University Press of Hawaii, Honolulu, 1976, p. 32.

[17] Peter J. Bertocci, "Social Organization and Agricultural Development in Bangladesh," in Stevens and Bertocci, op cit, p. 161. The figures are for 1963.

[18] The absence of a village focus was more marked in Bengal than in other regions of the Indian sub-continent. The reason for this, it has been suggested, was that the principle of individual land ownership was entrenched in Bengal. In some other parts of ancient India village lands were held in common, and therefore had to be managed in common. (See S. A. Qadir, Village Danishawar, Pakistan Academy for Rural Development, Comilla, 1960, p. 21.)

[19] Anwarul Hoque, "Cooperation under Extreme Traditionalism and Unfavorable Physical Conditions: A Study of a Cooperative in an East Pakistan Village," in Inayatullah, ed., Cooperatives and Planned Change in Asian Rural Communities, United Nations Research Institute for Social Development, Geneva, 1970, p. 67.

[20] Abdul Muyeed, Strategies Evolved in a Development System of Planned Social Change in Rural East Pakistan: A Study of the Process of Institution-Building and its Integration in the Politico - Administrative Structure, Ph.D. Thesis, Michigan State University, 1969, p. 68.

[21] Peter J. Bertocci, Elusive Villages: Social Structure and Community Organization in Rural East Pakistan, Ph.D. Thesis, Michigan State University, 1970, p. 150.

[22] Ibid., pp. 159, 160.

[23] M. Nurul Huq, Village Development in Bangladesh (A Study of Monogram Village), Bangladesh Academy for Rural Development, Comilla, 1973, p. 92.

[24] Abdul Muyeed, op cit.

[25] Badruddin Ahmed, Leadership in Village Cooperatives, Bangladesh Academy for Rural Development, Comilla, 1972, p. 15.

[26] Anwarul Hoque, op cit, pp. 81, 82.

[27] Douglas Pike, Viet Cong, The M.I.T. Press, Cambridge, Massachusetts, 1966.

[28] Guy H. Fox, Final Report Covering Activities of the Michigan State University Vietnam Advisory Group for the Period May 20, 1955 - June 30, 1962, MSU Group, Saigon, 1967, p. 1.

[29] Nicholaas G. M. Luykx, III, Some Comparative Aspects of Rural Public Institutions in Thailand, the Philippines, and Vietnam, Ph.D. Thesis, Cornell University, 1962.

[30] Henry W. Fairchild, "Stopover at Comilla, 1959-1963," unpublished manuscript in the Asia Collection of the MSU Library.

[31] Ibid.

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[33] A. K. M. Mohsen, Report on a Rural Public Works Program, Pakistan Academy for Rural Development, Comilla, 1962, p. 18.

[34] Akhter Hameed Khan, Transfer of the American Model of Agricultural Extension to Ex-Colonial Countries, Rural Development Project, Michigan State University, 1978.

[35] Conversation with the author, 1977.

[36] Conversation with the author, 1976.

[37] "Summary of Essential Background Facts on the Pakistan Academies for Village Development as of 21 March 1960," authorship not noted.

[38] The note from the Chief Secretary had been drafted, at his request, by Akhter Hameed Khan and Richard Niehoff.

[39] Lawrence Ziring, The Ayub Khan Era: Politics in Pakistan, 1958-1969, Syracuse University Press, Syracuse, New York, 1971, p. 156.

CHAPTER 7

The Psychosocial Subsystem

	Operating Plant	Operational Control	Management Control	Strategic Planning
Static structures	S			
Simple machines	ST			
Machines with input	STE			
Organic systems	STEP			

Social structures are essentially contrived systems. They are made by men and are imperfect systems. They can come apart at the seams overnight, but they can also out last by centuries the biological organisms which originally created them. The cement which holds them together is essentially psychological rather than biological. Social systems are anchored in the attitudes, perceptions, beliefs, motivations, habits and expectations of human beings. Such systems represent patterns of relationships in which the constancy of the individual units involved in the relationships can be very low. An organization can have a very high rate of turnover of personnel and still persist. The relationships of items rather than the items themselves provide the constancy.[1]

Introduction

In the third chapter, a visual paradigm for organizational analysis was presented as Figure 3-16. Since the diagram incorporated the contents of two figures in Kast and Rosenzweig's text, it was rather complex. To simplify interpretation of the paradigm, an exploded view of it was also displayed. That view is reproduced in Figure 7-1.

The labelling of three of the subsystems in Figure 7-1 as nuclear, and of three as orbital subsystems should not be taken too seriously. The analogy with the structure of an atom, which has several particles clumped together at the center and has shells of orbiting electrons, was made to give visual emphasis to the idea that the three most critical subsystems in an organization are the structural subsystem, the technical subsystem, and the psychosocial subsystem. Together with the pattern of linkages with the environment (including input and output flows), these three subsystems define the essential operating characteristics of the organization.

Another heuristic virtue of the paradigm shown in Figure 7-1 is that it calls attention to the areas in which the three nuclear subsystems overlap. In chapter five, accordingly, the interaction of the technical and the structural subsystems was examined. In this chapter, which treats the psychosocial subsystem, the interdependency of the psychosocial subsystem, the structural subsystem, and the technical subsystem will be investigated. The central region in which these three subsystems converge has been labelled the operating plant in Figure 7-1. From the interaction of these three subsystems in an organization's operating plant, the most essential qualities of the organization emerge.

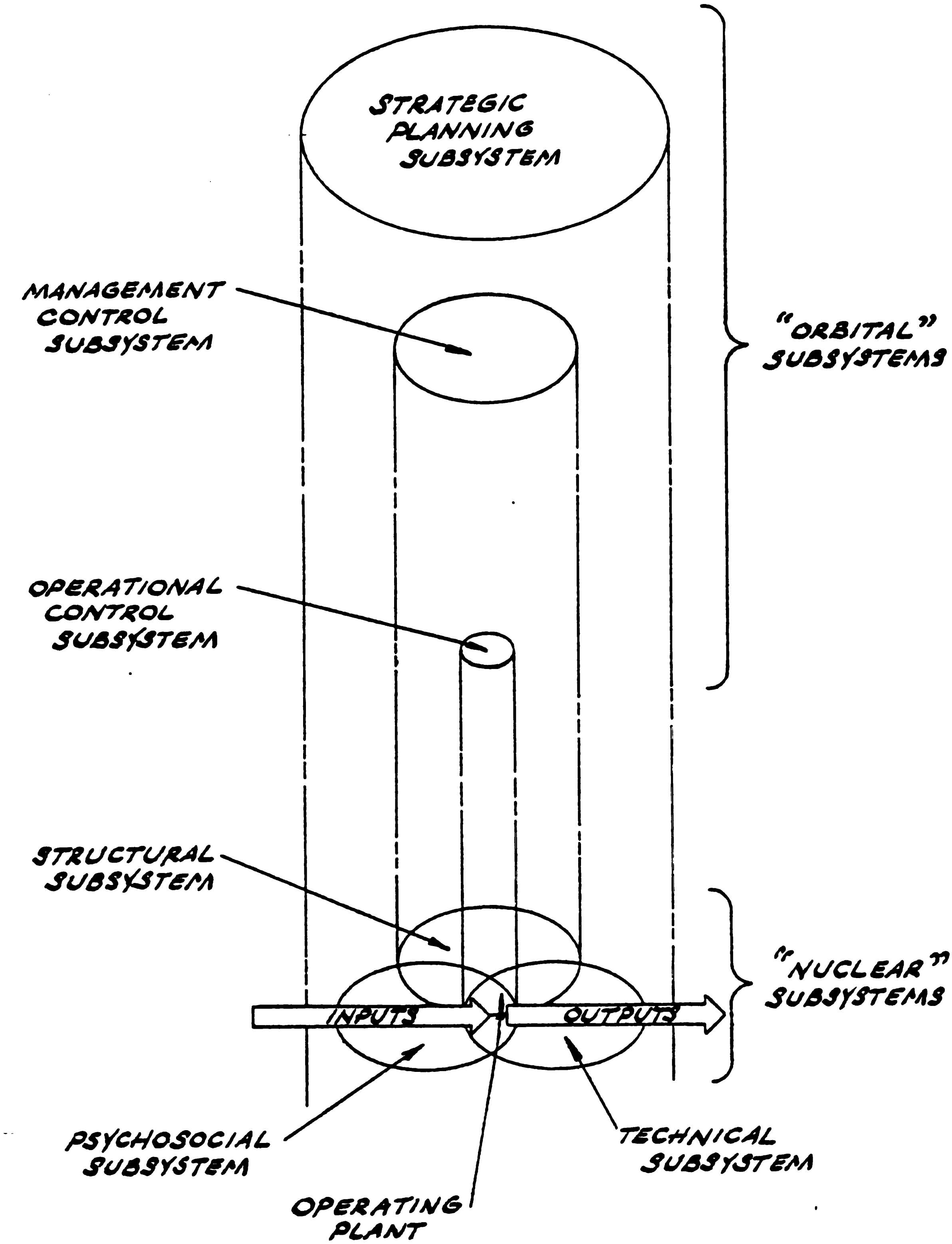

FIGURE 7-1 EXPLODED VIEW OF THE ORGANIZATIONAL PARADIGM.

The concept of a psychosocial subsystem advanced by Fremont Kast and James Rosenzweig was also discussed in the third chapter, and a substitute definition of the psychosocial subsystem was proposed. The psychosocial subsystem was redefined as <u>that set of beliefs and practices which sustain functional order in the working relationships of the organization's participants</u>. Although this concept was touted as being more precise than Kast and Rosenzweig's, it does require clarification.

The first question that needs to be answered before this definition can be applied is: What is functional order? A method of addressing that question can be found in Figure 7-1. The psychosocial subsystem contributes to the maintenance of order in: 1) the structural subsystem, 2) the technical subsystem, and 3) the internal consequences of an organization's linkages with its environment. The structural and technical subsystems of an organization are bonded to the human psyche by a configuration of status and role relationships. These are part of the organization's psychosocial subsystem.

Fremont Kast and James Rosenzweig, who invented the term "psychosocial subsystem," do not explicitly consider the interaction between the psychosocial subsystem and the other subsystems in an organization. In a few passages, such as those quoted below, they demonstrate a flickering awareness of the interdependence of the psychosocial subsystem and other subsystems in an organization, but they do not develop the argument in a formal way.

> Individuals in social relationships constitute the psychosocial subsystem in organizations. The general "atmosphere" is affected by many variables, some integral, others peripheral. Societal culture sets an overall framework; industry mores and practices have an impact; and many variables are peculiar to specific organizations. Technology and structure affect organizational

climate, as do employee attitudes and morale.

> Status systems serve to structure social relationships and provide a framework within which group endeavor can be coordinated toward objectives. Role systems are integrally related with status systems. Status concerns the relative prestige of a position in a structural relationship within organizations; role relates to the behavior patterns identified or expected for a given position.[2]

There was a brief mention in the third chapter of the restrictiveness of the definition of the psychosocial subsystem adopted for the purposes of this volume. The maneuvering and obstructionism which so often are to be found in organizations did not seem to have a place in the functional concept of a psychosocial subsystem. Positive attitudes which reinforce and stabilize the structural and technical subsystems could be treated within the context of the proposed definition. Yet obtuse or self-serving attitudes, though they might be prevalent among the organization's members, would seem not to be a part of the psychosocial subsystem. Political struggle within the organization might also seem out of place.

Very few organization theorists are well schooled in political science. The tumult of politics is beyond their recognition. Yet politics is an aspect of personal interaction which can be of overwhelming importance for a rural development organization, as Uphoff and Esman indicate in two of their seven propositions about the desiderata for successful rural development.

- "<u>Distribution of assets and income</u> poses a serious political issue whenever raised.... More equitable distribution appears to be a necessary if not sufficient condition for extensive rural development, though enclave development can occur in its absence."

- "Politics, the competition among groups for influence and resources, must be accepted as inevitable and legitimate in rural local organization. We must recognize that there will always be politics and that it can distort and corrupt instead of reconcile and uplift. The basic objective should be that all people be included in a share of benefits.... What must be avoided is the politics of exclusion or monopoly, where practices of patronage cut certain persons or groups off from the benefits of government. This is devastating to an organization's legitimacy and ultimately to its effectiveness."[3]

Are these political factors, since they may serve to disrupt rather than to stabilize the structural and technical subsystems, to be considered as outside of the compass of the psychosocial subsystem? If no way were to be found to accomodate the review of these forces, then the analytic paradigm presented in this book would have to be judged deficient.

A study of the physiology of the human body would be incomplete if the disruptions of discare were ignored. The analogy is not entirely fair, since Uphoff and Esman pointed out that politics can be just as much a positive as a negative influence in rural development organizations. All politics should not be equated with organizational disease. An inclusive political process may, in fact, contribute significantly to the legitimacy of the organization, reinforcing the credibility and status of its leaders, and thereby strengthening the structural subsystem.

Relevant Research

To prepare a theoretical foundation for the consideration of the psychosocial subsystem in the Comilla cooperatives, strands of research must be brought together from the fields of institution-building, political science, and non-formal education. Because of the intellectual walls which usually divide these disciplines from one another, their union may seem strange, perhaps forced. The reader's patience is solicited.

The Inter-University Research Program in Institution Building was introduced in the last chapter. There the notion of linkages, which is one aspect of the institution building perspective, proved helpful in explaining the relationship of the Comilla cooperatives to their environment. The overall institution-building schema has been summarized by Milton Esman, chief theoretician of the inter-university research program, in the diagram shown as Figure 7-2.

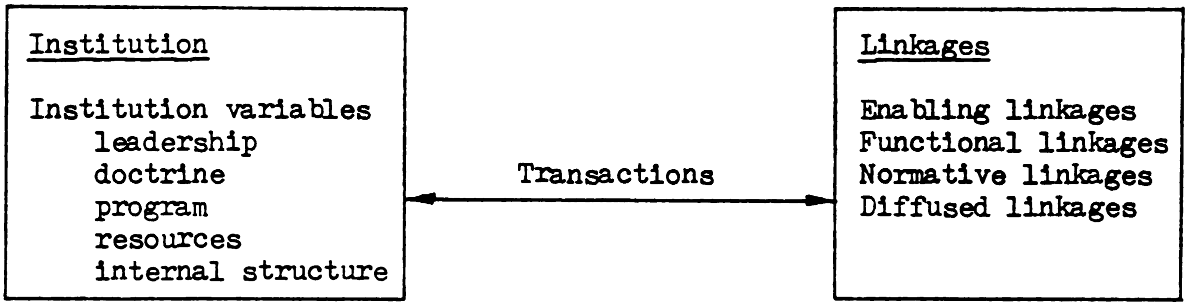

Figure 7-2: The Institution-Building Universe.[4]

Scholars in the institution-building research program were disappointed by the inutility of their fourfold taxonomy of linkages, so the discussion in Chapter 6 disregarded the distinctions displayed on the right hand side of Figure 7-2 among enabling, functional, normative and diffused linkages. A simple distinction between horizontal and vertical linkages was employed instead.

The discussion in this chapter focuses on the contents of the left hand side of Figure 7-2. The five significant components of an institution are there described as leadership, doctrine, program, resources, and internal structure. At least one of these phrases, internal structure, should seem familiar to the reader. Chapter 4 of this book dealt with the structural subsystem of the Comilla cooperatives. The combination of Esman's two variables of program and resources can be compared to the technical subsystem of Chapter 5. Another association can be made between leadership and the management subsystems which will be treated in Chapter 8. From these comparisons, it is simple to make the inference that doctrine is the subject matter of this chapter.[5]

Of all the institutional attributes highlighted by the institution-building model, Milton Esman thought that doctrine was the most elusive and one of the most important. In a retrospective essay he commented, "The original institution building definition of doctrine as the 'specification of values, objectives, and operational methods...the stable reference point...' has been proved by several researchers to be too static and too monolithic.... Institutional doctrine is a combination of these themes which can be and are manipulated by institutional leadership to enhance internal cohesion, and to make it more acceptable in the external environment. Management of values is not a trivial function of leadership, especially in an organization committed to innovative purposes in an environment where neither the organization nor its innovations have yet been accepted."[6]

There is considerable overlap, evidently, between the attribute of doctrine, which Esman contends can "enhance internal cohesion," and the concept of a psychosocial subsystem, which was defined above as sustaining "a functional order in the working relationships of an organization's participants." Are the concepts identical, or does one contain some elements not found in the other? If the two concepts were really identical, why should we not relabel the psychosocial subsystem the "doctrinal subsystem," and be done with it?

In their own paradigm for organizational analysis, Fremont Kast and James Rosenzweig include what they call a "goals and values subsystem." Values and doctrine are such similar constructs that Esman treats them as synonymous. In the discussion of Kast and Rosenzweig's paradigm in the third chapter, I argued that the goals and values subsystem could be abolished as an analytic category. As described by Kast and Rosenzweig, it was not a subsystem. Values could be addressed, I contended, in the context of the psychosocial subsystem. And it is here, indeed, that we have come across them under the rubric of doctrine.

The addition of doctrine, or organizational values, to the psychosocial subsystem gives no cause for concluding that doctrine comprises the sole contents of the subsystem. All is still present that resided in the psychosocial subsystem before the addition of the subject of doctrine. Status and role relationships, mentioned earlier, are good examples of other factors which belong in the general category of the psychosocial subsystem. Yet there is no heading in the institution building paradigm under which status and role relationships can be discussed. This logic demonstrates that the institution building paradigm displayed in Figure 7-2 is less comprehensive than the paradigm shown as Figure 7-1.

Since Milton Esman admits that he found the concept of doctrine to be elusive, I will turn to two political scientists, Gabriel Almond and Sidney Verba, who have executed a brilliant empirical study of the related construct of political culture. In their classic book, <u>The Civic Culture</u>, Almond and Verba make use of the concept of culture in the sense of "a psychological orientation toward social objects."[7] The political culture, they say, consists of "attitudes toward the political system and its various parts, and attitudes toward the role of the self in the system."[8] This is a more diffuse and fundamental concept than that of political doctrine, which would consist of ideological beliefs about the political system, founded upon the attitudes incorporated in the political culture.

Previous to Almond and Verba's monumental research project, which was conducted in 1959-60, many investigations had been undertaken of the influence of family patterns and child rearing practices upon national politics. Most such studies, such as those which linked the authoritarian German family to the fragility of democracy in the Weimar republic, had been centered on one country. Almond and Verba compared the political cultures of five countries -- the United States, Great Britain, Germany, Italy and Mexico -- on the basis of 1,000 interviews in each country. From such a huge data base, any quick-minded social scientist could derive a host of conclusions. The main thing that saved Almond and Verba's book from the appearance of a statistical digest is that they did not analyze their data by computer, theirs being one of the last great examples of survey research in the pre-computer era.[9] The wealth of findings reported in the book is not susceptible to a quick summary, so I shall forgo the attempt.

For our purposes, the most useful chapter in Almond and Verba's book is the last, which contains no tables at all. In that summary chapter, the authors describe the sort of political culture which they found, from their studies of the five nations, to be most suitable to a stable democracy. They described the civic culture as a mixed culture, in which

> There is political activity, but not so much as to destroy governmental authority; there is involvement and commitment, but they are moderated; there is political cleavage, but it is held in check. Above all, the political orientations that make up the civic culture are closely related to general social and interpersonal orientations. Within the civic culture the norms of interpersonal relationships, of general trust and confidence in ones social environment, penetrate political attitudes and temper them.[10]

Trust and confidence. Those are not the terms in which the typical Bengali village has been described. Atomized and suspicious would be closer to the mark. Muslim Bengali women, as we have seen, are confined by tradition to their <u>baris</u>, and must overcome powerful social injunctions if they seek to build trustful relationships with women from other quarters of their village. The men congregate in their mosques and in their clans, but they do not have strong communal loyalties. Yet if attitudes of trust and confidence are fundamental to the civic culture, and if the civic culture is the basis of democracy, how could it be expected that a democratic organization such as a cooperative would thrive in rural East Pakistan or in Bangladesh?

Part of the answer, as we shall see in the next chapter, is that some of the most successful village cooperatives were more authoritarian than democratic. Still, the official management structure of the village cooperatives was democratic in form, having elected officers and relying on frequent participation by the membership in decision making. If the attitudes which were appropriate to this form of organization were not present to begin with among the villagers, could it be that the cooperatives in some manner instilled them?

Almond and Verba ponder the same sort of issues in the last pages of their book. They wonder how democracy can be expected to take root in the developing countries, where the prevalent political culture is typically very different from that found in the United States and in Great Britain. The sense of involvement with the democratic political system, and of commitment to it, is often weak in such countries. Political cleavages predominate over political bonds. The atmosphere is not right for democracy. How, then, can the civic culture be created, or approximated, out of alienation and hostility? Almond and

Verba's response is brief, and not well thought out. They suggest, in the next to the last paragraph of their book, that in the developing countries education and industrialization will enhance the attributes which make up the civic culture.

This was not a consistent position for Almond and Verba to assume, since in earlier passages they make it clear that the civic culture has not been taught in the schools in the United States. The political culture which has been advocated in high school civics classes is a rational-activist culture, in which the citizen is expected to be forever calculating his advantages and involving himself in all aspects of the political process. In the civic culture, by contrast, the citizen <u>believes</u> he is capable of influencing the government, but is <u>actually</u> passive most of the time. The possitivity of the citizenry allows the official elites the latitude necessary to govern. The civic culture is learned in the United States, Almond and Verba contend, through informal out-of-school observation of the political behavior of family members, friends, and respected acquaintances.

