AGAINST ALL ODDS:
SUCCESSFULL CASES OF COLLECTIVE USE OF TRACTORS IN RURAL CEARÁ, BRAZIL

by

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ABSTRACT

Governments and international donors have long financed tractors for small farmers in the backward rural areas as a means of increasing their standard of living and promoting development. Past experiences in the provision of collective tractors to these areas showed negative results in that the tractors ended up benefiting mostly better-off farmers or were left in the countryside without maintenance. This study examines several cases of collective tractors managed successfully by rural associations and cooperatives in the semiarid area of the state of Ceará in Northeastern Brazil. What conditions have been necessary for this good performance? In answering this question, I review the past experience of federal and state programs providing these machines to farmers, and the current approach under which farmers have to contribute with a percentage of the total cost of the tractor. As a result of this direct stake in the good functioning of the tractor, I argue that these organizations have been able to adequately manage their tractors by developing a clear set of rules that (i) minimized the conflicts for the use of the machine and (ii) recovered their operation and maintenance costs. The arrangements these groups have devised included more equitable assignments in the order of tractor use and criteria for defining it on the basis of the rainfalls. Revenue maximization and cost rationalization are also part of the arrangements that the communities have learned and adopted over time. I conclude with some remarks on how planners and policy makers should continue funding tractors to these kind of organizations.

Thesis Supervisor: Judith Tendler
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LIST OF ACRONYMS

APCR	Apoio às Pequenas Comunidades Rurais (Program of Support to Small Rural Communities under the original Northeast Rural Development Program)
CEB	Comunidades Eclesiais de Base (Chrisitian Base Communities)
COAPEC	Cooperativa Agrícola de Piquet Carneiro (Agricultural Cooperative of Piquet Carneiro)
CODAGRO	Companhia de Desenvolvimento Agrícola do Ceará (Ceará Agency for Agrarian Development)
COSENA	Cooperativa Agrícola de Senador Pompeu (Agricultural Cooperative of Senador Pompeu)
CEPA	Comissão Estadual de Planejamento Agrícola (State Commision for Agricultural Planning)
EMATERCE	Empresa de Assistência Técnica e Extensão Rural do Ceará (Technical Assistance and Rural Extension Agency)
FIBGE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
INCRA	Instituto Nacional de Colonização e Reforma Agrária (National Institute for Colonization and Agrarian Reform)
IPLANCE	Fundação Instituto do Planejamento do Ceará (Institute for Planning of Ceará)
PAPP	Programa de Apoio ao Pequeno Produtor Rural (Northeast Rural Development Program)
POLONORDESTE	Programa de Desenvolvimento das Areas Integradas do Nordeste (Development Program for Integrated Areas of the Northeast)
PPP	Programação por Projeto (Programming per Project)
PT	Partido dos Trabalhadores (Workers Party of Brazil)

SEPLAN - CE	Secretaria do Planejamento e Coordenação do Estado do Ceará (Ceará State Secretariat of Planning and Coordinating)
SUDENE	Superintendência de Desenvolvimento das Areas Integradas do Nordeste (Superintendency for the Development of the Northeast)

CURRENCY EXCHANGE RATE

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R$0,91 = US$1.00

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CHAPTER 1
INTRODUCTION

A common belief about the collective use of tractors by small farmers is that usually it does not work. Past failed experiences in the developing world pointed in that direction, suggesting that either tractors did not work in the advantage of the poorer farmers or that the farmers were not able to deal adequately through their collective arrangements with the machinery. Collective tractor use tends to be plagued with problems such as poor record keeping, lack of adherence to efficient land preparation schedules, lack of spare parts and fuel, high costs of tractor use relative to the value of crops cultivated, favoritism and a lack of commitment on the part of some tractor owners and hired drivers (Ishuza, 1991). Additional problems have to do with the lack of technical assistance, the lack of commands in the communities and rigidity in the scheme for the use of the machine (Villeneuve, 1963). Willingness of all farmers to use the machine first as soon as the rains commenced generated conflicts and polarizations. These polarizations would many times end without satisfactory agreements for the tractor use or they tended to be appropriated by the larger or better off farmers.[1] The tractors and equipment ended having a short life due to corrosion and poor maintenance and operation (Catterick, 1976). On the one hand, this was an effect of the difficulty to arrange a scheme of use acceptable for the entire community and, on the other hand, the results of using political power for obtaining special privileges in the tractor use.

Furthermore, the use of collective tractors for tail-end hirers entailed many times a greater risk than a failure in the provision of animal power, considering the eventual breakdowns and the non-arrival or late arrival of tractors. By the time the pool tractor reached these poorer farmers, the time for the land preparation had already passed

[1] For example, Dube (cited in Khanna, 1983) concluded that nearly seventy percent of the development program benefits in India, which also included the provision of tractors, went to the 'elite' group.