In the early nineteen sixties, when Almond and Verba wrote their book, education was still usually equated with schooling. Many deficiencies of this equation have since come to the fore, such as: that it neglects the learning potential of adults, that it is too expensive as a means of teaching all of the burgeoning population of developing countries, and that it biases education toward a narrow band of academic subjects. Enlightened policy makers have since come to recognize that education which takes place out of school and which is more closely focused on specific skills, from literacy to line-sowing, is more suited to many of the needs of developing countries. Non-formal education is the label which is generally applied to such modes of instruction.

The chain of thought which has been developed above leads to the conclusion that non-formal education is the technique of preference for inculcating the attitudes which would bind a rural development organization together. The skills required for effective participation in and management of a rural development organization could also be imparted through non-formal education. These conclusions may seem obvious here, but I have been amazed to discover that they are almost entirely absent from the literature on non-formal education, and from the literature on institution-building. Some examples of this oversight are cited below.

The late Frederick H. Harbison of Princeton University was one of the most distinguished advocates of the importance of non-formal education in developing countries. In his book Human Resources as the Wealth of Nations, Harbison advocated an alternative to the Gross National Product, or GNP, measure of national economic growth. The GNP approach measures progress in terms of the production of goods and services. In order to accelerate such production, economic development policies based on the GNP approach may favor capital-intensive modern economic enclaves, usually in urban areas, at the cost of neglecting the persistent unemployment of the mass of the country's labor force. The human resources approach, instead, holds that the ultimate basis of wealth is the realization of human potential rather than the accumulation of material objects. Under a development policy guided by the precepts of the human resources approach, the employment and improvement of the entire labor force, including the residents of rural areas, becomes a central goal. Both formal and nonformal education contribute to the employability, enrichment, and productivity of the labor force.

Harbison admits that organization is the most perplexing of all human resources problems. "Organization is required to mobilize the energies of the labor force. It is necessary to create a state, to build economic and political institutions, to propagate ideologies, and thus to carry forward every aspect of national development.... In the human resources perspective, organization-building is the most critical of all tasks for national development. Good organization makes it possible to maximize employment and learning opportunities; poor organization can perpetuate the underdevelopment and underutilization of the capacities of man."[11] The proposition is grand, but the sequel is incredibly feeble. In the three sentences which follow the ones just quoted, Harbison says that nobody knows how to design organizations that are suitable to the needs of developing countries, or to produce the organization-builders who will construct them. In sad contrast to his populist faith in the productive potential of the labor force in other spheres, Harbison implies that organization building is an elite activity. He expresses the hope that organization-builders will arise out of the welter of learning opportunities provided by a human resources approach to development. The issue is dropped there, and never raised again in his book.

Nonformal educational endeavors in rural areas of the developing countries are uncoordinated, unevaluated, and inefficient. Such is the complaint of Philip Coombs and Manzoor Ahmed, authors of a World Bank sponsored study on the potential contribution of nonformal education to the alleviation of rural poverty. They say that what has been missing is a unifying doctrine, "an all encompassing vision of what the basic social mission of agricultural education and research should be and of what different elements, in conjunction with one another, would be required in order to accomplish that mission."[12] How might such a doctrine be elaborated and imparted? Coombs and Ahmed's suggestion is a pallid one, but characteristic of their professional outlook as international consultants. Each developing country should "undertake a comprehensive and dispassionate appraisal of its agricultural knowledge system. This effort should be led by one or more broad gauged senior analysts who have no axe to grind either for or against any particular component, and should involve the participation and close cooperation of all interested government organizations."[13] Imagine the benighted fisheries officer and plant protection officer in some remote riceland seat of government seeking mutual inspiration from the doctrine resulting from this dispassionate, bureaucratic review!

As a part of their investigation of rural local government in Asia, the Rural Development Committee at Cornell commissioned a study of training and research related to rural development. The report of the working group on Rural Development Training and Research makes no mention of the role of training as an instrument for institution building. The strategy of extended rural development, the report asserts, "<u>very much depends upon an expanded and well-articulated system of organization down to and including the local level</u>."[14] But even in the passages of the report that deal with institution-building, the contribution which training can make to the crystallization of such local organizations is neglected.

In 1976 the U.S. Agency for International Development underwrote a conference on Non Formal Education and the Rural Poor which was held at Michigan State University. Syed A. Rahim of the East-West Communication Institute, in Honolulu, presented a paper at the conference on the non-formal education aspects of the Comilla project. Rahim describes the many training sessions for model farmers, village cooperative managers, and others that were held at the Thana Training and Development Center at Abhoy Ashram in Comilla. He also mentions the in-service training of government officials conducted at the Academy for Rural Development campus at Kotbari, a few miles away. The purpose of all this training, as Rahim describes it, was to encourage acceptance of proposed innovations. Rahim's major example of an innovation is technical, the cultivation of rice according to the methods advocated by the Japanese agricultural experts at Comilla. Rahim showed no perception of the contribution of training to obtaining acceptance of organizational innovations.[15]

The scholars who participated in the Inter-University Research Program in Institution Building were caught up in the exposition and critique of their analytic paradigm, and gave out very little advice as to how someone engaged in the task should go about building an institution. Despite their academic origins, these pundits did not recognize the significance of learning in building institutions. Yet it is inescapably apparent, from deductive logic alone, that roles, status and doctrine are learned. The people who participate in organizations may change from year to year, but there is a discernable constancy in the way the participants view roles, status, and doctrine in the organization. They must have learned these things. And where there is learning there must be education, even if it is the sort of informal education which comes from observing and conversing with other workers on the job.[16]

For models of how education can be mobilized in the service of institution-building let us turn to the revolutionary periods in China and Vietnam. In the nineteen thirties in China and in the nineteen sixties in Vietnam revolutionary organizations of all sorts -- armies, parties, peasant associations -- were constructed by communist insurgents out of the same sort of quarrelsome, tradition-bound, and seemingly intractable people as must form the basic material of rural development organizations around the world. These revolutionary organizations proved to be supple and powerful. They were built, in large part, through non-formal education.

First an example of fairly formal education for revolutionary institution-building. After the Long March which took them 6,000 miles around the periphery of China, past the snowy borders of Tibet, and to the security of a new base in the empoverished northern province of Shensi, the Chinese communists set about rebuilding their forces in preparation for a protracted war. Mao Tse Tung himself had admitted that in the southern base area which the reds had been forced to abandon insufficient time had been devoted to training the communist army. He had observed in 1928, six years before the start of the Long March, that "The average soldier needs six months' or a year's training before he can fight, but our soldiers, though recruited only yesterday, have to fight today with practically no training to speak of. Exceedingly poor in military technique, they fight by courage alone."[17] The mistake of neglecting training was not to be repeated in the Shensi base area.

In 1936 a young American reporter, Edgar Snow, penetrated to the rebel stronghold in Shensi and spent four months there interviewing the communist leaders and soldiers. He visited the Red Army University, which was led by a brilliant 28 year old army commander named Lin Piao, who was reputed never to have lost a battle. With some modifications, the Red Army University was recognizable as an officers training academy such as all modern armies maintain. Classes of the Red Army University were held in caves, and for paper students used the blank sides of nationalist propaganda leaflets. For every two years of active service, an army commander or commissar was required to spend four months in training. This was a higher ratio of training time to service time than is to be found in most armies, certainly more than would be the case in other armies at war. The content of the training, also, was distinctive. Political and doctrinal matters were given equal emphasis with military skills, as Edgar Snow discovered to his embarassment when he offered to answer questions from cadets on current affairs. He was showered with pointed, knowledgeable inquiries such as:

"What is the future of the international student movement, which has its center in Paris?"

"In your opinion, can Leith-Ross's visit to Japan result in Anglo-Japanese agreement on policies toward China?"[18]

Classroom training was not the only, or the most important, method of education employed in the Chinese red army. The most common and potent method was education by example. This was deemed especially proper in the teaching of social status relationships, which were intended to be egalitarian rather than hierarchical. In a report to the central committee of the Chinese Community Party, Mao Tse Tung wrote:

> All alike share the same hardships; everybody from the army commander down to the cook lives on a daily fare worth five cents, apart from grain. In the matter of pocket money, if two dimes are alloted, it is two dimes for everybody; if four dimes are alloted, it is four dimes for

everybody.

> Apart from the role played by the Party, the reason why the Red Army can sustain itself without collapse in spite of such a poor standard of material life and such incessant engagement is its practice of democracy. The officers do not beat the men; officers and men receive equal treatment; soldiers enjoy freedom of assembly and speech; cumbersome formalities and ceremonies are done away with; and the account books are open to all.... The newly captured soldiers in particular feel that our army and the Kuomintang's army are worlds apart. They feel that, though in material life they are worse off in the Red army than in the White army, spiritually they are liberated.[19]

These two methods of teaching -- didactically and by example -- were combined and exploited to an unprecedented degree by the insurgents in south Vietnam in the nineteen sixties. In the secure base areas an extraordinary number of people were trained for all sorts of roles -- as officers, as medics, as nurses, as political cadre. When I was stationed in Sadec, in the middle of the Mekong delta, in 1967 and 1968 I would talk now and then to the revolutionary defectors, or Hoi Chanh, at the provincial reeducation center. It was astonishing how many of them had travelled to the mangrove swamps of Camau, at the tip of the delta, to attend training sessions. In the locale where the guerilla war was being conducted, moreover, the insurgent troops would spend most of their time training, planning, preparing themselves for battle, conducting propaganda among the villagers, and farming. Douglas Pike contends that in the period of 1962-63, when the intensity of the guerilla war was only moderate, a typical Main Force unit would spend only one day a month in combat.[20]

In organizational sophistication, the communist revolutionaries in Vietnam surpassed by far their mentors in China. For Mao Tse Tung, the primary instrument of revolution was the red army, which he maneuvered brilliantly around the huge territory of China. Mao had no exact counterpart in Vietnam, since as an intellectual and a theoretician he stood head and shoulders above the Vietnamese communists. The Vietnamese political leader most analogous to Mao Tse Tung was Ho Chi Minh. Ho was once asked why he didn't write books in the manner of Mao Tse Tung. He laughed and retorted, "If there is a subject Chairman Mao hasn't written about, tell me and I'll try to fill in the gap."[21]

The gap that Ho Chi Minh filled in actuality was one that he did not expound upon in writing. Ho was a master inventor of front organizations. The Viet Minh, under whose banner the Vietnamese fought for their independence from the French, was the most renowned front organization founded by Ho Chi Minh. Parties as well were maneuvered by him like front organizations. He would found them, infiltrate them, disband them, and change their names, always with the aim of promoting revolution, independence, and national unification. For Mao Tse Tung the revolution was war; for Ho Chi Minh it was a political struggle conducted by parties and front organizations, and assisted when need be by military force. The Leninist doctrine of the organizational weapon was clearly imprinted on Ho Chi Minh, and only vaguely perceptible in Mao Tse Tung.[22] Ho Chi Minh refined the organizational weapon. Lenin had wielded it like a cudgel. Ho Chi Minh parried and thrust with it like a rapier.

It is likely that Ho Chi Minh had a hand in the formation of the South Vietnamese National Liberation Front. The plan for creating such a front was first announced in North Vietnam at the third congress of the Lao Dong (workers) party in September of 1960. The National

Liberation Front was officially formed two months later, in the south.

For the purposes of this book, the significance of the National Liberation Front lay in its deployment as an institution-building instrument. Through the NLF, the rural people of South Vietnam were cajoled, persuaded, and intimidated into becoming active, well-organized revolutionaries. In the National Liberation Front they learned the doctrine, roles, and skills appropriate to the revolution. This was non-formal education with a vengance. Douglas Pike, who has characterized the NLF as "a Sputnik in the political sphere of the Cold War,"[23] describes the indoctrination carried on by the front in terms of communication. He could just as easily have employed the concept of non-formal education.

Pike explains that the main channels of communication employed by the National Liberation Front were the functional liberation associations, such as the Farmers' Liberation Association and the Women's Liberation Association, which were formed by the National Liberation Front in each village.

> With the social organization as a communication device we reach the heart and the power of the NLF. Here lay the solution to the mystery that for so long puzzled knowledgeable and thinking Americans: How could the NLF achieve success in the face of overwhelming GVN* military superiority and massive inputs of American material resources for civic action programs to alleviate economic grievances? Not superior ideology, not more dedicated personnel, not because the voluntary support of the villager had been won, but the social movement shaped into a self-contained, self-supporting channel of communication -- that was the NLF's secret weapon.[24]

* Government of Vietnam, the south Vietnamese regime.

The range of techniques employed by the National Liberation Front for the indoctrination and mobilization of the villagers -- agit-prop teams, struggle movements, mutual criticism, and the like -- need not distract us here. The relevant point was that the NLF built its organization by reshaping the villagers' attitudes. The front played upon latent hostilities toward the government, and upon ever-present Vietnamese nationalism, to elicit the villagers' emotional commitment to its cause. Once the villagers were engaged by the social movement of the NLF, they were molded into dedicated, effective supporters of the organizations through which the revolution was pursued. The following text, from a document captured in 1961, describes the symbiosis between organization-building and psychological transformation in the National Liberation Front. It could just as well have been written about the cooperatives in Comilla, though the struggle in Comilla was against poverty, not against the government.

> An enlightened people if unorganized cannot be a force to deal with the enemy.... Therefore organization of the masses is essential; it facilitates our cause in all ways.... The (social movement) provides a strong force to oppose the enemy; it makes the Party's task much easier, (and) it both provides an audience for the agit-prop cadre and facilitates further agit-prop work. The (social movement) is a measure of our physical and moral strength; it is a practical way of both serving the people's interests and guaranteeing Party leadership among the people; it is the decisive element in the Revolution.[25]

The Psychosocial Subsystem at the Village Tier

A prodigious amount of training of village personnel was conducted in the Comilla cooperatives. Statistics give a glimpse of the scale of this non-formal educational activity. As of the end of 1965, weekly classes at the Thana Training and Development Center were being attended by 183 managers of village cooperatives, 139 model farmers, 51 village accountants, 91 Imams learning to teach literacy in their mosques, and by 34 village midwives. Together with the village health workers (27 in weekly training classes) schoolteachers (95 trainees), research enumerators (20), family planning workers (20), women teachers (26), other women trainees (159), and other miscellaneous trainees (125), a total of 970 villagers were coming to weekly training classes in 1965. Altogether, 2,244 trainees from the villages of Comilla Kotwali Thana came to Abhoy Ashram to attend classes in 1965. Nine hundred seventy came to weekly classes, 80 to fortnightly classes, 268 to monthly classes, 253 to short courses, and 673 to intermittent training sessions.[26] This barrage of figures confirms that training was not a casual endeavor in the Comilla cooperatives.

The overt purpose of all of this training was to impart technical information. Village midwives, or dais, learned about sanitation and techniques of home delivery. The village accountants learned to keep ledgers. The chairmen of village cooperatives, who came to Abhoy Ashram for monthly classes, learned how to conduct meetings. And the model farmers, who were most commonly mentioned in the Comilla literature, observed the demonstration farm run by the Japanese agricultural experts at Abhoy Ashram, and learned about plant spacing and fertilizer requirements for improved rice variaties. In the various classes at the Abhoy Ashram training center, the instructors were usually either the thana officers of the nation-building departments (i.e. agriculture, fisheries, health), or personnel of the thana cooperative association, such as the inspectors. In most cases the trainees were expected to return to their village and impart the newly acquired knowledge to the other members of the local organization (cooperative, school, mosque) from which they came. This staged strategy of training -- in which the local organization selected someone to be trained, so that he could return to the community to disseminate what he learned -- has been cited as a more effective alternative to the extension approach, in which a knowledgeable official goes out to the villages to teach.[27]

Commenting on the difference between the Comilla approach to training and the orthodox extension approach, Akhter Hameed Khan has written:

> We replaced the government village level worker, who in reality supervised five villages, by a manager and a model farmer for each village, chosen by the group itself. Each manager and model farmer was trained directly by the Thana Training and Development Center experts. In a manner of speaking, an inefficient middle man in the delivery of advice and supplies was eliminated. Thus a major step was taken toward the peasants' self-management and self-reliance. However, the prospect of fewer government "workers" did not at all please the departments. Instinctively they hated decentralization, delegation and autonomy. And they ardently desired their own battalions of assistants.[28]

The foregoing passage appears in a paper which Akhter Hameed Khan delivered to an international convocation of social communications experts, held at the East-West Center in Honolulu. When he was talking to the peasants of Comilla, as he often did at cooperative rallies or in individual conversations, Akhter Hameed Khan did not dwell on conflicts between different methodologies for the dissemination of agricultural information. What he sought to communicate to the villagers, for the most part, was a doctrine of cooperative labor toward common goals. References to the brotherhood of all Muslims, to the need for solidarity among the exploited, and to the necessity of communal self-help laced these speeches, as can be seen in the excerpts below. Causes of disunity, such as factionalism and envy, were consistently denounced.

> If you are hoping for your situation to be improved by the efforts of outsiders, you are mistaken. That will not happen. You must make the efforts yourselves. Those of you who are Muslims can read in the Quran that Allah says: "Allah does not better the condition of any nation until that nation makes the change in its heart." That is, if there is envy, lack of faith, and factionalism in men's hearts, then you will see that their condition will not improve. Gradually it will worsen. But if the state of mind and heart changes, the external state will also change.
>
> There is a verse in the Quran, addressed to those who have just become Muslim. Allah, who knew of their condition, said: "Remember how you were separate, each group hostile to the others, and how Allah united your hearts. In Allah's goodness and kindness you all became like brothers."[29]
>
> I think the root of all progress in our thana -- scientific irrigation and introduction of improved methods -- is your discipline and organization. In this thana of ours, due to your concerted efforts, a new mentality and a new society has emerged. You have given respect in place of jealousy.... You have given up quarrels and started to work with unity and cooperation, and learned to save instead of wasting money. You have realized the value of labor, of industriousness in place of indolence. This is the main foundation. If we have such a character and such a society where there are no quarrels and no disunity, where all want to work cooperatively, where there is no jealousy but respect, and where there is will to help one another: people of such a society will not remain poor and their destitution will not persist.[30]

Was Akhter Hameed Khan's Islamic ideology of cooperation communicated to the village trainees at Abhoy Ashram by the inspectors and departmental officers who served as instructors? No record of what was said in those classes is available, so there is no way of telling for sure. Probably the fidelity with which the "party line" was communicated was poorer than in countries such as China and Vietnam, since there was no party organization dedicated to maintaining the ideological purity of the cadres who convinced the populace. It can be said, though, that a greal deal of attention was given to training the trainers, both in Comilla and in the expansion program thanas where the cooperative model was taken up in the nineteen sixties. Top-level personnel were brought to workshops and conferences at the Academy for Rural Development at Kotbari, and lower level personnel were indoctrinated and admonished in staff meetings.

A sense of solidarity was engendered, also, in the ritual of travelling from even the most remote villages to the Thana Training and Development Center for weekly classes. These regular meetings at the training center were among the few opportunities which the peasants had for moving outside of their usual orbits of village, market, and mosque. Within each village, similarly, attendance at the weekly cooperative society meeting fulfilled a deep hunger among the atomized Bengali villagers for identification with one another and with a larger movement.

In the end meetings and ideology proved to be insufficient instruments for the maintenance of solidarity among the cooperative membership. So long as the entrenched rural elites disregarded the village cooperatives -- as they did, by and large, until the advent of the Green Revolution transformed their attitudes toward the profitability of farming -- the small farmers within the cooperative fold made significant progress toward mutual betterment. However, the bulwark of small farmer solidarity was not strong enough to confine the machinations of the large farmers and moneylenders.

In the two organizational precepts quoted in the introductory section of this chapter, Norman Uphoff and Milton Esman bespoke their comprehension of the disruptive potential of favoritism and inequality. They called for a politics of inclusiveness in rural development organizations, so that all could share in the benefits, and they asserted that organizational solidarity was more easily attained in societies where the underlying distribution of assets and income is more egalitarian. I have explained already, in chapters one and two, how the democracy of poverty in East Pakistan allowed nonetheless for differentiation of the rural society into classes of big, or surplus, farmers, small farmers, land poor farmers, and landless laborers. All of these classes might be fitted into a range of landholdings of from zero to ten acres. Even in the fertile alluvial land of East Pakistan, a farmer could not garner the wherewithal from ten acres to carry on like a landed aristocrat. But he could acquire enough leverage to exploit his neighbors. Left to itself, the politics of the village cooperatives gravitated toward control by these surplus farmers, once those farmers saw the advantage of obtaining cheap credit to finance their agricultural operations. A politics of equality, and an ideology of solidarity, required active organizational intervention from above to balance the local power of the landed elite. In China and Vietnam, such intervention from above was accomplished via the communist party and its front organizations, supported by military force. No analog of such a party existed in East Pakistan, or exists in Bangladesh. The frail, and unfortunately corruptable, reed of the cooperative inspectorate was all that could take its place. But now we are getting ahead of our story, since the managerial supervision exercised through the inspectorate is a topic for the next chapter.

The major purpose of the cooperatives was to help the small farmers, not the big ones. The primary cooperatives would have been easier prey for the local landlords if the ideology of solidarity had not been communicated to the members. Up to a point, a powerful organizational doctrine could hold in check the disruptive machinations of the village elites, and thereby hold the cooperatives true to their purposes. When a local cooperative was captured by landlords, participation by the general membership fell off, savings deposits and loan repayments declined, and the organization disintegrated. So in safeguarding the integrity of the village cooperatives, the doctrine of solidarity helped to preserve functional order in the organization, much as a component of the psychosocial subsystem would be expected to do.

The contribution of doctrine to the maintenance of organizational order was even greater in the National Liberation Front of South Vietnam. The threat to organizational integrity there was posed not so much by local landlords, who had fled to the cities decades ago, but by the army of an opposing political system. Villagers who had been indoctrinated by the NLF were amazingly resistant to the blows which the Government of Vietnam and its American ally directed against them. In the end, as I have said above, the National Liberation Front crumbled under the pressure, leaving the final battles to be fought by main force North Vietnamese divisions. But considering the enemies it was faced with, the NLF put up an heroic struggle. The politicking between small and big farmers in Comilla seems petty in contrast. The resiliance of the NLF was due in large part to the strength of its revolutionary doctrine. The psychosocial subsystem of the NLF was nearly unbeatable.

Non-formal education in Comilla communicated more than values and doctrine. Through training, the clay of the village people was molded into competent managers, exemplary model farmers, and sagacious chairmen. Such, at least, was the ideal, and in a surprising number of cases it was achieved. Management skills were learned, and so was the capability to perform other roles in the village cooperatives.

The managers, model farmers and chairmen learned a great deal from each other when they gathered for their classes at the Thana Training and Development Center, Abhoy Ashram. Self-confidence through identification with a "guild" of local managers (or model farmers, or chairmen, or womens program organizers) may have been one of the most important things learned at Abhoy Ashram. Additionally, the inspectors and department officers who taught the Abhoy Ashram classes served as nonformal educators imparting job-related skills. There were classes on how to conduct a meeting, classes on how to cultivate fish, and classes on how to prepare loan applications. The teaching and learning of organizational roles and of job related skills contributed enormously to the viability of the structural and technical subsystems in the village cooperatives. Not until the officers of the village cooperatives learned to work together within the prescribed organizational framework could the new cooperative organizations function in the villages.

During the nineteen sixties the Comilla project favored the training of cooperative managers over the training of model farmers. The Comilla experiment in rural development had had its genesis in the collapse of the Village Agricultural and Industrial Development, or V-AID, program. V-AID had been born out of the same assumptions as the community development movement in India. As in the Indian program, the front line activist in V-AID was a village level worker. During the early nineteen sixties the administrators of the Comilla project were ambivalent as to whether the functions of the village level workers should devolve, in the new scheme, upon two or upon four new persons. In the four-way contest, the managers of the village cooperatives and the field inspectors of the central cooperative association were favored, while the model farmers and the extension staff were occassionally given attention and more frequently neglected. From July 1964 to April 1965, the position of model farmer was actually abolished, and in that period the managers were expected to double as model farmers.

The ambivalence of the Comilla project administration toward the two types of village workers resulted in part from the disappointments of extension in the V-AID program and in the early years of the Comilla experiment. In 1960, when the academy formed its first village cooperatives, the major improved practices being taught were low lift pump irrigation, line sowing, and the use of fertilizer. Although the farmers did take to irrigation once the technology and organization of that practice had been worked out by the staff of the Academy for Rural Development, there was but a faltering adoption of line sowing and chemical fertilization. According to Akhter Hameed Khan, the acreage under line sowing in 1962-63 was much less than in 1961-62. It was apparent that the farmers had rejected line sowing, and it seemed the reason was that the effect of line sowing on yields was nominal. There was no such spectacular reverse in the history of the adoption of fertilizer, but it was found that the farmers were for a long time wary of their use because of the tendancy of local rice variaties to lodge (fall over) when too great a dosage was applied.

Taking a lesson from these experiences, Akhter Hameed Khan concluded that the route to agricultural modernization was not through the alteration of the techniques of cultivation of the existing *aus* and *amon* rice crops, but through the provision of irrigation water and tractor services which would allow the farmers to grow a third crop of dry-season boro rice. Because tubewells and tractors are management-intensive inputs, the emphasis of the program shifted from extension to organization.

From 1964 to 1968, the slogan of the Comilla cooperatives might have been "All power to the Managers!" For a time, the managers even assumed the duties of model farmers. All commissions from the central association were given to the managers, who collected:

1. A 1% commission on all loans realized on time.
2. a. 50 paisa per member per month if attendance at weekly meetings averaged 81-100%.
   b. 37 paisa per member per month if attendance at weekly meetings averaged 61-80%.
   c. 25 paisa per member per month if attendance at weekly meetings averaged 51-60%.
3. 15 rupees per month if the village cooperative had an irrigation tubewell which was irrigating at least 25 acres of land.
4. 5 rupees for every eight-hour day that a tractor worked in the village.
5. 50 paisa per acre under improved practices of cultivation.

Although three of these five types of commissions relate to the utilization of improved practices, none of them was allocated to the model farmers. In the Comilla-type rural development projects which had been organized in neighboring Gaibandha thana there was a much stronger extension emphasis. The model farmers in the Gaibandha project were given the commission for acreage under improved practices.

Asked to explain the Comilla project's discrimination against the model farmers, Akhter Hameed Khan said:

> I came down squarely on the side of the managers in this dispute over the roles of the manager and the model farmer. I didn't want to have two people in the village running the local cooperative. The model farmer's function should be to demonstrate on his own farm the improved practices he had learned, and that is all. He should not challenge the manager's authority.[31]

In the last two years of the decade, in 1968-69 and in 1969-70, the pendulum of attention swung back to a more intermediate position between the managers and the model farmers. By then there was such a flood of new technical information to be imparted -- about the high yielding Green Revolution rice varieties, about potato and vegetable cultivation, and so forth -- that the contribution of the model farmer to the cooperatives' success attained greater importance. This uptick of interest in the model farmers is evident in the last row of Table 7-1. During the period from 1962-63 to 1967-68, the proportion of village cooperatives whose model farmers attended training classes hovered in the neighborhood of 63%. The proportion shot up to the ninety percent range in the last two years. The annual reports of the Kotwali Thana Central Cooperative Association, from which these figures were extracted, do not explain why more than one manager per village cooperative was in training at Abhoy Ashram each year.

When the managers, model farmers, and others who had attended classes at the Abhoy Ashram training center returned to their villages, they were expected to educate their fellow cooperative members. The major forum for this stage of the non-formal education process in the Comilla cooperatives was the weekly general meeting in each village cooperative society. Badruddin Ahmed puts it very well:

Table 7-1: Managers and model farmers trained each year for the agricultural cooperatives of Comilla Kotwali Thana.

	62-63	63-64	64-65	65-66	66-67	67-68	68-69	69-70
Village cooperatives (a)	110	122	152	158	225	261	301	316
Managers (b)	122	162	207	220	296	330	389	402
Model farmers (c)	59	71	115	115	150	140	278	288
Managers/cooperatives (b/c)	1.11	1.33	1.36	1.39	1.31	1.26	1.29	1.27
Model farmers/coops (c/a)	.54	.58	.75	.72	.67	.54	.92	.91

> The weekly cooperative meeting is not just a meeting held to conduct a little formal business. It is an educational experience intended to help the member learn how to become a modern man. It is as unthinkable to try to run a village cooperative without a weekly meeting as it would be to run a school without attendance at classes. And this is precisely because the village cooperative itself is a special kind of school. This school is linked to a communication centre which feeds it through the monitors in the class -- the manager, model farmer, chairman and those who receive training at the Thana Training and Development Centre.[32]

As a "special kind of school" in which non-formal education for the cooperative membership was carried on, the weekly meeting was expected to inculcate appropriate attitudes in the villagers. One of the most important attitudes was that of a positive orientation toward savings and loan repayment. When the cooperative experiment began, the scheme was derided by many seasoned officials and foreign experts on the grounds that Comilla villagers were too poor to save. But the poor farmers showed that they could save, and could do so consistently. Peer pressure was the main method for teaching the habit of savings. When roll was called in the weekly meeting, each member was expected to come forward and deposit a small amount of money. The loan limit alloted to the village cooperative society was dependent upon the society's record in savings and loan repayment, so each member recognized that he had a stake in the compliance of every other member.

Judging by the cooperatives' good performance in savings and in loan repayment, both in Comilla Kotwali Thana and in the expansion projects, the peer-pressure technique succeeded. In the older system of Union Multipurpose Cooperatives, where the membership was much less involved in the running of the organization, the record of capital accumulation by the membership and of loan repayment was much worse.

As a consequence the Union Multipurpose Cooperatives were incapable of attaining financial self-sufficiency, they served in most cases as conduits for lightly disguised grants from the government to the rural upper classes. Cooperatives of the Comilla type, on the other hand, proved themselves capable of covering a large portion of their administrative costs, and of financing most of their own loan operations. We can conclude that the psychosocial subsystem in the village cooperatives, acting through peer pressure on the membership, came to the rescue of the technical subsystem at the thana tier.

Did the peer pressure technique transform attitudes, or only behavior? I mentioned earlier Gabriel Almond and Sidney Verba's contention that democracy works best where the political attitudes of the citizenry approximate those of the civic culture. A parallel case could be made, to argue that the credit program in the village cooperatives functioned best where the membership had the financial attitudes of good Swiss citizens, saving money and repaying loans as a matter of high moral obligation.[33] Were such attitudes inculcated by the psychosocial subsystem of the village cooperatives? There is no way of knowing, since no social psychologist ever took to the field in Comilla in the nineteen sixties to investigate that question.

Neither is it known how the personal interactions within the village cooperatives influenced the political attitudes of the membership. Did the cooperative members really acquire the attitudes of the civic culture? The fractious tumult of cooperative politics which Peter Bertocci observed in the Comilla villages of Hajipur and Tinpara would not appear to have been grounded in the mutual trust that is characteristic of the civic culture. Yet it is conceivable that political attitudes were slowly and positively transformed in the local cooperatives, so that they could eventually have become democratic in actuality as well as in legal form. In the second chapter I mentioned Ayub Khan's quip to the effect that after a period of administrative tutelage the Basic Democracies system would become more democratic and less basic. A process of gradual democratization may have taken place in the Comilla cooperatives. Such is the impression of long time observers such as Akhter Hameed Khan. But solid evidence, gathered across many villages and over a span of many years, is lacking.

I caught a brief glimpse of the politics of Comilla village cooperatives when I participated in a field research team, led by Zaker Hussain, which investigated management in 45 primary cooperatives in Kotwali Thana in 1966. In the unpublished manuscript of my monograph on The Comilla System of Supervised Credit, which I wrote after our field team had finished its work, I reflected as follows on democracy in the village cooperatives:

> The fundamental concept of the Comilla cooperatives is that of democratic village organization. It is expected that if the members chose their own managing committee, and if the managers discuss all of the activities of the cooperative in the weekly meeting, then the cooperative members will themselves assure that the manager stays honest and continues to represent their interests.
>
> But the villagers of East Pakistan, even of Kotwali Thana, are not always the best of democratic citizens. They may not comprehend what is in their best interest or how their cooperative should be run. Being unaccustomed to cooperative organization, they may not care to reform their cooperative, even if they know it is going wrong.
>
> And the managers are not always the best of public servants. Some of the managers are rich farmers, more closely allied with the money lending class than with the cooperative membership. Some of them are outright thieves.

The conclusion reached by Zaker Hussain, Akhter Hameed Khan, and the other leaders of the Comilla cooperative organizations was that village democracy could not be trusted to function on its own. It must be closely supervised through the cooperative inspectorate. The inspectors were encouraged to mobilize public opinion against an irredeemable manager, or in extreme instances to file a criminal case against those who could not otherwise be dislodged. The approach of supervised democracy in the village cooperatives was more cautious and paternalistic than Ayub Khan's Basic Democracy system for governing rural Pakistan. Ayub Khan's regime did not exercise administrative sanctions against elected union councilors who were corrupt. The Comilla cooperatives did so, and by winning popular respect proved themselves more durable than the system of Basic Democracies.

The Psychosocial Subsystem at the Thana Tier

At the thana as at the village tier, training and indoctrination were significant in sustaining organizational order, and in restraining the temptation to corruption. Harry W. Blair has summed up the situation in pithy terms. "In the ethos of bureaucratic venality and peculation that is so pervasive in the subcontinent, it was considered absolutely essential to have a credible program that the individual peasant would have the confidence to invest in."[34]

Akhter Hameed Khan sought to indoctrinate the employees of the thana cooperative associations with the ideology of service, solidarity, and probity. Speaking to the employees of the Kotwali Thana Central Cooperative Association in 1969, for example, he said,

> An organization is damaged by three causes:

> thefts, fraud, and factionalism.... The meaning of theft is: to get a thing on which you have no legitimate right and to take advantage therefrom.... The meaning of deception is: I was given an assignment, but I didn't discharge it properly, or just set it aside, or I did not make any attempt to learn the work.... The next is factionalism -- internal dissension and disputes.... Our organization has been growing only because these three things did not exist here. We have always thought that we are not working for the benefit of any particular person. The entire work is for the benefit of all, specially for the poor people in the villages and the town.[35]

Exhortations of the brotherhood of all Muslims are to be found in Khan's speeches to the thana employees, but they are muted compared to the trumpet blasts in his speeches to the villagers. It is as if the distinction between the thana and village tiers was matched in Akhter Hameed Khan's mind by the differentiation between Western and non-Western society. His vision of a smoothly coordinated thana government was abstract and quite Western in character. At the thana level was to be found a set of organizations sufficiently formal, and sufficiently sophisticated, so that he could bring to bear upon it his training in the Indian Civil Service and the advice of his cohort of foreign experts.

The struggle to reconcile modernity and traditionalism, or Islamic and European values, is an issue of acute sensitivity throughout the Muslim world. Failure to achieve such a reconciliation led to an Islamic revolution in Iran in 1979. For Akhter Hameed Khan, as for many officials in Pakistan and in Bangladesh, the solution to this dilemma lay in a segregation of the extremes.

The Western influence upon the thana cooperative organizations was direct. Robert Havener, a senior advisor in Comilla in the mid-sixties, used to conduct weekly classes in accounting and business management for the staff of the KTCCA. A few years later Henry Larzelere, an MSU professor of agricultural economics who was stationed at Comilla, did the same. In an interview in June of 1976, Larzelere recalled that he ran management training exercises for the section chiefs in the Kotwali Thana Central Cooperative Association (such as the head of the dairy and of the cold storage), encouraging all of them to propose ways of handling administrative problems in each section. "The key decisions in the KTCCA were made by the section chiefs," Larzelere said. "There were no farmers in that group. Those people were all bureaucrats running their own shops. It worked so long as there was a person such as Akhter Hameed who would call them up short to remind them of the people they were really working for."

The problem of maintaining responsiveness and honesty in public agencies is not unique to Comilla. It is faced equally by the government of New York City. The distinction between the two locales was that the quota of in-service training, exhortation and indoctrination per employee was probably greater in Comilla than in New York. The integrity of the structural and technical subsystems in the Comilla cooperatives was thereby protected, and the responsiveness of the system enhanced.

In the course of the theoretical discussion in the third chapter, Kenneth Boulding's criteria for distinguishing living from non-living systems were described, and deemed sufficient for discriminating, in the typology which I proposed, between machines with input and organic systems. Organic systems, it was proposed, are capable of self-maintenance and reproduction.

In this chapter, most of the discussion has centered on ways in which formal organizations such as the cooperatives can maintain their internal integrity. The contribution of ideology to organizational maintenance was given special emphasis. It bears mentioning that ideas and values are also critical in organizational replication. A well-articulated concept, or doctrine if you will, of how an organization should be structured and of how it should function can play the same sort of role in organizational replication as does the genetic code in biological reproduction.

In the case of Comilla, the genetic instructions for the structural and technical subsystems of an ideal Thana Central Cooperative Association were clarified in Kotwali Thana and in the three earliest expansion projects during the experimental period lasting from about 1960 to 1965. By the mid-sixties the doctrine of what such an organization should look like and how it should work had crystallized in the minds of people such as Akhter Hameed Khan, Zaker Hussain, and some of the faculty at the Academy for Rural Development. The molecule of DNA containing the genetic code had been completed. To spawn other Thana Central Cooperative Associations thereafter, the new doctrine had to be transmitted to the personnel, and especially to the leaders, of the unhatched cooperative associations. The genetic code had to be passed on to the next generation. This task of transmission was accomplished, by and large, through non-formal education. Through classes at the academy and through field trips to the Abhoy Ashram training center and around the thana, the directors of the expansion projects were indoctrinated. And just as it is a miracle of nature that each newborn creature is not an absolute mutant, but instead bears a strong resemblance to its parents and ancestors, so the cooperative associations that sprung up in the thanas of Comilla district, and later in many other thanas of

East Pakistan and of Bangladesh, looked rather like the original organization, the Kotwali Thana Central Cooperative Association, as it had appeared in about 1965, before it altered its own form by adding the extra tier of the Agricultural Cooperatives Federation.

The analogy between biological and organizational reproduction is imperfect, because the instructions for replication are not inculcated solely in the personnel of the next generation of organizations. In the organizational universe, a supervisory official or agency, operating from a predetermined budget and staffing pattern, frequently manages the process of organizational duplication. If the newly founded organizations stray from this manager's conception, he brings them into compliance with his standards. No such super-organic manager is to be found in the biological world, unless, that is, one credits the reality of Mother Nature.

Notes for Chapter 7

The Psychosocial Subsystem

1 Daniel Katz and Robert L. Kahn, The Social Psychology of Organizations, John Wiley and Sons, New York, 1966, p. 33. Reprinted by permission of John Wiley and Sons.

2 Fremont E. Kast and James R. Rosenzweig, Organization and Management: A Systems Approach, Second edition, McGraw Hill, New York, 1974, pp. 245-247. Copyright 1974 by the McGraw Hill Book Company. Used with permission of McGraw Hill Book Company.

3 Norman T. Uphoff and Milton J. Esman, Local Organization for Rural Development: Analysis of Asian Experience, Rural Development Committee, Cornell University, Ithica, 1974, pp. 101, 103.

4 Milton J. Esman, "The Elements of Institution Building," in Joseph W. Eaton, ed., Institution Building and Development, from Concepts to Application, Sage Publications, Beverly Hills, 1972, p. 22.

5 This closeness of fit between the institution building paradigm and my own is fortuitous. The scholars who participated in the Inter-University Research Program in Institution Building knew next to nothing about organization theory. In an essay written near the end of the research project, which terminated when its Ford Foundation and USAID funding expired, William J. Siffin rubbed his eyes and observed, "The IB perspective sits on top of a veritable midden heap of what is loosely called 'organization theory.'" (William J. Siffin, "The Institution Building Perspective: Properties, Problems, and Promise," in Institution-Building: A Model for Applied Social Change, edited by D. Woods Thomas, Harry R. Potter, William L. Miller and Adrian F. Aveni, Schenkman Publishing Company, Cambridge, Massachusetts, 1972, p. 122.)

6 Milton J. Esman, "Some Issues in Institution Building Theory," in Thomas, op cit, p. 79. Reprinted with permission.

7 Gabriel A. Almond and Sidney Verba, The Civic Culture: Political Attitudes and Democracy in Five Nations, Little, Brown and Co., Boston, 1965, p. 13.

8 Ibid., p. 12.

[9] Peter Almond, Gabriel's son, was employed by his father throughout a summer in sorting the 5,000 questionnaires so as to prepare the tables for the book. Almond and Verba's quaint methodology of data analysis had its drawbacks, since they did not make use of correlation, chi-square, tests of statistical significance, or other techniques which would have enriched the book. The credibility of the study rests mainly on the size of the sample.

[10] Almond and Verba, op cit, p. 360.

[11] Frederick H. Harbison, Human Resources as the Wealth of Nations, New York, Oxford University Press, 1973, p. 133.

[12] Philip H. Coombs and Manzur Ahmed, Attacking Rural Poverty, How Nonformal Education Can Help, The Johns Hopkins University Press, Baltimore, 1974, p. 134.

[13] Ibid., p. 135.

[14] E. Patrick Alleyne, et al, Training and Research for Extended Rural Development in Asia, Rural Development Committee, Cornell University, Ithica, 1974, p. 8. Italics in original.

[15] Syed A. Rahim, "Non Formal Aspects of the Comilla (Bangladesh) Project," in Richard O. Niehoff, editor, Non Formal Education and the Rural Poor, Program of Studies in Non Formal Education, Michigan State University, East Lansing, 1977.

[16] Coombs and Ahmed distinguish among informal education, non-formal education, and formal education. Both non-formal and formal education are structured and systematic, but non-formal education is not school-bound. Informal education, in their definition, takes in all education that is not structured or systematic, such as the education that results from interactions in the work environment.

[17] Mao Tse Tung, "The Struggle in the Chinkang Mountains," in Selected Works of Mao Tse Tung, Volume one, Lawrence and Wishart, London, 1954, p. 81.

[18] Edgar Snow, Red Star Over China, first revised and enlarged edition, Victor Bollancz, Ltd., London, 1968, p. 116.

[19] Mao Tse Tung, "The Struggle in the Chinkang Mountains," op cit, pp. 82, 83.

[20] Douglas Pike, Viet Cong, The M.I.T. Press, Cambridge, Massachusetts, 1966, p. 238.

[21] Jean Lacouture, Ho Chi Minh: A Political Biography, Random House, New York, 1968, p. 247.