(Lipton, 1984). Poor tractor management and a low degree of utilization also account for this failure in the collective use of tractors, which result in the excessive costs of tractor cultivation (Catterick, 1976; Bassi et al., 1994).[2] The literature also abounds with examples such as frequent tractor breakdowns resulting from the inadequate training of tractor drivers or problematic maintenance and repair of tractors. Maintenance of tractors, being expensive, due to the cost of fuel and parts, is even made more expensive and difficult given the complex technology involved.

In light of all these problems and considerations, tractor schemes continue to be promoted and subsidized by many national governments. Many reasons account for this appeal of tractor mechanization, namely the prestige associated with their introduction as "modern" farming, the inadequate methods of appraising mechanization projects[3]--on a technological or financial basis rather than on an economic or national basis--the tied aid policies of donor countries, the bureaucrats vision of mechanized farming as an alternative to unresponsive small farmers, the timeliness of operations achieved by these machines, as well as the profitable non-agricultural uses (Catterick,1976; Binswanger, 1978; Farrington et al., 1982; Farrington et al., 1984; Biggs et al., 1993). The failure of the introduction of mechanized agriculture on a large governmental scale and of tractor hiring services, as a means of spurring mechanized cultivation, led sometimes to the promotion of individual ownership of tractors (Ishuza, 1991). This approach proved to be inadequate, considering the cost of the equipment (De Regt, 1960; Binswanger, 1987). New tractor owners encountered financial difficulties largely because they allowed the tractors to travel long distances between plots that were often small, awkwardly shaped, and badly cleared (Khan, 1964).

In my visit to 17 communities in Northeastern Brazil, I found that many of the things previously portrayed with respect to the use of collective tractors, the picture in some cases still remained the same. Nevertheless that, I also found in the same region,

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[2] Bassi and Dyson (1994) point out the low level of utilization of tractors in Nigeria as a result of the unique nature of Nigerian farming system, socio-economic factors, technical/educational factors, extension service factors, management factors, inadequate staff, equipment and funding for research and development.

[3] De Regt (1960) argues that the profitability of mechanization in agriculture will be increased by means of a collective use of the machines, which from the point of view of national economy and of the individual farmers, has the additional advantage of lowering capital needs for mechanization and of a more rapid application of modern machinery.

some examples of collectives that had managed to go beyond these problems and had come to deal with their tractors in adequate terms. What were the characteristics underlying the successful provision of these tractors? What replicable lessons can be brought up from the experience of all these cases so that policy-makers can improve the tractor performance on future projects of this kind? All my case studies involve collective groups--in fact associations and cooperatives--in charge of tractors provided under a rural development program in the state of Ceará in Northeastern Brazil.[4] The groups under review in this study include:

i) The District Association of the Small Producers of Cipó dos Anjos (*Associação Distrital dos Pequenos Produtores dos Cipó dos Anjos*), an association comprised of 12 communities;

ii) The Association of the Free Workers of Califórnia (*Associação dos Trabalhadores Livres da Califórnia*), an agrarian reform settlement;

iii) The Community Association of Oiticica (*Associação Comunitária de Oiticica*), an association of individual small producers;

iv) The Community Association of Morada Nova (*Associação Comunitária de Morada Nova*), also an association of individual small producers;

v) The Association of the Small Producers of Massapê (*Associação dos Pequenos Produtores dos Massapê*), an agrarian reform settlement as well;

vi) The Agricultural Cooperative of Senador Pompeu (*Cooperativa Agropecuária de Senador Pompeu*, COSENA), a cooperative comprised of 24 communities of small farmers;

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[4] The Brazilian Northeast has long constituted the single largest pocket of rural poverty in Latin America. This region, covering nine states (including Ceará) and part of a tenth, accounts for 19% of Brazil's total land area and 30% of its 147 million population. More than half of all Brazilians living in poverty, and almost two-thirds of the country's rural poor, live in this area (World Bank, 1995). Among the Northeastern states, Ceará ranks as the third largest--146,817 km^2, which represents 9.6% of the area of the whole Northeast and 1.7% of Brazil--and most populated state, with a population of 6.4 million people, which in regional terms represents 15% of the whole Northeast population (42.5 million people). In economic and social terms, Ceará also fares worse than the rest of the Northeast and still lags far behind Brazilian standards. In 1992, for example, GDP per capita was 54% of the national GDP, while the illiteracy rate was 61% as compared to 38% for the whole Northeast and 20% for the nation overall. The rural areas present an even more depressing scenario, if we consider that only 10.6% of the rural households in the Northeast have access to running water and in Ceará only 3.8%.

vii) The Agricultural Cooperative of Piquet Carneiro (*Cooperativa Agrícola de Piquet Carneiro*, COAPEC), another cooperative of small farmers, comprised of 25 communities.