[22] Ho was the more senior of the two revolutionaries, and had learned his Leninism at first hand, in Moscow in 1927 and 1924. Ho never met Lenin himself, but he was an intimate colleague of Lenin's closest desciples. Ho was a strong supporter of Lenin's third international. He once wrote: "There is a legend, in our country as well as in China, on the miraculous 'Book of the Wise.' When facing great difficulties, one opens it and finds a way out. Leninism is not only a miraculous 'book of the wise,' a compass for us Vietnamese revolutionaries and people: it is also the radiant sun illuminating our path to final victory, to Socialism and Communism." (From Lacouture, op cit, p. 32.) Mao Tse Tung, in his formative years, had no international exposure. He first set foot outside of China after the revolution had triumphed, when he travelled to Moscow in 1949.

[23] Douglas Pike, op cit, p. 111.

[24] Ibid., p. 124. Reprinted with permission.

[25] Ibid., pp. 125, 126.

[26] These figures are from Table C of Appendix XI in Arthur F. Raper, Harry L. Case, Richard O. Niehoff, William T. Ross, and Edgar A. Schuler, Rural Development in Action, The Comprehensive Experiment in Comilla, East Pakistan, Cornell University Press, Ithica, 1970.

[27] Nurul Islam, ed., Agricultural Policy in Developing Countries, Halstead Press, New York, 1974, p. XVI.

[28] Akhter Hameed Khan, "My Lessons in Communication," paper presented at the Communication Institute Seminar, East-West Center, Hawaii, January 1975 (mimeographed), p. 10.

[29] Akhter Hameed Khan, "A Light in the Darkness," speech at Comilla Cooperative Societies rally, October 14, 1962, translated from the Bengali by Marianna Tax Choldin.

[30] Akhter Hameed Khan, Address to the Comilla Cooperative Societies rally, November 26, 1967, translated from the Bengali by Khandker M. Rahman.

[31] Conversation with the author, 1975.

[32] Badruddin Ahmed, Manual on Comilla Cooperatives, Bangladesh Academy for Rural Development, Comilla, 1972, p. 41.

[33] The Raiffeisen cooperatives were sometimes cited as progenitors of the Comilla cooperatives. Could the success of those nineteenth century German cooperatives have been due in part to the Calvinist beliefs of the member farmers? Fear of punishment by a wrathful God would have been a considerable incentive to loan repayment.

[34] Harry W. Blair, The Elusiveness of Equity: Institutional Approaches to Rural Development in Bangladesh, Rural Development Committee, Cornell University, Ithica, 1974, p. 42.

[35] Akhter Hameed Khan, "Address Before the Employees of the KTCCA," June, 1969 (mimeographed).

CHAPTER 8

The Management Subsystems

	Operational Plant	Operational Control	Management Control	Strategic Planning
Static structures	S			
Simple machines	ST			
- - - - - -	- - - -	- - - -	- - - -	- - - -
Machines with input	STE			
Organic systems	STEP	STEPO	STEPOM	STEPOMR

> The near universality of hierarchy in the composition of complex systems suggests that there is something fundamental in this structural principle that goes beyond the peculiarities of human organization.... There are strong reasons for believing that almost any system of sufficient complexity would have the rooms within rooms structure that we observe in actual human organizations. The reasons for hierarchy go far beyond the need for unity of command or other considerations related to authority.[1]

Introduction

In his insightful little book on planning and control systems, in which he sets out the typology of operational control, management control, and strategic planning, Robert N. Anthony compares the process of operational control to the action of the autonomic nervous system, and the process of management control to the activity of the human cerebral cortex. He flatly asserts, however, that "Biological analogies are not useful for studying the process of strategic planning."[2] Through the exercise of the strategic planning function, an organization can change its form and function, as by adding a new product division. Human beings, Anthony points out, are incapable of such conscious self-alteration. People cannot will themselves an extra arm or leg. The capability of human organizations consciously to transform themselves, Anthony says, is unique in the universe.

Anthony puts the case too strongly. Human beings do exhibit the ability to transform many aspects of themselves, or at least of their relationship to the world around them, through the exercise of strategic planning. True enough, people don't change their biological bodies (except in minor ways, such as exercising to keep fit), but they can alter their jobs, their marital status, and many other aspects of their personal reality.

The capacity for foresight in humans is thought to reside in the frontal lobes of the brain, the section immediately behind the forehead. Anxiety resides there also. Extirpation of the frontal lobes through a lobotomy does not entirely eliminate a patient's ability to ponder events which may lie ahead, but does effectively remove his ability to picture himself as an actor who could influence those impending events.[3] The patient glides serenely into the oncoming future, taking everything as it happens.

At the other end of Robert Anthony's spectrum of management functions, it may be reasonable to compare the function of operational control to the operation of the autonomic nervous system, which controls basic body functions such as digestion, breathing, and blood flow. Anthony states that operational control is concerned with the effective completion of tasks in an organization. This is the realm of foremen and sergeants. Though they might not be flattered by the comparison, to an observer who is detached from the personal realities of the organization their work might sensibly be compared to that of the medulla oblongata, the spinal cord, and the efferent visceral nerves in a human being. The common mission is to keep fundamental processes going at the right pace, and in the right relation to one another. The common methodology is that of closed loop feedback control, which is classically illustrated in the sympathetic and parasympathetic components of the autonomic nervous system. The sympathetic nerves speed up the functioning of the heart and other organs to which they are connected, and the parasympathetic nerves slow them down; too strong a message from the one will induce a restraining message from the other.

Anthony's comparison of management control to the functions of the cerebral cortex requires some refinement. The neocortex of the human brain is subdivided into hemispheres, lobes, and folds. The frontal lobes, as I have mentioned, are the locality of foresight and of rational intervention, functions which are comparable to strategic planning in organizations. Various other portions of the convoluted neocortex correspond to different sensory and muscular systems in the body. There are folds which assimilate the information sent in from the sense of touch in the hand, and folds which transmit instructions to the muscles of the hand. Inasmuch as obtaining and assuring the proper use of resources (or inputs) is one aspect of management control in organizations, and inasmuch as human beings accomplish these same functions via the sensory and motor systems controlled by the neocortex, then the neocortex can be considered the location of neurological activities which resemble management control.

In the previous chapter I stated that the operating plant of an organization is the locus of interaction among the structural, technical and psychosocial subsystems. These three subsystems taken together are what the skeleton, muscles and organs, and hormones are to a human being. The structural, technical and psychosocial subsystems encompass the fundamental processes of the organization, just as the basic activities that make a human being live and move are carried out by the skeleton, muscles and organs, and hormones.

Just as a man would be incapacitated without a brain, and dead without a nervous system, so an organization requires management subsystems to provide it with control, competence and direction. But not all parts of the brain are vital. A man can live, may even appear normal, if his frontal lobes have been excised. So also an organization can get along handily without a strategic planning subsystem. Robert Anthony cites a 1962 Stanford Research Institute study in which it was estimated that no more than 25 manufacturing companies in the United States had a long range planning program which was fully developed and staffed. Especially for an organization which performs repetitive tasks in a predictable environment, a strategic planning subsystem is a luxury.

At the other end of the management scale, we might ask if an organization could "survive" without an operational control subsystem. Perhaps it could. In Chapter 3 I quoted Henry Kissinger's description of soviet army battalions that advanced into their own artillery fire, carrying out orders without adjustment to circumstances. The soviet battalions behaved like systems with open loop control; they operated according to pre-calibrated instructions, and were incapable of feedback. They carried on through the strength of their organizational doctrine, which held that they should move on and execute orders at all costs.

The soviet army example brings to light an interesting rule of organizational design: doctrine can be substituted for management. In Comilla, the need for managerial sanctions to control peculation was diminished to the extent that the cooperative employees believed in Akhter Hameed Khan's ideology of probity and public service. In another sphere, the trade off between ideology and administrative control can be seen as the nub of the ideological disagreement between Chinese and Russian communists. The Chinese believe that the populace should control itself through the acceptance of doctrine. Because mass conformity has been attained in China, the communist party there rules with a relatively light hand, although it is quite prepared to snuff out any deviation which challenges the basic precepts of communism. The Russian communists have inherited the dark suspicion of the common people which typified the czars. They rule through draconian autocracy.

What about the intermediate range of management? Is the possession of a management control subsystem a luxury or a necessity for human organizations? In biological organisms, the acquisition of resources such as food, water and air are vital functions. In Robert Anthony's typology, control over the acquisition and use of resources are functions of management control. Can we conclude that an organization must have a management control subsystem to survive? Not necessarily. The example of plants -- which have no nervous systems -- makes it clear that the functions of acquiring and dispensing resources can be accomplished without much management control. Indeed, when a stroke reduces a human being to endless coma, due to the loss of function in the neocortex, we commonly say that that person has become a vegetable. He lives, but in a terribly reduced state. So likewise an organization might get by without a management control subsystem, just as the soviet battalions carried on without an operational control subsystem. An organization thus deprived of management would hardly be agile, but it might function.

There may appear to be a problem with plants, because in Figure 3-11 the category of plants in the Boulding typology was matched with the category of organic systems with operational control. The analogy of the operational control subsystem in an organization to the autonomic nervous system in man was posed above. Yet plants have no nervous systems. How, then, can plants perform functions of operational control? It seems that they do so, in an inefficient but satisfactory way, by means of hydraulic and chemical feedback.

Two of Uphoff and Esman's maxims about rural development organization are pertinent to the study of management subsystems in the Comilla cooperatives.

- "<u>Sanctions</u> to control the acts of leaders of local organizations should be applied both from above and below to get best performance.

- "<u>Decentralization</u> of operating decisions within a system of centrally determined policies provides the best way of combining authority with the most relevant information and most informed judgement."[4]

Additionally, we will be looking again, but from a different angle, at a proposition which was reviewed earlier, in the chapter on organizational structure. There the multi-tiered pattern of rural development organization was discussed in terms of architectural desiderata. In this chapter we will consider the implications for management of the multi-tiered arrangement.

Relevant Research

The largest proportion of those who write seriously about modern organizations are business school professors, business consultants, retired businessmen, or some combination of these types. Management advice, as a consequence, is the core topic of most of the literature about organizations. The number of books and articles on the managerial process, business decision making and such topics is huge, and far beyond my capability to review them sensibly. It will better serve the purposes of this chapter to concentrate on some further commentary on Robert Anthony's management typology, and to mention some examples of management systems in cooperatives in other areas of the world.

The seeds of Robert Anthony's generalizations seem to have fallen on infertile ground. Hardly anyone among the great cohort of management writers has sought to make use of his ideas. The taxanomic urge is a highly unusual characteristic among the members of the intellectual circle of business school professors such as Robert Anthony. He knew as much when he published his book. In the preface, he quotes the commentary of one of his colleagues about the manuscript of his book on planning and control systems:

> I am a patient man, I believe, but my tolerance of the sort of Medieval scholasticism that speculated on 'angels per pin point' or on orders of classification is not great. I, frankly, couldn't care less. Go ahead and publish, but don't expect me to read it.[5]

Perhaps it was because the faculty of the Harvard Business School are accustomed to dealing with the top management of American corporations that Anthony said he found it so difficult to define the lowest level of management, the level which he eventually termed operational control. In retrospect, the two ends of his scale, strategic planning and operational control, appear to be more sharply defined than the middle management role which he described as that of management control.

A slight variation on Anthony's typology of management has been set forth by Fremont Kast and James Rosenzweig. They admit the polarity of the concepts of strategic planning and operational control, and term the intermediate function coordinative management. "The coordinative manager operates between the operating and the strategic levels and serves to mediate and coordinate the two. This level transforms the uncertainty of the environment into the economic-technical rationality necessary for input into the operating subsystem."[6] Kast and Rosenzweig have developed an excellent diagram to summarize the differences among these types of management. I have reproduced it as Figure 8-1.

I hope that Figure 8-1, taken together with an exhibit from Anthony's book which I have shown as Figure 8-2, will suffice to explain the distinctions among strategic planning, management control, and operational control. The reader should note that most of the activities listed in the first column of Figure 8-2 are purely planning activities, that most of the entries in the third column, under operational control, are purely control activities, and that the entries in the middle column include a mixture of planning and control. This observation should not mislead the reader into thinking that a superior classification could be devised by separating management functions into those of planning on the one hand and control on the

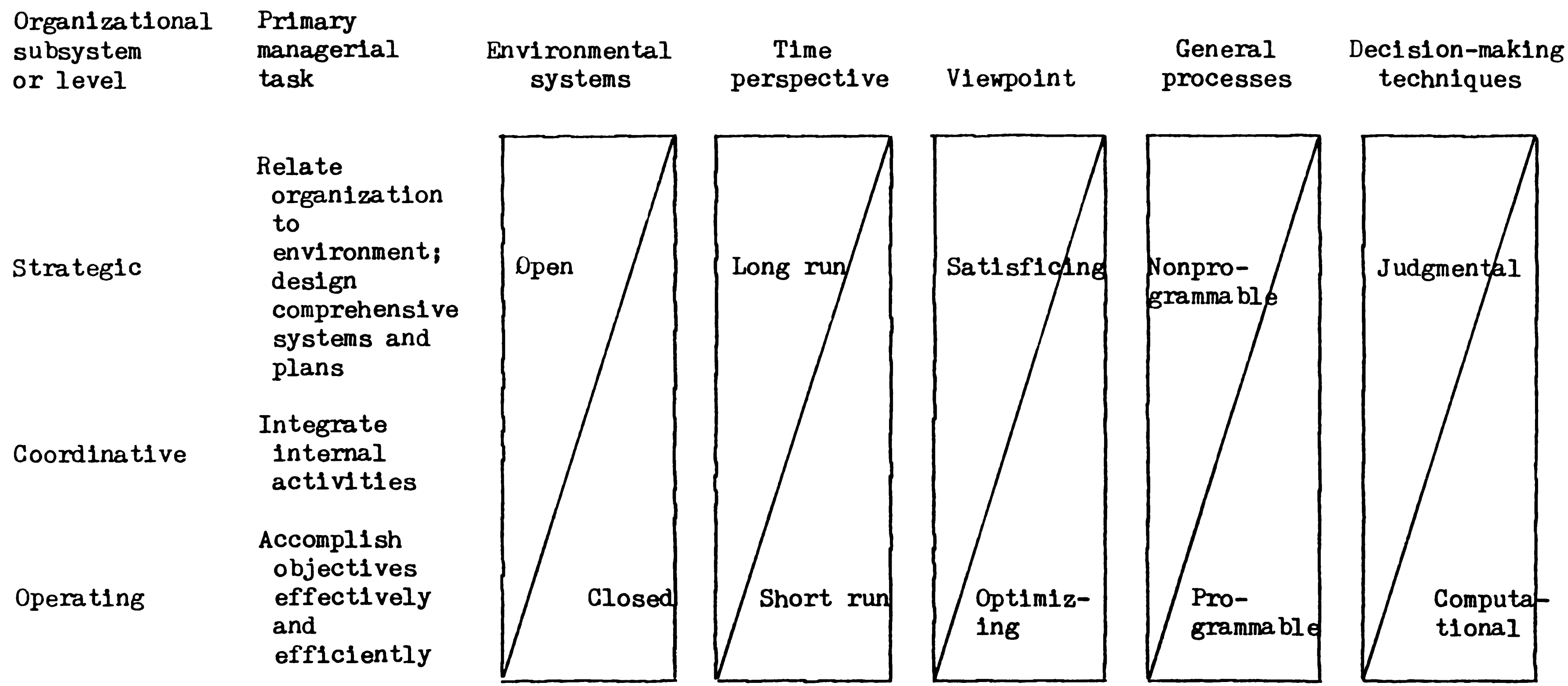

Figure 8-1: The managerial task: strategic, coordinative, and operating subsystems.[7]

Strategic Planning	Management Control	Operational Control
Choosing company objectives	Formulating budgets	
Planning the organization	Planning staff levels	Controlling hiring
Setting personnel policies	Formulating personnel practices	Implementing policies
Setting financial policies	Working capital planning	Controlling credit extension
Setting marketing policies	Formulating advertising programs	Controlling placement of advertisements
Setting research policies	Deciding on research projects	
Choosing new product lines	Choosing product improvements	
Acquiring a new division	Deciding on plant rearrangement	Scheduling production
Deciding on non-routine capital expenditures	Deciding on routine capital expenditures	
	Formulating decision rules for operational control	Controlling inventory
	Measuring, appraising, and improving management performance	Measuring, appraising, and improving workers' efficiency

Figure 8-2: Examples of activities in a Business Organization Included in Major Framework Headings.[8]

other. This is, in fact, the sort of classification which is employed by many authors of texts on business management. Anthony contends, though, that "this is <u>not</u> a useful breakdown. The trouble, essentially is that, although planning and control are definable abstractions and are easily understood as calling for different types of <u>mental</u> activity, they do not relate to separable major categories of activities actually carried on in an organization, either at different times, or by different people, or for different situations."[9]

Strategic planning and operational control can readily be distinguished from one another because in almost all complex organizations these activities gravitate to different categories of people. In a business corporation the board of directors and the president would do the strategic planning, while production foremen and clerical supervisors would perform the duties of operational control. In an army strategic planning would be the responsibility of the generals and the general staff (plus, perhaps, the political leaders of the country), while the duties of operational control would fall to sergeants and lieutenants. In a communist party the central committee would take charge of strategic planning, and operational control would be accomplished by cadres and cell leaders. Management control, as Kast and Rosenzweig imply by their term "coordinative management," is more or less the set of management activities which are performed by the managers in the middle, who mediate between the strategic planners above and the operational controllers below.

As these examples demonstrate, the most successful kinds of organizations in the modern world have tended to segregate the functions of strategic planning, management control and operational control, and to array the personnel charged with these activities into a vertical hierarchy. Rural cooperative organizations in several developing countries have adopted a hierarchical, multi-tiered pattern of organization, but this has not been clearly linked to a hierarchy of management functions. Therein has lain a major weakness, I believe, of the cooperative movement in most developing countries.

As early as 1895, when Frederick Nicholson published a highly influential report on the possibilities for cooperatives in India, a two-tiered structure for Asian rural cooperatives was proposed. Nicholson had been deputed by the Madras Presidency to tour Europe and study rural credit. He returned to India enthused by the rural credit cooperatives in Germany which had been established by Friedrich Wilhelm Raiffeisen. (More than half a century after Nicholson wrote his report, Akhter Hameed Khan, who is an astute historian, was to cite the Raiffeisen cooperatives as one of his inspirational models.) Nicholson proposed that village cooperatives should be serviced by district cooperative banks. The Indian Cooperative Credit Societies Act of 1904, which drew upon Nicholson's recommendations, was later transplanted to other countries in the eastern hemisphere by the British colonial service.[10] As a consequence, a multi-tiered cooperative structure is now the norm in many Asian countries.

Gordon Hugh Ward, a contemporary international consultant on cooperative organizations, advocates a pyramidal system of cooperative federations as the best structure for most developing countries. At the base of such a structure might be joint liability savings and loan societies of 10-50 members each, organized at the village level. The second tier, at the county, township or market town level, would consist of multi purpose farmers cooperatives of 500-3,000 members. These two tiers would be supported by provincial cooperative marketing and purchasing federations, and by a cooperative purchasing and marketing organization at the national level.[11] The hierarchy which Ward has in mind, clearly, is based on a layering of operational functions rather than a layering of management functions.

Management at the Village Tier

Robert Anthony defined operational control as "the process of assuring that specific tasks are carried out effectively and efficiently."[12] That phrase describes the minimal function of a manager of a village cooperative in the Comilla system. The local cooperative manager was expected to chastise and cajole members who did not attend weekly meetings, did not make savings deposits, or did not repay their loans. He was expected to see to it that the society's paperwork was kept in order, including especially the prompt issuance of receipts for all cash collected. In some respects the manager of the village cooperative was not so much an operational controler as an operative. He was the trusted courier, for example, who carried money to and from the bank at the thana training center, and he collected and disbursed funds within his village society. In those village cooperatives in which the manager failed to perform his minimal functions -- sometimes due to his disinterest but more often due to his corruption -- the society typically fell apart and its relations with the central association went sour.

The following two case studies, which are condensed from M. Zaker Hussain's report on A Field Investigation into the Management of Village Cooperatives, illustrate the disintegration of solidarity that generally followed a manager's derilliction of duty. In the first case the manager was simply inattentive to administrative detail, while in the second case the manager was corrupt. The cooperative in South Rampur village was the very first to be organized in Comilla Kotwali Thana, and was regarded with special affection by the leaders of the cooperative experiment. Perhaps they were deluded by their nostalgia when they made the curious decision to employ the society's upright but incompetent manager at the thana level. The black-listed societies, mentioned at the end of the South Rampur case study, were a group of 21 primary cooperatives in which management had fallen into such a bad state by 1965 that the central association denied them irrigation water and credit until they could bring their affairs into order.

South Rampur

> The manager of this society was respected by all the members. Nobody ever suspected his integrity. Members were complacent that things would be alright so long as he was in charge. They never bothered about receipts or entries in their pass books. Members repaid their loan to him without asking for receipts. He did not realize the necessity of placing the accounts before the members so that they could discuss them in meetings. Members seemed to be happy with him. But he was withdrawn from the society and given employment in the central association on 28-7-62. Trouble started from that time onward. The new manager was not given all the records, particularly the pass books, by the old manager. He could not explain the society's accounts to the members. Accounts began to fall into arrears. The members now became suspicious and they gradually took less and less interest in the society. The society reached a state of collapse. It fell into heavy arrears with the central association and declined to the status of a black-listed society.[13]

Bhubanghar

> The Bhubanghar society was organized on 16-10-61 with 37 members. Mr. Wahidur Rahman was its manager from the start. He comes from a respectable

> family in the village. It was therefore nothing unusual that Wahidur Rahman was selected as the manager of the society, though he does not command as much respect as his forefathers. People say he married thirteen times and at present has four wives.
>
> The society started working fairly well. Attendance and savings were fairly regular. The society got two loans -- one in February '62 for the purchase of fertilizer for demonstration plots in the village and the other of Rs. 5,000 in March '62 for the production of an aus crop. The manager took the entire fertilizer loan and got two shares of the aus loan -- one in his own name and the other in the name of his wife. The third loan which was issued in November '62 was also taken by the manager for the installation of a private tubewell in his house. From the beginning the manager attempted to derive the maximum personal benefit from the society's loan transactions.
>
> It was no wonder that the members lost interest in the society. The society reached its collapsing stage when Mr. Wahidur Rahman juggled the accounts of the society, failed to issue receipts for monetary transactions, issued unauthorized loans to his favorites without knowledge or sanction of the society, and himself defaulted in loan repayments.
>
> The inspector, by great persuasive efforts, did manage to realize all the society's loan, but it was impossible for him to revive the society until the members made up their minds to remove the manager and elect a new one. The regular visit of the inspector and his probe into the irregularities committed by the manager brought the society's problems to the surface. The inspector educated and influenced public opinion in the society. Gradually the members decided that they could not permit Wahidur Rahman to run their affairs. Once the members were mobilized, they not only removed Wahidur Rahman from office but resisted the disruptive tactics and family influence which he brought to bear against the reconstituted cooperative.[14]

In contrast to these two cases, the Rajashpur cooperative was well managed, functioning smoothly under the methodical leadership of a retired civil servant.

Rajashpur

> Members are happy with the performance of the society. They feel they are benefiting by it. Many members, for instance, do not have enough land. They take annual leases of land with money borrowed from the central association; they can repay the loan with the proceeds of one crop and can save the second crop for their own family consumption.
>
> There is good leadership in the society. Nobody can remain absent from the weekly meeting without permission. If any member fails to attend due to unavoidable circumstances he must come to the manager the next morning and report the cause of his absence. In case of failure of the absentee member to report, the manager himself pays him a visit. Mr. Hasan Ali Amin, the manager of this society, feels strongly that a society will go bad if the manager does not remind members to attend meetings and does not follow up those who show signs of indiscipline.
>
> The manager worked as a surveyor under the Settlement Department of the Government of East Pakistan. He is a competent person, systematic and methodical in his record keeping. He is respected by the members. He is considered to be an honest man.[15]

Zaker Hussain concluded that the best cooperative societies, such as Rajashpur, were typified by a harsh, self-imposed discipline which kept wavering members in line. The members of such societies were willing to undergo such discipline because their cooperative brought them economic prosperity, and served as a forum for settling their disputes. A necessary precondition for such solidarity and discipline was that the society have an honest manager who was conscientious in his adherance to recommended cooperative procedures.

The core functions of a village cooperative manager -- such as assuring that paperwork was completed properly, and that cooperative precedures were followed -- were in the realm of operational control. The managerial tasks of creating group solidarity and maintaining discipline could also be classified as operational control functions. These are tasks in which military sergeants, after all, are also expert.

In some instances the village cooperative managers were challenged to assume responsibilities that lay in the higher realm of management control. These instances arose, usually, when the village cooperative decided to extend itself beyond participation in the credit program, and to go into ventures such as tubewell irrigation or brick manufacturing. In chapter five I discussed the way that tubewells placed demands upon village cooperative management to plan and construct irrigation channels, set water rates and policies, and arrange for the supply of fuel. To be sure, none of these particular tasks appear in the middle column of Figure 8-2, where Robert Anthony lists examples of management control in an American business corporation. He defined management control as "the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives."[16] Assuring the fuel for the pump is secured, and that pumped water is used effectively, are activities which legitimately belong in the category of management control.

The impact of good local management on the capability of a cooperative to irrigate the village acreage is indicated by the data in Table 8-1. The table was constructed by combining information from two sources. At the conclusion of a four man field investigation into the management of 45 village cooperatives in Comilla thana, Zaker Hussain, the vice chairman of the Kotwali Thana Central Cooperative Association and the leader of the field research team, rated the management of the cooperatives as good, medium, and bad. The quality of management in several of these local cooperative societies had previously been rated as good or bad by Shamsul Huq, the director of the Agricultural

Cooperatives Federation. Shamsul Huq did not stipulate his criteria for judging a society's management as good or bad, while Zaker Hussain did. Use of irrigation is just one of 17 features which Zaker Hussain stated can be used to distinguish a good from a bad society. In sixteen of the villages that had been visited by the field team, irrigation tubewells had been installed. For two of these 16 tubewell societies, Zaker Hussain and Shamsul Huq disagreed in their ratings,[17] so those two cooperatives, Chowara and Sreemantapur, have been excluded from the data reported in Table 8-1. The acreage irrigated in each of the other 14 management-rated societies in 1965-66 was taken from the sixth annual report of the Comilla cooperative experiment.[18]

Table 8-1: Irrigated acreage for cooperatives with good, average and bad management.

	Average acreage irrigated for:		
Cooperatives with:	Cooperative members	Non-members	Total
A. Good management (N = 5)	40.17	20.9	61.1
B. Average management (N = 6)	24.08	18.71	42.79
C. Bad management (N = 3)	17.02	5.7	22.7
One-Tailed T-Tests	T value (probability)		
AB: 9 degrees of freedom	1.32 (.110)	.28 (.393)	1.05 (.161)
BC: 7 degrees of freedom	1.40 (.102)	1.47 (.093)	1.60 (.077)
AC: 6 degrees of freedom	1.32 (.118)	2.00 (.046)	1.73 (.068)

The uniformly increasing trend from the bottom to the top of each column of Table 8-1 suggests that the better the local cooperative management, the more acreage can be irrigated by a tubewell. The strongest distinction shown in the table is that between the mean irrigated acreage for non-members of cooperatives with good and bad management (comparison AC in the middle column). On first glance, it might appear odd that those who benefit most from good management inside a village cooperative are those outside the cooperative. But on reflection it does make sense that a well managed cooperative would minimize the cost of tubewell water to its members by selling as much as possible to outsiders. A six inch tubewell could command an irrigated area of 120 acres or more, and since the highest average total irrigated acreage shown in Table 8-1 was half that, it can be inferred that the supply of water was not the limiting factor in tubewell utilization. The limiting factor was the quality of cooperative management.

The importance of good local management for village irrigation was noted by the field research team which Zaker Hussain led in 1966. In my unpublished monograph on The Comilla System of Supervised Credit, written a few months after our team had concluded its work, I remarked:

> The research team discovered that in many cooperatives, managerial dishonesty and inefficiency were the limiting factors for the acreage covered by tubewell irrigation. Where the manager was incompetent or distrusted, there were numerous disputes about the allocation of water, cases of water theft by illegally cutting distributory channels, and instances of refusal to pay for water. Where either the manager or a body delegated by him had set up a plan for water distribution, authorized one or two men to carry out the plan by digging channels and releasing water into the fields, and announced a schedule for the payment of water rates, there were few disputes and a large acreage was brought under irrigation.

Although the manager was the most important figure in the management of a village cooperative, others were involved. Jockeying among management personnel could paralyze an honest manager, as was the case in Shishpur cooperative. The chairman of the Shishpur society, according to Zaker Hussain's account, started fomenting trouble when he grew jealous of the manager's success in placing two of his brothers in jobs with the central association. The chairman enlisted the support of members of the rai to which the manager did not belong, and began a campaign to unseat the manager. As a consequence of the prolonged quarrel which ensued, the society's tubewell closed down altogether.[19]

In the second chapter I described how electoral sanctions and the pressure of public opinion were exerted from below against the managing committee of each village cooperative. The frequency of cooperative meetings, which were supposed to be held in each village society once a week, contributed to the effectiveness of these mechanisms for accountability. Badruddin Ahmed explains:

> Every functionary has to come prepared to the weekly meeting so that he can answer to the queries of any member. A manager, for example, has to keep the account up-to-date so that any member wishing to compare his account can do so in the weekly meeting. Similarly a model farmer has to give the members the solution to a problem given him in the previous week, if he has got it from the Thana Training and Development Center.[20]

As the history of the Shishpur society illustrates, though, pressure from below could be a cause of disruption in cooperative management. Sanctions exerted from above, as through the recommendations of the inspectors on loan limits for each society, were also subject to distortion if the next higher level of management became corrupt. Accountability was the key problem in implementing the Comilla plan of decentralizating operational control of the cooperatives to the village level.

<u>Management at the Thana Tier</u>

In their review of the Asian experience in rural development organization, Uphoff and Esman remarked that two contradictory philosophies have been prevalent in the field of rural development. According to the paternalistic approach, the passive, fatalistic villagers are incapable of improving their lot, and must be organized and guided from above. The populistic approach, on the other hand, assumes that the people in the villages can manage their own affairs and transform their own communities. Students of organization theory will recognize the similarity of these approaches to Douglas McGregor's theories of management, theory X and theory Y.

The strength of the Comilla cooperatives resulted in part from their having found an organizational home for each of these philosophies. The village cooperatives were expected to function according to the populistic philosophy, while the thana cooperative association saw itself as the instigator of change in the villages and stood ready to chastize -- sometimes even to blacklist -- errant village cooperatives and to help them to straighten out their affairs.

In the intermediate echelon of the inspectorate the two philosophies met head on. The inspectors stood midway between the village level and the thana level cooperative organizations, and their sympathies were often divided between the two. Was the inspector an organizer and inspirational leader in the community development tradition? Or was he a disciplinarian and a petty bureaucrat in the tradition of South Asian civil servants? The cooperative association never clearly prescribed either the proper functions or the proper allegiance of the inspectors. Perhaps it was natural that toward the end of the decade of the sixties some inspectors succumbed, and took advantage of their positions for personal gain.

During the year that I was stationed at the Academy for Rural Development in Comilla, 1965-66, I paid a good deal of attention to the inspectors. I befriended a few inspectors and traveled with them by night to cooperative meetings in the villages. To obtain a more systematic assessment of the inspectors' work, I submitted a written questionnaire to all the Kotwali Thana inspectors in December of 1965, and followed up with an interview with each inspector. On the basis of that pilot study of the inspectors in Kotwali Thana, I prepared a more extensive questionnaire and asked the inspectors in Kotwali Thana and in the expansion project thanas to fill it in. The second questionnaire was completed and returned by the inspectors in two of the three expansion projects that had been founded in 1963-64 (those in Natore and Gaibandha thanas) and by five of the seven expansion projects dating from 1965-66 (those in Hajigonj, Brahman Baria, Serail, Chandina, and Laksam thanas in Comilla district). Taking into account the number of inspectors who were employed in each thana at the time, the overall response rates for the survey were: Comilla Kotwali Thana, 75%; 1964 projects, 67%; and 1966 projects, 58%. At the time of the survey, the Kotwali Thana Central Cooperative Association was five years old. The Agricultural Cooperatives Federation in Kotwali Thana had not yet been created. The projects in Natore Thana of Rajshai District and in Gaibandha Thana of Rangpur District (1964 projects) were three years old, and the expansion projects in Comilla district had been running for nine months.

In Table 8-2 I have summarized some of the demographic characteristics of the cooperative inspectors, as determined by my survey. The Kotwali Thana inspectors differed in several respects from those that had

Table 8-2: Background characteristics of inspectors.

	Kotwali Thana	1964 projects	1966 projects	All Inspectors
Mean age	32 yrs.	26 yrs.	28 yrs.	28 yrs.
<u>Education</u>				
Up to Class IV	100%	100%	100%	100%
Up to Class VII	100%	100%	100%	100%
Up to Class X	100%	100%	100%	100%
Matriculate	11%	83%	42%	48%
Intermediate	0%	8%	5%	6%
Graduate	0%	0%	5%	3%
Training in Agriculture	22%	100%	46%	50%
Special training for job of inspector	67%	92%	68%	75%
<u>Occupation of Father</u>				
Farmer	56%	67%	79%	70%
Educator	22%	8%	5%	10%
Civil servant	11%	17%	16%	15%
Doctor	11%	8%	0%	5%
<u>Place of birth</u>				
Rural area	100%	83%	95%	93%
Urban area	0%	17%	5%	7%
<u>Residence</u>				
Rural area	67%	42%	74%	63%
Urban area	33%	58%	26%	37%
N	9	12	19	40

been hired in the newer projects. The Kotwali thana inspectors were older, somewhat less educated, less likely to be trained in agriculture or in specific preparation for their job, and more likely to have been born in a rural area. These differences arose because recruitment policies in Kotwali thana favored the hiring of talented managers from village cooperatives, whereas the expansion projects favored hiring personnel from other government agencies, or young people taking their first job. The Kotwali thana policy had the advantage of tying the village and the thana tiers of the cooperative organization more closely together. On the other hand, inspectors who were recruited from the villages may have been more likely to succumb to the temptations of favoritism or outright corruption.

Akhter Hameed Khan always opposed the local recruitment of high level officers of the thana cooperative associations, whether in Kotwali thana or elsewhere. For fear of the corrupting influence of friends and relatives upon these officers, they were never posted to their home thana. Similar precautions might have been advisable for the inspectors in Kotwali thana.

After I had completed my pilot interviews with the inspectors in Kotwali thana, I consulted with Mr. Shamsul Huq, who was then Deputy Project Director of the KTCCA in charge of field supervision, to prepare a list of fifteen functions which the inspectors fulfilled. On the second questionnaire which I circulated, the inspectors were asked to rank these fifteen functions in terms of the amount of time they devoted to each function throughout the year. An aggregate task ranking, together with a rank order correlation coefficient (W) was then computed for each group of inspectors.

The low rank order correlation of .38 for the inspectors in the

Table 8-3: Inspectors' ranking of their activities.

Kotwali thana	1964 projects	1966 projects	
1	2	2	Urging society members to save more
2	4,5	1	Urging society members to buy more share capital
3	15	3	Organizing new societies
4	11	14	Collecting loan repayments
5	1	9	Urging society members to adopt more improved agricultural practices
6	8	10	Checking on loan utilization
7	10	4	Inspecting the books of the societies
8	4,5	11	Urging tubewell societies to use more irrigation water
9	3	5	Urging societies to hire more tractor services
10	7	12	Processing loan applications
11	6	7	Advising primary societies how to apply for loans (including advice on production plans)
12	12	13	Urging societies to engage in joint marketing through the Central Cooperative Association
13	14	6	Reporting grievances and demands of the primary societies to the Officers of the Central Cooperative Association
14	13	8	Organizational Paperwork (drawing up tables, writing letters and reports, etc.) and meetings of the Central Cooperative Association
15	9	15	Recommending loan limits
W = .64	W = .81	W = .38	

1966 projects was probably due to their newness on the job; having been at work for only nine months, these inspectors had not settled into a regular work pattern. The inspectors in the 1964 projects, who showed strong agreement on the ranking of their functions, emphasized agricultural improvement more than the Kotwali inspectors. The 1964 project inspectors spent most of their time urging the adoption of improved agricultural practices, and they gave relatively high rankings to urging cooperative members to hire more tractor services and to use more tubewell irrigation water. The bulk of the work of the Kotwali inspectors, by contrast, was centered on the administration of the loan program.

The similarity between the jobs of the inspectors and the cooperative managers in Kotwali thana was striking. The inspector seemed, in many instances, like a back up manager for troubled cooperative societies. In my interviews with the Kotwali inspectors, I asked whether they would spend more time with a society which had a bad manager or with a society which had a good manager. All of the nine Kotwali thana inspectors said they would spend more time helping the society with the bad manager. As one inspector put it, "I have to spend more time with the bad manager because he cannot do everything regularly and systematically without the help of the inspector."

In a 1964 survey, a staff researcher of the Pakistan Academy for Rural Development asked all of the managers of the primary cooperative societies to list their duties and responsibilities.[21] Some of the managers' responses to this open ended question are listed in the left hand side of Table 8-4. The comparable activities on the right hand side of the table are listed as they were ranked by the Kotwali inspectors in the author's survey.[22]

Table 8-4: Comparison of Managers' and Inspectors' activities in Kotwali thana.

Managers' Activity	Place in Frequency Description	Order in Ranking	Inspectors' Activity
To collect weekly savings and/or deposit them in the Central Bank	1	1	Urging society members to save more
To teach the members improved agricultural practices	2	5	Urging society members to adopt more improved agricultural practices
To keep accounts and records of the societies	3	7	Inspecting the books of the societies
To procure loans and distribute them	6	10	Processing loan applications
To prepare plans and programs of the societies	8	11	Advising primary societies on how to apply for loans
To maintain liaison between the Central Association and the primary societies	9	13	Reporting grievances and demands of the primary societies to the Central Cooperative Association

The similarity between the two lists is remarkable. On the basis of these surveys, one could almost characterize an inspector as a glorified manager who was not authorized to carry cash. An inspector was both a teacher and a trouble shooter. As a field worker, he was needed mainly when irregularities arose. If all the managers had carried out in their village cooperatives the tasks in which they were instructed in their weekly training classes, there would have been little need for the inspectors to go on tour. Good managers were substitutes for good inspectors.

Good inspectors were also substitutes for bad managers. As disciplinary figures, the inspectors would recommend that the central association file charges in court against managers who had stolen money or against borrowers who had defaulted. The inspectors did not often bring this residual authority into play, however, since they preferred to mobilize group opinion in a cooperative against wrong-doers. A strong dosage of democratic correction by the cooperative members -- the eviction of a criminal manager from his office -- could cure the worst cases of corruption. But if the inspector did not influence public opinion in the society, inciting the members to over-throw their manager, the cooperative was likely to languish in distrust.

Given the overall similarity of the duties of the managers and the inspectors, it seems reasonable to assert that the major managerial responsibilities of the inspectors, like those of the managers, were in the category of operational control. In accordance with our general theory, we might anticipate that closed loop information feedback would be an important aspect of the managerial control exercised by the managers and inspectors. Such was indeed the case, though more markedly for the inspectors than for the managers.

An inspector in the Comilla cooperatives worked at the confluence of several information feedback loops. Many of these loops were described in the section of chapter five which dealt with loan issue and repayment procedures. In drawing up draft loan limits for each society under his supervision, for example, the inspector would lower his proposed credit limit for societies where attendance, loan repayment, and savings and share purchases were poor. The resultant restriction of cooperative credit -- which was in especially high demand in the late sixties because of the costly input requirements of the high yielding varieties of rice seeds -- would stimulate the malfunctioning societies to bring themselves up to standard.

Audit procedures of the central association were another example of managerial control through information feedback, although because these procedures were so slow-paced the inspectors tended not to be involved in them in an on going way. The accounts of all the primary societies were audited for each fiscal year by trained auditors deputed to the Comilla project from the cooperative department. Since so few auditors were deputed, and since the accounting system was itself so Byzantine, there was usually about a one-year lag in the completion of these audits.

An audit report was written up for each society, and the manager was required to write an audit rectification report which would show how he had corrected each of the errors noted in the audit report. At the annual general meeting of the village cooperative, the inspector for the society would read aloud both the audit report and the audit rectification report.

Management control, as defined by Anthony, is distinguished from operational control in two critical respects: a) management control involves the acquisition and use of resources, and b) management control is tuned to the accomplishment of the organization's objectives.

The upper-echelon management of the Agricultural Cooperatives Federation displayed both of these characteristics of management control. As one of the autonomously managed profit centers in the KTCCA, the ACF was responsible for matching costs with expenditures with the objective of running the rural credit operations at as small a deficit as possible. Net savings, loan issue and repayment, and borrowed equity capital were to the managers of the ACF the essence of their organization's cash flow. They tried to maximize savings, share purchases, and loan repayments, and to minimize the need for borrowing from the

KTCCA, in order to hold their deficit in bounds. The quality of management in the village societies, similarly, was to the Agricultural Cooperatives Federation a problem of more than philosophic importance; a poorly managed village cooperative was a poor loan risk.

The income-earning orientation in the Agricultural Cooperatives Federation had its drawbacks. During the frantic growth year of 1967-68, an inordinately large quantity of loans were issued to the primary cooperatives. Badruddin Ahmed comments: "To implement this policy the inspectors were given immense responsibilities and were asked to invest more to justify the viability of the Agricultural Cooperatives Federation as an independent organization capable of maintaining its own staff. Higher investment means higher revenue income and higher income means higher salary."[23]

Aside from the objective of achieving financial viability, the Agricultural Cooperatives Federation shared in many of the larger purposes of economic and social uplift of the whole Comilla experiment. The women's program and the youth program, for instance, were administered through the Agricultural Cooperatives Federation. The major assignment of the ACF, however, was the administration of the rural credit program, and in that sector the pressure for self-sufficiency was paramount.

The resemblance of the concept of management control to that of middle management was touched upon previously in this chapter. Management controllers usually report upwards; they are not typically the top brass in an organization. The major function of the executives (the directors and deputy directors, not the inspectors) in the Agricultural Cooperatives Federation was management control over the rural credit program. As with middle managers anywhere, the inclination of these executives was to report upwards in a bureaucratic hierarchy. By and large, the administrators in the Agricultural Cooperatives Federation saw themselves as answering to the higher level decision-makers in the Kotwali Thana Central Cooperative Association. Yet according to the formal organizational structure and by-laws of the Agricultural Cooperatives Federation, this inclination was incorrect. Because the ACF was registered as a cooperative organization, it possessed, in accordance with East Pakistan cooperative law, a managing committee. The majority of the members of the managing committee were elected by the membership. Primary cooperatives, not farmers, were the members of the ACF, and each village cooperative was entitled to one vote in electing the managing committee. (For a few years one third of the members of the ACF managing committee were appointed by the registrar of cooperative societies, who usually chose employees of the ACF or of the KTCCA, or faculty from the Academy for Rural Development. The by-laws of the ACF were later changed to provide for the election of all members of the managing committee.)