The recent literature on common property resources shows the successes of dealing collectively with natural constraints (Ostrom, 1990; Bromley et al., 1992; Wade, 1986). This literature stresses that neither the state nor the market has been successful in enabling individuals to sustain long-term, productive use of natural resource systems. Institutions specially set by user groups over long periods of time have fared better. Dealing successfully with a collectively owned capital good such as a tractor also implies special arrangements within the groups in charge of them. In many of my cases I found that the groups had come up with innovative arrangements and a clear set of rules that they have institutionalized, either formally or informally, for a more efficient use of the machine.

First, all the groups had minimized the conflicts that usually arise around tractor use. Past conflictive experiences of deciding the order of use of the tractor have led to a series of arrangements that work for the benefit of the majority, namely, more equitable assignments by limiting the amount of time of use available for each, deciding the order by means of a lottery, adapting in that sense to the climate of the region. In order to take most of the advantage of the machine, these groups have developed innovative systems to cope with natural limitations, particularly the lack of rainfalls. In that regard, the reasons explaining the adoption of one or other measure are driven by the group's previous experience with communal work and their leadership.

Second, the groups had been able to recover their costs for operation and maintenance (O&M). By devising several rules for the use of the machine, they have not only maximized their revenues but also rationalized their costs. They have achieved this by charging user fees, having a more efficient deployment of the machines, monitoring their accounts, selecting their tractor drivers and limiting the use of the machine to only those members who are in good stand with the association or cooperative. Additional considerations are the alternative uses they have given their tractors, particularly non agricultural activities in off-season periods. To achieve that, the groups have had to

undergo a learning process over time, which had been done by a trial and error process, and also through cooperation with other communities.

The collective tractors under review in this study have all been given to these small farmers' associations under the framework of the PAPP *(Programa de Apoio ao Pequeno Produtor Rural)* program, a rural development initiative based on the model of Social Investment Funds. As such, it is a demand-driven program for tackling rural poverty in the entire Northeast of Brazil, financed by the World Bank (around 60% of the project's cost), the respective state governments (30%) and by the beneficiaries themselves (around 10%), who usually provide their portion of the project's cost in kind or labor. In the case of tractor subprojects (as the World Bank defines the projects included in this program) the costs owed by the community usually are defrayed through the construction of a *galpão*--Portuguese for a rural facility similar to a warehouse--for sheltering the tractor from sun and rainfall and for storing produce after the harvest. In this way, community members have thus realized that the tractor is part of their association's assets and no longer those of the state government's,[5] which in itself has not only enhanced their sense of ownership, but also increased the prospects for the sustainability of the investment.

Dispersed throughout the countryside of the Northeast in the past years, SEPLAN, the state planning agency in charge of the program in Ceará, is financing these tractors to rural communities with the aim of increasing the cultivated area of the state and raising the incomes of small farmers relying on subsistence agriculture. Subsistence farms in Ceará, raising food for their families on marginal, rainfed land, share common features with those around the world: farmers often mix different crops in the same field to reduce the risk if a particular crop fails, they grow a variety of staple crops--beans, manioc, maize, rice--to meet family needs, and they rarely purchase artificial fertilizers or pesticides (Wolf, 1986). Resulting from this indigence, they barely could use tractors in the process of land preparation for cultivation and in the harvest as supplemental power for processing these crops.

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[5] This approach increases the rate of performance of subprojects in general, in that in having the direct beneficiaries make the final decision as to what kind of subproject suits most their necessities, the World Bank (1995) expects that they will take more care of the project's O&M.

Tractors have turned out to be one of the most popular types of PAPP subprojects in the last few years--out of 446 subprojects provided in 1994 in the Northeast, 97 (21.7%) were tractors. The high demand for tractors is not only manifested in the actual number of tractors requested and provided under the program in the state of Ceará--by 1995, according to World Bank (1995) figures, 198 tractor subprojects (15.6% of all the subprojects submitted in Ceará and 9.7% of those submitted in the whole Northeast) were being implemented or were already completed--but also in the standardization of project documents, technical designs and unit costs that SEPLAN is now following before the approval of a tractor subproject. There are several reasons underlying this high demand for collective tractors under the program, such as the presence of tractor dealers influencing in the decision making process and the created demand for these type of machines in that particular environment, not to mention the benefits that a machine such as a tractor can introduce into the type of regime that is still predominant in Northeastern Brazil.