According to the theory of separation of powers embodied in the cooperative law, the managing committee was to set policies for the Agricultural Cooperatives Federation, and the ACF project director and his staff were responsible for implementing those policies. That was not the way it worked. In a study that spanned the years from 1967 to 1970, Badruddin Ahmed, a faculty member of the rural development academy, reported that the managing committee rubber-stamped the decisions of the ACF administration concerning the distribution of loans, the allotment of new tubewells, the preparation of the annual budget, and the appointment of new employees in the federation.[24]

According to one school of thought, it was just as well to keep the ACF managing committee at arms length when it came to substantive decision making. Even more than the managing committee of the primary cooperatives, the ACF managing committee came to be dominated by larger farmers, and by persons jointly engaged in farming and in business. No landless laborer or near landless farmer was ever elected to the ACF managing committee between 1966 and 1970. The proportion of small farmers owning from one to two acres -- the class of farmers whom the cooperative system was intended to serve, in the manner of a rural trade union protecting them from exploitation -- was never greater than one quarter of the members of the managing committee, and fell to 17% in the committee elected for 1969-70.

In the period of the early nineteen seventies, when administrative discipline was especially shaky throughout Bangladesh under the regime of Sheik Majibur Rahman, the ACF managing committee exerted its influence over the running of the federation more strongly than it had before. The committee's tendancy was not to set general policies -- which was the proper role envisioned for it in the cooperative law -- but to delve into the detailed operation of the credit program. An instance of the resultant abuses was reported by Ali Akhtar Khan:

> There was an influential and active manager.... He was a member of the ACF managing committee and of its loan committee. He used to visit the ACF at least once a day. From there he could manage a big flow of loans to his neighboring societies, to his own society, and ultimately to himself and other relatives.[25]

As the apex organization of the Comilla cooperatives, the Kotwali Thana Central Cooperative Association engaged in strategic planning, the highest of Anthony's three levels of management. Policy decisions about the scale of credit operations, and about expansion into new areas of economic activity, were made at the KTCCA level. And it was among the leaders of the KTCCA, and between them and the faculty of the Academy for Rural Development, that the great debates took place as to where the cooperative system should turn so as to accelerate rural development in the thana. The contigent of foreign experts and advisors in Comilla, who perforce saw the larger outlines of affairs rather than the fine details, also made their impact mainly at the level of the KTCCA.

The Kotwali Thana Central Cooperative Association did not specialize in strategic planning. As the financing bank for its member federations such as the Agricultural Cooperatives Federation and the Special Cooperative Societies Federation, the KTCCA was mainly engaged in management control over its loan funds. But of all the three tiers in the Comilla cooperative organization, the KTCCA partook much more than the other two in strategic planning activities.

The Academy for Rural Development at Kotbari, some seven miles away from the cooperative headquarters complex at Abhoy Ashram, had an important role in strategic planning which should not be overlooked. The academy, after all, was the organization which first gave birth to the cooperative experiment in the early nineteen sixties. Through their field research in the villages of Comilla Kotwali Thana, the academy faculty monitored the impact of the cooperatives on many aspects of rural life. And in weekly staff meetings and yearly planning conferences in which academy faculty and cooperative association officials participated, the progress and shortcomings of the cooperative organizations at each tier of the Comilla system were reviewed, and proposals for improvements were set forth.

Notes for Chapter 8

The Management Subsystems

[1] Herbert A. Simon, The New Science of Management Decision, Harper and Row, New York, 1960, p. 10. Reprinted by permission of Herbert A. Simon.

[2] Robert N. Anthony, Planning and Control Systems: A Framework for Analysis, Graduate School of Business Administration, Harvard University, Boston, 1965, p. 55.

[3] Carl Sagan, The Dragons of Eden: Speculation on the Evolution of Human Intelligence, Random House, New York, 1977, p. 70.

[4] Norman T. Uphoff and Milton J. Esman, Local Organization for Rural Development: Analysis of Asian Experience, Rural Development Committee, Cornell University, Ithica, 1974, p. 102.

[5] Anthony, op cit, p. vii. Reprinted with permission.

[6] Fremont E. Kast and James E. Rosenzweig, Organization and Management: A Systems Approach, second edition, McGraw Hill Book Company, New York, 1974, p. 120.

[7] Ibid., p. 121.

[8] Anthony, op cit, p. 19.

[9] Ibid., pp. 10, 11. Reprinted with permission.

[10] For concise histories of the Indian cooperative movement, see Elliot Tepper, Changing Patterns of Administration in Rural East Pakistan, Asian Studies Center, Michigan State University, East Lansing, 1966, and Gordon Hugh Ward, "The Structure and Organization of Cooperatives in Developing Nations," in Mary J. McGrath, ed., Guidelines for Cooperatives in Developing Economies, International Cooperative Training Center, The University of Wisconsin, Madison, 1969.

[11] Ward, op cit, p. 14.

[12] Anthony, op cit, p. 18.

[13] M. Zaker Hussain, A Field Investigation into the Management of Village Cooperatives in the Comilla Experimental Area, Pakistan Academy for Rural Development, Comilla, 1966, pp. 25, 26. Zaker Hussain led a four-man investigative team which visited 45 village cooperatives in Comilla Kotwali Thana to gather material for this report. The author was one of the members of that team.

[14] Ibid., pp. 60, 61, 65.

[15] Ibid., pp. 47, 49.

[16] Anthony, op cit, p. 17.

[17] The reader who pursues this matter and checks Chapter 2 of Hussain's report will find that the comparison of ratings is a bit more complicated than the text portrays it to be. Shamsul Huq only rated societies as having good and bad management. The list which he gave to the field team at the start of their investigation did not include any cooperatives with average management. Chowara was rated by Shamsul Huq as having bad management, whereas Zaker Hussain placed it in the medium category. Sreemontopur got a good rating from Shamsul Huq, and a medium rating from Zaker Hussain.

[18] A. Aziz Khan, A New Rural Cooperative System for Comilla Thana, Sixth Annual Report, Pakistan Academy for Rural Development, Comilla, 1967, p. 90.

[19] Hussain, op cit, pp. 29-31.

[20] Badruddin Ahmed, Manual on Comilla Cooperatives, Bangladesh Academy for Rural Development, Comilla, 1972, p. 44.

[21] Md. Ameerul Huq, The Characteristics of the Managers of the Agricultural Cooperatives in Comilla, Pakistan Academy for Rural Development, Comilla, 1965.

[22] Managers responding to Md. Ameerul Huq's survey could make as many responses as they liked. Their responses were then grouped and ordered according to frequency. In the author's survey, the inspectors were asked to rank 15 tasks on a predetermined list.

[23] Badruddin Ahmed, Who Decides? Role of Managing Committee in ACF, Bangladesh Academy for Rural Development, Comilla, 1972, pp. 23, 24.

[24] Ibid.

[25] Ali Akhter Khan, Rural Credit Programme of Agricultural Cooperative Federation, Bangladesh Academy for Rural Development, Comilla, 1971, p. 50.

CHAPTER 9

Conclusions

The commentary in this volume has covered a fair range of topics, from the musings of astrophysicist David Layzer about the conditions which prevailed during the first microsecond after the expansion of the universe began to the remarks of cooperative administrator Zaker Hussain about the necessity of village organization for pump irrigation. The scope of the inquiry was characteristic of essays in general systems theory, the purpose of which is to construct universal principles within which investigations of all phenomena can be encompassed.

The main contribution to general systems theory which has been made in this volume is a typological one. Three major typologies were presented and integrated: a typological matrix of systems, a classification of mathematical systems, and a paradigm for the analysis of organizations as a set of subsystems. To the extent that the integration of these typologies was successful, the overall coherence of the widespread discussion in these pages should have been apparent.

In the third chapter I referred to David Berlinski's reservations about the explanatory power of general systems theory. Berlinski levelled some of his strongest criticisms against mathematical systems theory, particularly of the sort which takes the form of systems of differential equations. Social systems, Berlinski contended, are far too complicated to be modelled mathematically.

The typological innovations which were described in the third chapter permit the formulation of a well-calibrated response to critics of systems theory such as David Berlinski. It is quite true that mathematical systems theory as it presently stands is inadequate for the representation of important aspects of organic systems. In formal organizations, these aspects would be the psychosocial subsystem and the managerial subsystems. In chapters seven and eight of this volume, accordingly, I did not venture to present mathematical models of the psychosocial subsystem or of the operational control, management control and strategic planning subsystems in the Comilla cooperatives. The absence of mathematical models from chapter six, which dealt with linkages between the cooperatives and their environment, was not due to the general unfeasability of creating such models, but to the deficiencies in my own education. Since the idea of linkages is derived from the concept of channels in communications theory, I suspect that reasonable linkage models could be created from the mathematical material of the theory of information and communication. Since I am not versed in that body of theory, I resorted to less rigorous methods for describing and explaining organizational linkages.

The sufficiency of mathematical systems theory for modelling the structural and technical subsystems of organizations was demonstrated in chapters three and four. Both the structural and the technical subsystem models showed themselves capable of tracking actual average data for the cooperative expansion projects. Some of the most specific conclusions emerging from this study were derived from those models. Among them were the following:

1. Economies of scale in administration can be reversed if the organization grows beyond a certain size. For the Comilla-type thana

cooperative associations in East Pakistan in the nineteen sixties, the optimum organizational size was between 50 and 70 employees, including both workers and supervisors. When thana cooperative associations grew beyond that size, they tended to become top heavy with supervisory personnel.

2. The optimum rate of growth for cooperatives of the Comilla-type was between 40 and 50 new village cooperative societies per thana per year.

3. A continuation of the pattern of operations of the cooperative associations founded in Comilla District in 1965-66 would have led to financial disaster. Annual profits would have ended in 1977, after which annual losses would have become greater each year. (This conclusion, like all others recorded here, assumes a history of environmental stability for the cooperative associations. In fact their environment became very unstable, due to the struggle for independence and its aftermath. The precision of the conclusion is therefore questionable. However, I believe that the general prediction of long-run financial peril is valid, even in the light of environmental turmoil.)

4. In order to achieve a trajectory which would have led to long-run financial health, the thana cooperative associations could have:

a) Increased their loan coverage requirements, so that more than one fifth of the value of loans outstanding would have had to be matched by savings and shares.

b) Held down the percentage of loans not repaid on time.

c) Increased their collection of interest on village loans to at least twelve percent.

Such policies could also have been mixed, in combinations specified in Table 5-11 in Chapter 5.

Other conclusions of a less numerical character were derived from the non-mathematical analyses in the preceding chapters. Among these conclusions were the following:

5. The validity of the seven principles of sound rural development organization which were pronounced by Norman Uphoff and Milton Esman in their summary of the Cornell study of rural local government in Asia was confirmed in the instances of the Comilla-type cooperatives, and of the Rural Public Works Program in East Pakistan in the nineteen sixties (Chapter 2).

6. The doomsday proposition, based on the second law of thermodynamics, that closed systems tend toward increasing entropy was shown to have limited applicability to biological systems and to human organizations (Chapter 3).

7. The dangers of excessive vertical proliferation in a rural development organization were pointed out. When more than two tiers of organizational structure are present in a local development agency such as a cooperative network in a thana, the organizational distance between the top leadership and the village membership may make it difficult to control corruption at the lower tiers (Chapter 4).

8. Several of the rural development technologies advocated by the Comilla experimenters required cooperation and organization for their attainment. This was especially true of the technologies of dry-season irrigation and tractor cultivation (Chapter 5).

9. During the nineteen sixties two credit technologies were employed in the cooperatives in Comilla Kotwali Thana. These were the technologies of supervised agricultural credit and of supervised cooperative management. Of these two technologies, the second is probably more suitable for replication in other developing countries, since it tended to promote the long-run financial health of the parent institution, the thana cooperative association (Chapter 5).

10. At the village tier, the Comilla cooperatives drew much of their propulsive energy from the previously untapped aspirations of small farmers, and, to a much lesser extent, of women. Both groups had been trapped by the pre-existent social systems, and saw the cooperatives as a means to improve their lot (Chapters 1, 2 and 6).

11. Successful leadership of the village cooperatives called for treading a narrow middle ground between promoting harmonious relationships with prestigious persons and established leadership groups (such as the reyai and samaj) on the one hand, and avoiding capture on the other hand by those local economic elites whose exploitation the cooperatives sought to displace (Chapters 2 and 6).

12. The capacity of the Comilla-type rural cooperatives for the mobilization of the rural populace was limited by the lack of formalization of horizontal linkages with social groups in the villages, and by the constriction of vertical linkages leading upwards to the thana cooperative association (Chapter 6).

13. The establishment of horizontal linkages with other agencies operating at the thana tier was the essence of the concept of the Thana Training and Development Center. However, the accomplishment of this horizontal coordination was dependent upon support from the provincial and central governments (Chapter 6).

14. By imparting organizational skills and ideology, non-formal education can play a crucial role in building rural development organizations (Chapter 7).

15. At a minimum, rural development organizations require an operational control subsystem at the village tier and a management control subsystem at the equivalent of the thana tier (Chapter 8).

16. Those rural development organizations which include a strategic planning subsystem are likely to be more flexible, creative and successful than those which do not (Chapter 8).

* * * * *

Throughout this volume I have sought to weave together theory and reality. To those readers who are or who have been immersed in the daily complexities of running a rural development organization, the discourses on general systems theory and the second law of thermodynamics may have seemed irrelevant. For an organization theorist, by contrast, the discussions of loan issue procedures in village cooperatives may have seemed inapplicable to the study of the industrial corporations which comprise his customary universe. If this research project has succeeded, it will have broadened the vision of both kinds of people.

When I began this research project, I described to my father some of the theoretical concepts which I was seeking to test against the subject matter of the rural cooperative organizations that I had observed in Comilla in 1965-66. With the disguised impatience of a parent who is trying to sound interested in his offspring's work, my father asked, "Will the study be of any use to anyone?" If indeed this study will ever be of any use to anyone, it will probably be by virtue of the sixteen conclusions listed above. As for the utility of the theoretical insights reported in earlier chapters, I can only apologize, like any social scientist, and say that you can't build an atomic bomb from these equations.

APPENDIX A

Mathematical Derivations

Chapter 3

Reinforcement model of dyadic interaction

The reinforcement model of dyadic interaction presented as 3.5 can be solved as follows.

$$\dot{x} = \alpha y$$
$$\dot{y} = \alpha x \qquad (A.1)$$

Take the derivative with respect to time of the second equation, and substitute the expression for $\dot{x}$ from the first equation, to obtain $\ddot{y} = \alpha \dot{x} = \alpha(\alpha y) = \alpha^2 y$, $\ddot{y} - \alpha^2 y = 0$.

The characteristic polynomial of this system is seen to be $\lambda^2 - \alpha^2 = 0$, which factors to $(\lambda + \alpha)(\lambda - \alpha) = 0$. The roots of the characteristic polynomial are $\lambda = -\alpha$ and $\lambda = \alpha$. The general solution for x must have the form

$$x = c_1 e^{\alpha t} + c_2 e^{-\alpha t}. \qquad (A.2)$$

c_1 and c_2 can be expressed in terms of the initial values of the two state variables. Evaluating A.2 at $t = 0$, we find $x_o = c_1 e^{\alpha o} - c_2 e^{-\alpha o} = c_1 + c_2$, so $c_1 = x_o - c_2$. To obtain an expression for c_2, differentiate A.2 to obtain $\dot{x} = c_1 \alpha e^{\alpha t} - c_2 \alpha e^{-\alpha t}$. At $t = 0$, this becomes $\dot{x}_o = c_1 \alpha - c_2 \alpha$. From A.1 we know that

$\dot{x}_o = \alpha\ y_o$. So we have $\alpha y_o = c_1 \alpha - c_2 \alpha$, or $c_2 = c_1 - y_o$.

Substituting into A.3, $c_1 = x_o - c_1 + y_o$, or $c_1 = \frac{x_o + y_o}{2}$.

Since $c_2 = c_1 - y_o$, $c_2 = \frac{x_o + y_o}{2} - y_o = \frac{x_o + y_o - 2y_o}{2} = \frac{x_o - y_o}{2}$.

The general solution for x is therefore seen to be

$x = \frac{x_o + y_o}{2} e^{\alpha t} + \frac{x_o - y_o}{2} e^{-\alpha t}$. A similar procedure can be used to determine the equation for y in 3.7.

<u>Open system models of dyadic interaction</u>

The three open system models of dyadic interaction, with step, delayed step, and ramp input signals, can readily be solved through the use of La Place transforms. In the general case, a linear dynamic system subjected to an input signal, U (t), can be restated in terms of La Place transforms as follows:

$$\begin{aligned} &\dot{X} = AX\ (t) + GU\ (t) \text{ becomes} \\ &SX\ (S) - X\ (0) = AX\ (S) + GU\ (S). \end{aligned} \qquad (A.3)$$

In the second equation S is an operator indicating the La Place transform $L\{f\ (t)\} = X\ (S) = \int_0^\infty X\ (t)\ e^{-St}\ dt$. Rewriting A.3 to bring similar terms together yields:

$$\begin{aligned} &SX\ (S) - AX\ (S) = X\ (0) + GU\ (S), \text{ or} \\ &(SI - A)\ X\ (S) = X\ (0) + GU\ (S). \end{aligned} \qquad (A.4)$$

Since A.4 is a matrix equation, it cannot be solved by dividing through by (SI - A). Instead, the equation may be multiplied on both sides by $(SI - A)^{-1}$, the inverse of (SI - A), to yield

$$X(S) = (SI - A)^{-1} X(0) + (SI - A)^{-1} GU(S). \qquad (A.5)$$

In the three open system dyadic interaction models shown in Table 3-2, the matrix A is $\begin{bmatrix} 0 & \alpha \\ \alpha & 0 \end{bmatrix}$, so $(SI - A) = \begin{bmatrix} S & -\alpha \\ -\alpha & S \end{bmatrix}$. It can easily be shown that the inverse of this matrix is $\frac{1}{S^2 - \alpha^2} \begin{bmatrix} S & \alpha \\ \alpha & S \end{bmatrix}$.

To evaluate the first expression on the right hand side of A.5, $(SI - A)^{-1} X_o$, all that needs to be done is to find the inverse La Place transform of $(SI - A)^{-1}$. There are two components to this problem: finding the inverse La Place transform of $\frac{S}{S^2 - \alpha^2}$, and finding the inverse La Place transform of $\frac{\alpha}{S^2 - \alpha^2}$. Each of these problems can be solved by a partial fraction expansion.

$$\frac{S}{S^2 - \alpha^2} = \frac{S}{(S - \alpha)(S + \alpha)} = \frac{k_1}{S - \alpha} + \frac{k_2}{S + \alpha}. \qquad (A.6)$$

Multiplication of A.6 by $(S + \alpha)(S - \alpha)$ yields

$$S = k_1 (S + \alpha) + k_2 (S - \alpha). \qquad (A.7)$$

To find k_1, set S equal to the root with which it is associated in A.6, $S = \alpha$. $\alpha = k_1 (\alpha + \alpha) + k_2 (\alpha - \alpha) = 2 \alpha k_1$, so $k_1 = \frac{1}{2}$. Similarly, for k_2, $-\alpha = k_1 (-\alpha + \alpha) + k_2 (-\alpha - \alpha) = -2 \alpha k_2$, so $k_2 = \frac{1}{2}$. Therefore,

$$\frac{S}{S^2 - \alpha^2} = \frac{1}{2} \left[\frac{1}{S - \alpha} + \frac{1}{S + \alpha} \right]. \qquad (A.8)$$

From a table of inverse La Place transforms, A.8 can be rewritten in the time domain as $L^{-1}\left[\frac{S}{S^2 - \alpha^2}\right] = \frac{1}{2}\,(e^{\alpha t} + e^{-\alpha t})$.

The same procedure yields

$$L^{-1}\left[\frac{\alpha}{S^2 - \alpha^2}\right] = \frac{1}{2}\,(e^{\alpha t} - e^{-\alpha t}). \tag{A.9}$$

Putting A.8 and A.9 together, we see that

$$L^{-1}\left[\frac{1}{S^2 - \alpha^2}\begin{pmatrix} S & \alpha \\ \alpha & S \end{pmatrix}\right] = \frac{1}{2}\begin{pmatrix} e^{\alpha t} + e^{-\alpha t} & e^{\alpha t} - e^{-\alpha t} \\ e^{-\alpha t} - e^{-\alpha t} & e^{\alpha t} + e^{-\alpha t} \end{pmatrix}. \tag{A.10}$$

In the examples in Chapter 3, the parameter α in the dyadic interaction model was assigned the value ln2, so A.10 can be evaluated as

$$\begin{bmatrix} \frac{2^t + 2^{-t}}{2} & \frac{2^t - 2^{-t}}{2} \\ \frac{2^t - 2^{-t}}{2} & \frac{2^t + 2^{-t}}{2} \end{bmatrix},$$

which is the expression for e^{At} in the reinforcement model of dyadic interaction which was given in the text of Chapter 3 in equation 3.9.

Because the input signal of strength β is applied equally to both parties in the dyadic interaction experiments described in Chapter 3, the coefficient matrix G in the expression $(SI - A)^{-1}$ GU (S) in equation A.5 is in all three instances the vector $g = \begin{pmatrix} \beta \\ \beta \end{pmatrix}$. $(SI - A)^{-1}$ G can therefore be written as

$$\frac{1}{S^2 - \alpha^2}\begin{pmatrix} S & \alpha \\ \alpha & S \end{pmatrix}\begin{pmatrix} \beta \\ \beta \end{pmatrix} = \frac{\beta}{(S - \alpha)\ (S + \alpha\ )}\begin{bmatrix} S + \alpha \\ S + \alpha \end{bmatrix} = \frac{\beta}{(S - \alpha)}\begin{pmatrix} 1 \\ 1 \end{pmatrix}, \tag{A.11}$$

due to the cancellation of the factor $(S + \alpha\ )$.

La Place transforms of the three input signals illustrated in the third chapter are tabulated below.

Table A-1: La Place Transforms of Three Input Signals

Signal	Time Function	La Place Transform
Step	U (t)	$\frac{1}{s}$
Delayed Step	u (t - a)	$\frac{e^{-as}}{s}$
Ramp	r (t)	$\frac{1}{s^2}$

The mechanics of finding the inverse La Place transform for these three input signals are similar, so only one case will be demonstrated, that of a step function input. From A.11 we can write

$$(SI - A)^{-1} \, GU \, (S) = \frac{\beta}{S - \alpha} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \frac{1}{S} = \frac{\beta}{S \, (S - \alpha)} \begin{pmatrix} 1 \\ 1 \end{pmatrix} . \qquad \text{(A.12)}$$

Partial fractions may be used to expand this as follows.

$$\frac{\beta}{S \, (S - \alpha)} = \frac{k_1}{(S - \alpha)} + \frac{k_2}{S} \qquad \text{(A.13)}$$

$$\beta = k_1 \, S + k_2 \, (S - \alpha)$$

$$\text{Let } S = \alpha \implies \beta = k_1 \alpha \, , \; k_1 = \frac{\beta}{\alpha}$$

$$\text{Let } S = 0 \implies \beta = -k_2 \alpha \, , \; k_2 = - \frac{\beta}{\alpha}$$

Entering these values for k_1 and k_2 into A.13, we find

$$\frac{\beta}{S \, (S - \alpha)} = \frac{\beta}{\alpha} \left(\frac{1}{(S - \alpha)} - \frac{1}{S} \right) .$$

Taking the inverse La Place transform,

$$L^{-1}\left[(SI - A)^{-1}\, GU\,(S)\right] = \frac{\beta}{\alpha}\begin{pmatrix} e^{\alpha t} - 1 \\ e^{\alpha t} - 1 \end{pmatrix}.$$

To check the validity of these derivations, we may use the reduction method which was illustrated above for the solution of the closed system model of dyadic interaction. As an example, let us take the solution for the ramp input signal. In Table 3-1 the forced solution for the ramp input was given as $\begin{pmatrix} x \\ y \end{pmatrix} = \frac{\beta}{\alpha^2}\begin{pmatrix} e^{\alpha t} - \alpha t - 1 \\ e^{\alpha t} - \alpha t - 1 \end{pmatrix}$. Combining this with the expression for e^{At} derived above, the general solution for the variable x is seen to be:

$$x = \tfrac{1}{2}\,(e^{\alpha t} + e^{-\alpha t})\, X_o + \tfrac{1}{2}\,(e^{\alpha t} - e^{-\alpha t})\, y_o + \frac{\beta}{\alpha^2}\,(e^{\alpha t} - \alpha t - 1). \tag{A.14}$$

To test this solution via the reduction method, let us reduce the open system model with a ramp input into an equation from which the variable y has been eliminated. The model is

$$\dot{x} = \alpha y + \beta t$$
$$\dot{y} = \alpha x + \beta t.$$

Take the derivative with respect to time of the first equation, and substitute the second equation into the result in order to eliminate y.

$$\ddot{x} = \alpha\dot{y} + \beta = \alpha\,(\alpha x + \beta t) + \beta = \alpha^2 x + \alpha\beta t + \beta.$$
$$\ddot{x} - \alpha^2 x = \alpha\beta t + \beta. \tag{A.15}$$

In equation A.14 we have an expression for x derived from the La Place transform solution of the model. That expression, and its second derivative with respect to time, can be substituted into the left hand side of equation A.15. After many cancellations, the value of the expression $\ddot{x} - \alpha^2 x$ turns out indeed to be $\alpha\beta t + \beta$, confirming the

La Place transform solution.

Chapter 4

Solution to a closed system difference equation model with an equilibrium point

In matrix notation, a closed system difference equation model has the form $X_{n+1} = B\,X_n + R$. A comparable change equation form of the same model is $\Delta X = AX_n + R$, in which $A = B - I$. If the model is in a state of static equilibrium $\Delta X = 0$. At that equilibrium point in the phase space of the system, therefore, $AX^*_n + R = 0$, so $AX^*_n = -R$. It is easy to conclude that at the equilibrium point $X_n{*} = -A^{-1}\,R$. (The star notation indicates equilibrium.)

Consider, now, a vector comprised of differences between the state variables X_n, and the equilibrium vector X^*. Call this vector of deviation scores $\tilde{X}$. $\tilde{X}_n = X_n - X^*$. By definition,

$$\begin{aligned}
\Delta\tilde{X} &= \tilde{X}_{n+1} - \tilde{X}_n \\
&= (X_{n+1} - X^*) - (X_n - X^*) \\
&= X_{n+1} - X_n. \\
&= \Delta\,X \\
&= AX_n + R \\
&= A\,(\tilde{X} + X^*) + R \\
&= A\tilde{X} + (AX^* + R).
\end{aligned}$$

It was determined above that the equilibrium point X^* is the point at which $AX^* + R = 0$, so we have $\Delta\tilde{X} = A\tilde{X}$. The conclusion is that the deviation scores constitute a linear system. That system can be solved through application of the standard solution formula $\tilde{X}_n = B^N\,X_o$, which is the equivalent for difference equations of the formula $X = e^{At} X_o$ for differential equations. But $\tilde{X}_n = X_n - X^*$, and in particular $\tilde{X}_o = X_o - X^*$. Therefore,

$$\tilde{X}_n = X_n - X^* = B^N (X_o - X^*), \text{ or}$$

$$X_n = X^* + B^N (X_o - X^*).$$

Chapter 5

Calculation of effective interest rate

The problem is to determine the effective, or prevailing interest rate on loans outstanding. Let x = the effective interest rate, an unknown. Let y = the known amount of interest collected during the course of a fiscal year. Let $z(t)$ = the total of loans outstanding at time t. For example, $z(t_1)$ is the value of loans outstanding at time t. Measurements of $z(t)$ are reported annually, so let us look at the time interval from t_1 to t_2, where $t_2 - t_1 = 1$, representing one year.

To solve this problem it is necessary to assume that $z(t)$ is a function of time, i.e., $z = f(t)$. The simplest function is a straight line, $z = a + bt$. Over the interval from t_1 to t_2, then,

$$y = \int_{t_1}^{t_2} x\, z(t)\, dt = \int_{t_1}^{t_2} x\, (a + bt)\, dt$$

$$= xa \int_{t_1}^{t_2} dt + xb \int_{t_1}^{t_2} t\, dt$$

$$= xat \Big|_{t_1}^{t_2} + \frac{xb}{2} t^2 \Big|_{t_1}^{t_2}$$

$$= xa\ (t_2 - t_1) + xb\ (t_2^{\ 2} - t_1^{\ 2}).$$

The expression $(t_2^{\ 2} - t_1^{\ 2})$ can be factored to $(t_2 - t_1)(t_2 + t_1)$. We assumed above that $t_2 - t_1 = 1$, so we have

$$y = xa + \frac{xb}{2}\ (t_2 + t_1)$$

$$= x\ (a + \frac{b}{2}\ (t_2 + t_1)).$$

This last expression is simply x times the average of $z\ (t_1) = a + bt_1$ and $z\ (t_2) = a + bt_2$. Therefore,

$$x = \frac{y}{\frac{z\,(t_1) + z\,(t_2)}{2}} = \frac{2y}{z\,(t_1) + z\,(t_2)}\ .$$

To illustrate the application of this formula, values for annual interest collections (y) and loans outstanding (z) may be extracted from Table 5.8, which shows annual average values for financial variables in the 1966 expansion projects. On June 30, 1967, for instance, total loans outstanding (z) stood at 220 thousand rupees. A year later the figure was 594 thousand rupees. Interest collections during 1967-68 were 31 thousand rupees. Plugging in the values $z\ (t_1) = 220$, $z\ (t_2) = 594$ and $y = 31$, the prevailing interest rate, x, can easily be calculated as 7.6%.

APPENDIX B

Cooperative Association Questionnaire

To gather data for the analysis of organizational structure presented in Chapter 4, a questionnaire was circulated to the project directors of all of the thana cooperative associations that were functioning in the nineteen sixties. The text of the questionnaire is reproduced at the end of this appendix. In preparing the questionnaire, the author pretested and refined it by filling it in with information recorded in the 1968-69 budget of the Kotwali Thana Central Cooperative Association.

For Kotwali thana, the actual questionnaire responses reflect the staffing of the field supervision section of the KTCCA prior to 1966, and of the Agricultural Cooperatives Federation thereafter. For the expansion projects, the responses reflect the total staffing of the thana cooperative association, including that of organizational units not directly involved in cooperative credit activities, such as the machine section.

The four most important variables which were extracted from this questionnaire were Workers, Divisions, Supervisors, and Levels, the four variables of the structural control model discussed in Chapter 4. For definitions of these variables, and for rules as to how they should be evaluated, I relied principally on two organization theorists: Marshall W. Meyer and Peter M. Blau. (See Marshall W. Meyer, "Size and the Structure of Organizations: A Causal Analysis," American Sociological Review, V. 37, August, 1972, pp. 434-441, and Peter M. Blau and Richard A. Schroenherr, The Structure of Organizations, Basic Books, New York, 1971, especially Appendix C.) Although the structural control model was drawn from the work of Norman Hummon, he had taken his data from Meyer, so I worked from Meyer's variable definitions.

Workers were defined as all non-supervisory personnel in the thana cooperative association, including, for example, inspectors, village accountants, drivers, mechanics, typists, and peons. In many cases all workers were listed in column e of question 7 of the questionnaire. Sometimes village accountants, assistant inspectors and inspectors had to be added in from the responses to question 4 and 5.

Peter Blau defined an organizational division as a major organizational unit whose chief reports to the director or deputy director of the overall organization. He stipulated that in order to be classified as a division a unit must include at least five people. Because the thana cooperative associations were smaller than the employment security agencies which Blau studied, I modified his definition by asserting that a division must include at least 3 employees, including a section chief. In the questionnaires, the divisions were usually listed in column a of the responses to question 7.

Supervisors were defined as including the project director, the deputy project directors (sometimes there were several), chief inspectors and section chiefs. Generally, these officers were listed in the responses to question 3, and in columns b and d of question 7.

The hardest variable to score was levels. Meyer counted the levels within each organizational section, summed this count across sections, and added one for the organizational chief to obtain the number of organizational levels. This procedure did not seem appropriate for the thana cooperative associations, because the only organizational section which showed any indication of having more than two levels was the field supervision section. If the field supervision section had three levels the whole organization was scored as having three levels. Otherwise, the organization was scored as having two levels.

A decision table was drawn up to clarify the scoring procedure for levels. Some field supervision sections were divided up into blocks, as was the case in the Agricultural Cooperatives Federation in Kotwali Thana. For those thana cooperative associations and years in which the block pattern of field organization prevailed, the blocks were listed in response to question 8 of the questionnaire. Two other characteristics of the field supervision section were incorporated into the decision table; whether the section had a designated chief, and whether there were assistant inspectors employed in the section. In the decision table, a Y indicates that the characteristic was observed, and a N indicates it was not observed.

Table B-1: Decision table for scoring levels.

Field Section has								
Blocks	Y	Y	Y	Y	N	N	N	N
Chief	Y	N	Y	N	Y	Y	N	N
Asst Insp	Y	Y	N	N	Y	N	Y	N
Levels	3	3	3	2	3	2	2	2

The actual questionnaire follows.

Thana: ____________________ Information as of June 30, ________

Cooperative Association Questionnaire

This questionnaire has been prepared by Blake W. H. Smith, a graduate student at Michigan State University, in connection with his doctoral thesis research. The research study focuses on the evaluation of the Comilla-type cooperative associations during the nineteen sixties. Although a great deal of information is available at Michigan State University on the finances of the cooperative associations, the available literature does not describe their internal organizational structure. The major purpose of this questionnaire is to elicit that information. So as to provide a picture of how the organization of each cooperative association changed over time, you are asked to fill in this questionnaire once for every year in which your cooperative association was functioning during the nineteen sixties. With the exception of question 6, all answers are to be given as of June 30 of the year indicated above. Your cooperation in completing this questionnaire will be appreciated. Please try to return the completed questionnaire to the address below before November 1, 1977. Thank you.

Blake W. H. Smith
1312-D University Village
East Lansing
Michigan 48823
USA

1. Person completing this questionnaire.

   Name: Title:

2. Sources used in completing this questionnaire.

3. Who was the officer in charge of the thana cooperative association?

   Name: Title:

4. How many inspectors were employed?

   Chief inspectors:

   Inspectors:

   Assistant inspectors:

5. How many village accountants were employed?

6. For the amon and boro seasons of the fiscal year ending on the date entered above, approximately what proportion of loan applications were approved for issue by the thana cooperative association? Answers should be for rice production loans only. Reasonable estimates will be sufficient.

	Amon	Boro
Percentage of applications:		
Percentage of loan amount requested:		

Thana: ____________________ Information as of June 30, __________

7. Please list and describe the organizational sections which reported <u>directly</u> to the officer named in response to question 3. The total of the entries in column "f" should equal the total number of full-time thana level officers and employees of the cooperative association, including everybody from deputy directors to peons. The director of the cooperative association would be included as well, if there was an administrative section headed by him, as was the case in the A.C.F. in Comilla Kotwali Thana. Do not include managers of primary cooperative societies or other village-level personnel in the answers to questions 7-9. Use extra pages if necessary, but please mark them as to thana and year.

a	b		c	d	e	f = b + d + e
Section	Section chief		Monthly salary of section chief (Rs.)	Number and titles of other supervisory personnel in section	Number and titles of non-supervisory personnel in section	Total personnel in section
	Name	Title				

Thana: ______________________ Information as of June 30, __________

8. Were any of the sections listed in response to question 7 divided further into subsections? If so, please list and describe the subsections which reported directly to any of the section chiefs named above. The subsection chiefs should have been among those listed in column d of question 7. If any of these subsections were further divided into smaller functional units, please explain this in columns "e" and "f."

a Section	b Subsection	c Subsection chief Name	 Title	d Monthly salary of subsection chief (Rs.)	e Names and titles of unit chiefs reporting to subsection chiefs	f Names and titles of subunit chiefs reporting to unit chiefs

9. If any organizational section contained more than four levels of supervision, and therefore could not be adequately described by the answers to questions 7 and 8, please explain below.

APPENDIX C

Cooperative Credit Simulation

The essentials of the computer program used to simulate the financial operations of a thana cooperative association were explained in Chapter 5. A few more details and conceptual issues are discussed here. The program itself is then listed.

The overall sequence of the program is that recommended by Thomas Manetsch in systems science courses at Michigan State University. (See Thomas J. Manetsch and Gerald L. Park, System Analysis and Simulation with Applications to Economic and Social Systems, Department of Electrical Engineering and Systems Science, Michigan State University, East Lansing, 1977, p. 11-14.) Values are first assigned to model parameters; state variables are initialized; time is initialized at T = 0; rate variables are initialized; output characteristics are specified; time is updated as T = T + DT; state variables are computed for T = T + DT; rate variables are computed for T = T + DT; output is printed; and the last three stages are repeated (by use of a DO loop) until the desired run length has been attained. In this instance, all of these steps are included in a subroutine, labelled CREDIT, so that various parameter values may readily be changed from run to run in the main program.

Most of the program initialization statements have been justified previously, in Chapter 5. Additionally, it might be noted that the initial values of the variables for workers and supervisors are the same as those that were assigned at n = 0 in the mathematical model presented in Chapter 4. The initial value of the capital account, CACCT = 61, was estimated by taking the capital loan for 1965-66 (200), subtracting from it the amount placed on fixed deposit (100), adding the amount of village capital generated in 1965-66 (52), subtracting loans issued (105), and adding loans repaid (14). This initialization procedure ignores operating costs and interest earnings and payments during 1965-66, because of gaps in the available data. Probably the error entailed in neglecting these factors is within the range of ± 20 for the initial value of the current account. The long run effect of a modest change in the initial value of CACCT should be minimal so the error, if it exists, is not of much significance.

Quite a few interest payments and collections are included in the simulation program. One of these, interest payments on capital loans from the government's central bank, was set to zero in all the runs reported in this volume. The implications of interest charges on capital loans could easily be explored, though, by assigning positive values to the capital loan interest rate, CIR.

A simplification was involved in programming interest charges and collections on the current account. When the current account of a thana cooperative association was negative, indicating an overdraft, the interest charge was as the program indicates, at 6%. When the current account was positive, the project directors usually shifted any excess above immediate needs to a savings account earning 3.5% interest. The program ignores this point, and assumes that a positive balance on the current account earns 6% interest. The consequences of this simplification are minor, because even under the most favorable conditions discussed in Chapter 5, such as a village loan interest rate of 14%, the current account in the simulation was always overdrawn after T = 3.

One way to check on the internal consistency of the model is to see if it conserves flow. Conservation of flow is an important systems property. The idea is that whatever is stored in a process such as a delay should equal what was there initially, plus what has come in less what has gone out. The actual financial data for each of the expansion projects that were started in Comilla district in 1965-66, as well as the average data for the set of seven cooperative associations, exhibit this property perfectly. In Table C-1, as in the actual data reported, bad debts are included in total loans outstanding (TOTLON). In the table, VLISM is the sum of loans issued during the year, and VLRSM is the sum of loans repaid during the year.

Table C-1: Conservation of flow in the actual data and in the fidelity run.

	$(TOTLON)_n$	=	$(TOTLON)_{n-1}$	+	$(VLISM)_n$	-	$(VLRSM)_n$	+	error
<u>Actual average data</u>									
1966	91	=	0	+	105	-	14	+	0
1967	220	=	91	+	216	-	87	+	0
1968	594	=	220	+	599	-	225	+	0
1969	1293	=	594	+	1179	-	480	+	0
1970	1712	=	1293	+	1205	-	786	+	0
<u>Simulation results from the fidelity run</u>									
t = 1	211	=	91	+	203	-	83	+	0
t = 2	619	=	211	+	619	-	211	+	0
t = 3	1213	=	619	+	1142	-	547	-	1
t = 4	1712	=	1213	+	1196	-	727	-	20

For the first two years, the model checks out as yielding perfectly consistent results. Small errors appear in the last two years, but the largest of these is no greater than 1.2% of loans outstanding.

The simulation program itself is listed on the following pages.

```
C  DECK LISTING FOR THE FIDELITY RUN.
FTN.
LGO.
*EOR
      PROGRAM COOPS(INPUT,OUTPUT)
C
      COMMON/AA/DEP,RGROW,BETA,VLIR
      COMMON/BB/NIPP,RLGTH,KPRT
C
C
C  PARAMETERS WHICH MAY BE CHANGED FROM RUN TO RUN.
C
C  DEP IS THE PROPORTION OF CAPITAL LOANS ISSUED WHICH IS PLACED IN
C     THE FIXED DEPOSIT ACCOUNT IN THE LOCAL BANK.
C  RGROW IS THE RATE OF GROWTH OF THE VILLAGE COOPERATIVES.  THE UNITS
C     OF RGROW ARE COOPERATIVES PER YEAR.
C  BETA IS A PARAMETER OF THE SAVINGS FUNCTION, XSAV, AND OF THE LOAN
C     ISSUE RATE, RLOANS.
C  VLIR IS THE INTEREST RATE PAID BY THE VILLAGE COOPERATIVES ON LOANS
C     FROM THE THANA COOPERATIVE ASSOCIATION.
C
      DEP = 0.
      RGROW = 42.
      BETA = 4.17
      VLIR = .09
C
C
C  NIPP IS THE NUMBER OF ITERATIONS (CYCLES) PER PRINT.
C  RLGTH IS THE LENGTH OF THE RUN, AS MEASURED IN YEARS.
C  KPRT IS A PARAMETER WHICH CONTROLS PRINTING.
C
      NIPP = 25
      RLGTH = 4.
    1 FORMAT(1H ,*STATE VARIABLES*//)
      KPRT = 1
      PRINT 1
      CALL CREDIT
      PRINT 10
      PRINT 10
C
    2 FORMAT(1H ,*RATE VARIABLES*//)
      KPRT = 2
      PRINT 2
      CALL CREDIT
      PRINT 10
      PRINT 10
C
    3 FORMAT(1H ,*INTERNAL DELAY RATES*//)
      KPRT = 3
      PRINT 3
      CALL CREDIT
   10 FORMAT(*          *)
C
C
      STOP
```

```
      END
C
      SUBROUTINE CREDIT
C
      COMMON/AA/DEP,RGROW,BETA,VLIR
      COMMON/BB/NIPP,RLGTH,KPRT
C
C
C  DT IS THE AMOUNT BY WHICH TIME IS INCREMENTED ON EACH LOOP OF THE
C     PROGRAM.  IN THIS MODEL THE UNIT OF TIME IS ONE YEAR.  DT = .01,
C     FOR EXAMPLE, INDICATES THAT THE PROGRAM CYCLES 100 TIMES IN ONE
C     YEAR.
C
      DT = .01
C
C
C  INITIALIZE PARAMETERS FOR THE DELAY IN REPAYING VILLAGE LOANS.
C
C  DEL1 IS THE AVERAGE DELAY IN REPAYING LOANS ON TIME.
C  PRLATE IS THE PROPORTION OF LOANS THAT FALL OVERDUE.
C  DEL2 IS THE AVERAGE ADDITIONAL DELAY IN REPAYING OVERDUE LOANS.
C  PLR IS THE PROPORTION OF OVERDUE LOANS WHICH MUST BE WRITTEN OFF.
C
C
      DEL1 = 1.25
      PRLATE = 0.
      DEL2 = 2.
      PLR = .33
C
C
C  INITIALIZE INTEREST RATE PARAMETERS.
C
C  CIR IS THE INTEREST RATE PAID BY THE THANA COOPERATIVE ASSOCIATION ON
C     LOANS FROM CENTRAL BANKS.
C  FIXDIR IS THE INTEREST RATE EARNED ON FIXED DEPOSITS IN THE LOCAL BANK.
C  CACTIR IS THE INTEREST RATE EITHER EARNED OR PAID ON THE CURRENT
C     ACCOUNT IN THE LOCAL BANK.
C  SAVIR IS THE COMPOSITE INTEREST RATE WHICH THE THANA COOPERATIVE
C     ASSOCIATION PAYS TO THE VILLAGE COOPERATIVES FOR SAVINGS DEPOSITS,
C     AND AS DIVIDENDS ON SHARES.
C
      CIR = 0.
      FIXDIR = .05
      CACTIR = .06
      SAVIR = .035
C
C  INITIALIZE MISCELLANEOUS PARAMETERS.
C
C  MCOOPS IS THE MAXIMUM NUMBER OF VILLAGE COOPERATIVES.
C  ALPHA IS THE RESPONSIVENESS COEFFICIENT IN THE SAVINGS FUNCTION,XSAV.
C
      MCOOPS = 350.
      ALPHA = .27
C
C
```

```
C  INITIALIZE STATE VARIABLES
C
C  NCOOPS IS THE NUMBER OF VILLAGE COOPERATIVES IN THE THANA.
C  WORKRS IS THE NUMBER OF WORKERS EMPLOYED BY THE THANA COOPERATIVE
C     ASSOCIATION.
C  SUPVIS IS THE NUMBER OF SUPERVISORS EMPLOYED BY THE THANA COOPERATIVE
C     ASSOCIATION.
C  WORKRS AND SUPVIS ARE INCREMENTED ONCE EACH YEAR, AT THE BEGINNING
C     OF THE YEAR.
C  CACCT IS THE CURRENT ACCOUNT OF THE THANA COOPERATIVE ASSOCIATION
C     WITH THE LOCAL BANK.
C  FIXDEP IS THE FIXED DEPOSIT OF THE THANA COOPERATIVE ASSOCIATION IN
C     THE LOCAL BANK.
C  TSAV IS THE INTEGRAL, OR RUNNING TOTAL, OF TOTAL SAVINGS AND SHARES.
C  THE VARIABLES STORE1 AND STORE2 ARE INTERNAL TO THE DELAY IN REPAYMENT
C     OF VILLAGE LOANS.
C  PENDNG IS THE AMOUNT OF VILLAGE LOANS NOT YET DUE.
C  OVRDUE IS THE AMOUNT OF VILLAGE LOANS WHICH ARE OVERDUE.
C  TVLOAN IS THE TOTAL OF LOANS OUTSTANDING TO VILLAGE COOPERATIVES.
C  BDSM IS THE INTEGRAL OF BAD DEBTS.
C  TBLOAN IS THE TOTAL OF LOANS OUTSTANDING FROM CENTRAL BANKS.
C  CLISM IS THE INTEGRAL, OR RUNNING TOTAL, OF CAPITAL LOANS ISSUED BY
C     CENTRAL BANKS.
C  CLRSM IS THE INTEGRAL OF CAPITAL LOANS REPAID TO CENTRAL BANKS.
C  VLISM IS THE INTEGRAL OF LOANS ISSUED TO VILLAGE COOPERATIVES.
C  VLRSM IS THE INTEGRAL OF LOANS REPAID BY VILLAGE COOPERATIVES.
C  VLINT IS THE INTEGRAL OF INTEREST PAYMENTS ON LOANS TO VILLAGE
C     COOPERATIVES.
C  FMSM IS THE INTEGRAL OF THE FINANCIAL MARGIN FROM THE CREDIT OPERATIONS
C     OF THE THANA COOPERATIVE ASSOCIATION.
C  OPCSM IS THE INTEGRAL OF THE OPERATING COSTS OF THE CREDIT SYSTEM.
C  PROFSM IS THE INTEGRAL OF PROFITS.
C  THE VARIABLES CLISM THROUGH PROFSM ARE SET TO ZERO AT THE BEGINNING
C     OF EACH YEAR.  OUTPUT FOR THESE VARIABLES REPRESENTS THE VALUE
C     ACCUMULATED DURING THE YEAR.  A NEW YEAR IS CONSIDERED TO HAVE
C     BEGUN WHENEVER THE VALUE OF T PASSES AN INTEGER VALUE.
C  THE UNITS OF VARIABLES CACCT THROUGH PROFSM ARE THOUSANDS OF RUPEES.
C
      NCOOPS = 40
      WORKRS = 23.33
      SUPVIS = 3.67
      CACCT = 61.
      FIXDEP = 100.
      TSAV = 52.
      STORE1 = 60.
      STORE2 = 31.
      PENDNG = STORE1 + STORE2
      OVRDUE = 0.
      TVLOAN = PENDNG + OVRDUE
      BDSM = 0.
      TBLOAN = 200.
      CLISM = 0.
      CLRSM = 0.
      VLISM = 0.
      VLRSM = 0.
```

```
      VLINT = 0.
      FMSM = 0.
      OPCSM = 0.
      PROFSM = 0.
C
C  INITIALIZE TIME
C
      T = 0.
C
C  INITIALIZE RATE VARIABLES
C
C  CLI IS THE ANNUAL RATE AT WHICH CAPITAL LOANS ARE ISSUED TO THE
C     THANA COOPERATIVE ASSOCIATION BY CENTRAL BANKS.
C  CLR IS THE ANNUAL RATE AT WHICH CAPITAL LOANS ARE REPAID TO CENTRAL
C     BANKS.
C  GRANT IS THE ANNUAL GOVERNMENT SUBSIDY FOR THE ADMINISTRATIVE COSTS
C     OF THE THANA COOPERATIVE ASSOCIATION.
C  OPCOST IS THE ANNUAL OPERATING COST OF THE THANA COOPERATIVE
C     ASSOCIATION.
C  RLOANS IS THE AVERAGE ANNUAL RATE AT WHICH LOANS ARE ISSUED TO
C     VILLAGE COOPERATIVES.
C  VLI IS THE CURRENT RATE AT WHICH LOANS ARE ISSUED TO VILLAGE
C     COOPERATIVES.
C  THE VARIABLES RINT1, RINT2, REPAY1, AND REPAY2 RE INTERNAL TO THE
C     DELAY IN LOAN REPAYMENT BY VILLAGE COOPERATIVES.
C  VLR IS THE RATE AT WHICH VILLAGE COOPERATIVES REPAY THEIR LOANS.
C  ST1DOT AND ST2DOT ARE USED IN CALCULATING THE RATE OF CHANGE OF THE
C     TWO COMPONENTS OF LOANS NOT YET DUE, STORE1 AND STORE2.
C  BDEBTS IS THE RATE AT WHICH OVERDUE LOANS ARE WRITTEN OFF.
C  OVRDOT IS THE RATE OF CHANGE OF LOANS WHICH ARE OVERDUE.
C  SAV IS THE RATE OF CAPITAL FORMATION (SAVINGS PLUS SHARE PURCHASE) BY
C     THE VILLAGE COOPERATIVES.
C  CIP IS THE INTEREST PAYMENTS MADE ON LOANS FROM CENTRAL BANKS
C  CACTIP IS THE INTEREST EITHER EARNED OR PAID ON THE CURRENT ACCOUNT
C     IN THE LOCAL BANK.
C  FIXDIP IS THE INTEREST EARNED ON FIXED DEPOSITS IN THE LOCAL BANK.
C  SAVIP IS THE INTEREST PAYMENT ON SAVINGS DEPOSITS, PLUS THE DIVIDEND
C     ON SHARES.
C  VLIP IS THE INTEREST PAID TO THE COOPERATIVE ASSOCIATION BY VILLAGE
C     COOPERATIVE BORROWERS.
C  FMARG IS THE FINANCIAL MARGIN OF THE COOPERATIVE ASSOCIATION.
C  CACDOT IS THE RATE OF CHANGE OF THE CURRENT ACCOUNT IN THE LOCAL BANK.
C  THE UNITS OF VARIABLES CLI THROUGH CACDOT ARE THOUSANDS OF RUPEES
C     PER YEAR.
C
      CLI = XCLI(T)
      CLR = XCLR(T)
      GRANT = 50.
      OPCOST = (1.4*WORKRS + 5.4*SUPVIS)/.862
      RLOANS = 4.74*TSAV - 174.65
      VLI = XISSUE(RLOANS,CACCT,FIXDEP)
      RINT1 = STORE1/(.5*DEL1)
      RINT2 = PRLATE*STORE2/(.5*DEL1)
      REPAY1 = (1. - PRLATE)*STORE2/(.5*DEL1)
      REPAY2 = OVRDUE/DEL2
```

```
      VLR = REPAY1 + REPAY2
      ST1DOT = VLI - RINT1
      ST2DOT = RINT1 - RINT2 - REPAY1
      BDEBTS = PLR*OVRDUE
      OVRDOT = RINT2 - BDEBTS - REPAY2
      SAV = XSAV(TSAV,TVLOAN,NCOOPS,ALPHA,BETA)
      CIP = CIR*TBLOAN
      CACTIP = CACTIR*CACCT
      FIXDIP = FIXDIR*FIXDEP
      SAVIP = SAVIR*TSAV
      VLIP = VLIR*TVLOAN
      FMARG = VLIP - CIP - SAVIP + CACTIP + FIXDIP
      PROFIT = FMARG - OPCOST + GRANT
      CACDOT = (1 - DEP)*CLI - CLR - VLI + VLR + SAV + PROFIT
C
C  SPECIFY OUTPUT CHARACTERISTICS AND PRINT VARIABLE VALUES FOR T = 0
C
C  NIT IS THE NUMBER OF ITERATIONS OF THE PROGRAM.
C  NIOL IS THE NUMBER OF ITERATIONS OF THE OUTER LOOP OF THE PROGRAM,
C     WHICH CONTROLS PRINTING.
C
      NIT=RLGTH/DT + .00001
      NIOL=NIT/NIPP
C
      GO TO (19,29,39),KPRT
   19 CONTINUE
   20 FORMAT (1H ,T6,*T*,T10,*NCOOPS*,T20,*TBLOAN*,T31,*CACCT*,T42,
     1*TSAV*,T51,*VLISM*,T61,*VLRSM*,T72,*BDSM*,T80,*TVLOAN*,T90,
     2*PENDNG*,T100,*OVRDUE*,T111,*VLINT*,T122,*FMSM*,T130,*PROFSM*)
   21 FORMAT(F6.2,I9,12F10.2)
      PRINT 20
   22 PRINT 21,T,NCOOPS,TBLOAN,CACCT,TSAV,VLISM,VLRSM,BDSM,TVLOAN,
     1PENDNG,OVRDUE,VLINT,FMSM,PROFSM
      GO TO 15
   29 CONTINUE
   30 FORMAT(1H ,T6,*T*,T13,*CLI*,T23,*CLR*,T30,*CACDOT*,T43,*SAV*,
     1T53,*VLI*,T63,*VLR*,T70,*BDEBTS*,T82,*VLIP*,T90,*FIXDIP*,T100,
     2*CACTIP*,T111,*FMARG*,T120,*OPCOST*,T130,*PROFIT*)
   31 FORMAT(F6.2,F9.0,12F10.2)
      PRINT 30
   32 PRINT 31,T,CLI,CLR,CACDOT,SAV,VLI,VLR,BDEBTS,VLIP,FIXDIP,CACTIP,
     1FMARG,OPCOST,PROFIT
      GO TO 15
   39 CONTINUE
   40 FORMAT(1H ,T6,*T*,T10,*STORE1*,T20,*STORE2*,T31,*RINT1*,T41,
     1*RINT2*T50,*REPAY1*,T60,*REPAY2*)
   41 FORMAT(F6.2,F9.2,5F10.2)
      PRINT 40
   42 PRINT 41,T,STORE1,STORE2,RINT1,RINT2,REPAY1,REPAY2
   15 CONTINUE
  100 FORMAT(*         *)
C
C  EXECUTION PHASE
C
      ICOUNT = 1.
```

```
      WORKRS = .766*WORKRS + 15.374
      SUPVIS = .894*SUPVIS + 1.316
      DO 11 IOL=1,NIOL
      DO 10 IIL=1.NIPP
C
C  UPDATE TIME
C
      T=T + DT
C
C  COMPUTE STATE VARIABLES FOR TIME T + DT
C
      TBLOAN = TBLOAN + DT*CLI - DT*CLR
      NCOOPS = XCOOPS(T,RGROW,MCOOPS)
      TSAV = TSAV + DT*SAV
      STORE1 = STORE1 + DT*ST1DOT
      STORE2 = STORE2 + DT*ST2DOT
      PENDNG = STORE1 + STORE2
      OVRDUE = OVRDUE + DT*OVRDOT
      TVLOAN = PENDNG + OVRDUE
      BDSM = BDSM + DT*BDEBTS
      CLISM = CLISM + DT*CLI
      CLRSM = CLRSM + DT*CLR
      VLISM = VLISM + DT*VLI
      VLRSM = VLRSM + DT*VLR
      VLINT = VLINT + DT*VLIP
      FMSM = FMSM + DT*FMARG
      OPCSM = OPCSM + DT*OPCOST
      PROFSM = PROFSM + DT*PROFIT
      CACCT = CACCT + DT*CACDOT
      FIXDEP = FIXDEP + DT*DEP*CLI
C
C  UPDATE RATE VARIABLES FOR TIME T + DT
C
      CLI = XCLI(T)
      CLR = XCLR(T)
      GRANT = 50.
      OPCOST = (1.4*WORKRS + 5.4*SUPVIS)/.862
      PRLATE = XPER(T)
      RLOANS = 4.74*TSAV - 174.65
      VLI = XISSUE(RLOANS,CACCT,FIXDEP)
      RINT1 = STORE1/(.5*DEL1)
      RINT2 = PRLATE*STORE2/(.5*DEL1)
      REPAY1 = (1. - PRLATE)*STORE2/(.5*DEL1)
      REPAY2 = OVRDUE/DEL2
      VLR = REPAY1 + REPAY2
      ST1DOT = VLI - RINT1
      ST2DOT = RINT1 - RINT2 - REPAY1
      BDEBTS = PLR*OVRDUE
      OVRDOT = RINT2 - BDEBTS - REPAY2
      CIP = CIR*TBLOAN
      CACTIP = CACTIR*CACCT
      FIXDIP = FIXDIR*FIXDEP
      SAVIP = SAVIR*TSAV
      VLIP = VLIR*TVLOAN
      FMARG = VLIP - CIP - SAVIP + CACTIP + FIXDIP
```

```
      PROFIT = FMARG - OPCOST + GRANT
      CACDOT = (1 - DEP)*CLI - CLR - VLI + VLR + SAV + PROFIT
C
C   MAKE START OF THE YEAR ADJUSTMENTS AND PRINT.
C
      IF(T .LE. ICOUNT) GO TO 10
      ICOUNT = ICOUNT + 1.
      WORKRS = .766*WORKRS + 15.374
      SUPVIS = .894*SUPVIS + 1.316
      OPCOST = (1.4*WORKRS + 5.4*SUPVIS)/.862
      SAV = XSAV(TSAV,TVLOAN,NCOOPS,ALPHA,BETA)
      CLISM = 0.
      CLRSM = 0.
      VLISM = 0.
      VLRSM = 0.
      VLINT = 0.
      FMSM = 0.
      OPCSM = 0.
      PROFSM = 0.
      PRINT 100
      CLISM = CLISM + DT*CLI
      CLRSM = CLRSM + DT*CLR
      VLISM = VLISM + DT*VLI
      VLRSM = VLRSM + DT*VLR
      VLINT = VLINT + DT*VLIP
      FMSM = FMSM + DT*FMARG
      OPCSM = OPCSM + DT*OPCOST
      PROFSM = PROFSM + DT*PROFIT
   10 CONTINUE
      GO TO (24,34,44),KPRT
   24 CONTINUE
   25 PRINT 21,T,NCOOPS,TBLOAN,CACCT,TSAV,VLISM,VLRSM,BDSM,TVLOAN,
     1PENDNG,OVRDUE,VLINT,FMSM,PROFSM
      GO TO 11
   34 CONTINUE
   35 PRINT 31,T,CLI,CLR,CACDOT,SAV,VLI,VLR,BDEBTS,VLIP,FIXDIP,CACTIP,
     1FMARG,OPCOST,PROFIT
      GO TO 11
   44 CONTINUE
   45 PRINT 41,T,STORE1,STORE2,RINT1,RINT2,REPAY1,REPAY2
   11 CONTINUE
      RETURN
      END
C
      FUNCTION XCLI(T)
C
C   THIS FUNCTION IS USED IN DETERMINING THE VALUE OF CLI, CAPITAL LOANS
C      TO THE THANA COOPERATIVE ASSOCIATION BY CENTRAL BANKS.  THE UNITS
C      OF XCLI ARE THOUSANDS OF RUPEES PER YEAR.
C
      XCLI = 0.
      IF(T .LE. 4.) XCLI = 200.
      RETURN
      END
C
```

```
      FUNCTION XCLR(T)
C
C  THIS FUNCTION DETERMINES THE RATE AT WHICH CAPITAL LOANS ARE REPAID
C     TO CENTRAL BANKS.  THE UNITS OF XCLR ARE THOUSANDS OF RUPEES PER
C     YEAR.
C
      XCLR = 0.
      IF(T .GE. 4. .AND. T .LE. 24.) XCLR = 50.
      RETURN
      END
C
      FUNCTION XCOOPS(T,RGROW,MCOOPS)
C
C  THIS FUNCTION DETERMINES THE NUMBER OF VILLAGE COOPERATIVES.
C
      XCOOPS = RGROW*T + 41.
      IF(XCOOPS .GE. MCOOPS) XCOOPS = MCOOPS
      RETURN
      END
C
      FUNCTION XISSUE(RLOANS,CACCT,FIXDEP)
C
C  THIS FUNCTION DETERMINES THE RATE AT WHICH LOANS ARE ISSUED TO THE
C     VILLAGE COOPERATIVES.  THE UNITS OF XISSUE ARE THOUSANDS OF RUPEES
C     PER YEAR.
C
      XISSUE = RLOANS
      IF(XISSUE .LT. 0.) XISSUE = 0.
      IF(CACCT .LE. -FIXDEP) XISSUE = 0.
      RETURN
      END
C
      FUNCTION XSAV(TSAV,TVLOAN,NCOOPS,ALPHA,BETA)
C
C  THIS FUNCTION DETERMINES THE RATE OF CAPITAL FORMATION (SAVINGS PLUS
C     SHARE PURCHASE) BY THE VILLAGE COOPERATIVES.  XSAV ASSIGNS A
C     VALUE TO SAV ONCE EACH YEAR.  THE UNITS OF XSAV ARE THOUSANDS
C     OF RUPEES PER YEAR.
C
      C = (TSAV/NCOOPS)*1000.
      OL = (TVLOAN/NCOOPS)*1000.
      R = 2245.
      XSAV = (ALPHA*(OL - BETA*C) + R)*NCOOPS/1000.
      RETURN
      END
C
      FUNCTION XPER(T)
C  THIS FUNCTION DETERMINES THE PROPORTION OF LOANS WHICH FALL OVERDUE.
C
      IF(T .LE. 1.) XPER = 0.
      IF(T .GT. 1. .AND. T .LE. 2.) XPER = .08
      IF(T .GT. 2. .AND. T .LE. 3.) XPER = .09
      IF(T .GT. 3.) XPER = .3
      RETURN
      END
*EOF
```

BIBLIOGRAPHY

Since several fields of intellectual inquiry have been drawn together in this book, I have made no attempt in this bibliography to indicate all of the works which I consulted in each field, or to compile a good list of references for each. One of the best bibliographies on the Comilla projects is to be found in Harry W. Blair's book, _The Elusiveness of Equity_. The volume by Manetsch and Park includes a good list of readings on systems science. For a bibliography on organization theory, I would recommend Kast and Rosenzweig's text on _Organizations and Management_.

The bibliographic listing which follows is simply a reordering, in alphabetical sequence, of the books and articles cited in footnotes at the end of the chapters of this book.

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