AGRICULTURAL SECTOR AND POVERTY IN CEARÁ

The Sertão--as the central semiarid part of the state of Ceará is known and where 92.24% of the total surface of the state is located--where all the tractors under this survey were operating, is an area of poor agricultural soils, largely due to their salinity and acidity, their high sand composition, and their saturation with sodium. Rural communities are basically composed of small landholders, where approximately 60% of the landholdings have an area of 100 hectares or less,[6] which in terms of area represents nearly 25% of the total cultivable area of the Sertão. The small producers, mostly owners of their lands (approximately 60 %), are engaged in subsistence agriculture (IPLANCE, 1995) with the main staple crops being manioc, maize, beans, and rice. Cotton used to be a very important cash crop up to the 1980s, when the boll-weevil destroyed the product and all the prospects for its cultivation in the short run. Producers have since then relied

[6] In the Sertao, large farmers are considered those that farm more than 100 has.; farmers cultivating between 20 and 100 has. are medium farmers; and farmers with plots below 20 has. are small farmers. Within this last group, I am including both the landowners and the tenants, who usually tend to cultivate less than four has. This classification is based on the specifications of rural labor unions, for whom the rural module equals 100 has. Local bank managers define them instead according to their financial returns.

exclusively on subsistence crops, developing a growing pattern that is in direct relationship with their needs. The climate of the region influences this pattern considering that it is extremely dry for most part of the year, with an annual average precipitation varying between 400 mm/year and 850 mm/year, usually lasting only four to five months. In a typical year, these are concentrated between January and May, forcing the timely plowing of the fields. Severe periodic droughts, which on average occur twice a decade,[7] constrain even more this already marginal basis for agriculture.

In the Northeast, the traditional growing methods have long been based in hand labor methods. Precisely, the low rate of growth of the Northeast's agricultural PEA is reflected in labor use by agricultural establishments. While from 1950 to1980 the number of persons employed per establishment and per cropped area have experienced declines of 1% and 1.3% per year respectively, the number of tractors has rapidly increased at 11.3% per year--from less than 0.1 tractors per thousand has. to 1.76 tractors per thousand has.--over the same period (May, 1986). Given that the provision of these machines is based on a collective use, the association of small farmers, in order to qualify for a tractor under the program, must comply with a series of requirements before and after the receipt of the tractor. Among those, the state rural extension agency, EMATERCE,[8] must verify the appropriateness of the region for the use of tractors, the association members have to guarantee a minimum of hours of use per year, and the community members have to agree on a scheme for the use of the tractor. Only in this way can small farmers adopt the use of such an expensive machine--its approximate cost in Ceará is US$33,300--and benefit from it.

METHODOLOGY

For this study, I traveled through five *municípios*[9] in the central Sertão region of the state of Ceará during the months of June and August of 1995. In the order I visited

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[7] The last of these severe droughts dates back to 1992 and 1993.

[8] EMATERCE is the agricultural extension agency of the state of Ceará, and the acronym stands for the Portuguese *Empresa de Assistencia Técnica e Extensao Rural do Ceará.*

[9] There are three levels of government in Brazil: federal, state and municipal. Under the 1988 Constitution, the nearly 4,000 *municípios* distributed among the 26 states have been given increased responsibilities and resources. The Brazilian *município* is similar to both the U.S. county and municipality,

them, these are Quixadá (72,334 inhab., 27.16 inh./ km^2), Quixeramobim (59,100 inhab., 16.52 inh./ km^2), Mombaça (40,833 inhab., 16.16 inh./ km^2), Senador Pompeu (26,597 inhab., 24.92 inh./ km^2) and Piquet Carneiro (13,097 inhab., 25.74 inh./ km^2). Within these *municípios*, I selected the communities by searching for the oldest standing tractor subprojects in the region, which ranged between six and seven years old. Since I was looking for successful cases of collective use of tractors distributed through the PAPP program and how communities deal with the tractor's O&M, it had more validity to look at projects with several years experience rather than recent ones. Usually, problems of this sort only arise some time after the projects have been underway, and not during the initial years. Throughout this process, I visited *in toto* 17 communities and interviewed 105 persons.

Considering that the prospects for improved agricultural productivity with mechanized agriculture have ended, in many cases, being negative or difficult to gauge due to the lack of data or the difficulty in isolating farm-level information (Ishuza, 1991), the criteria for defining success in this context was not an easy one. The difficulty in measuring quantitatively many of the achievements of the communities, such as the existence of previous communal work, was immense. Moreover, in terms of financial performance and considering the adverse climatic conditions of Ceará, it is difficult to find groups that have performed well over time. Thus, I regard the efforts of a community as a success if the groups recovered their operating costs for the tractor. However, I also recognize that additional considerations must be met if the tractor is to serve the community in a successful way. Some of these considerations, which a number of associations in Ceará already have achieved, consist of:

- Efficient management in the uses of the tractor and innovative institutional arrangements set up by the communities;
- Flexibility in the arrangements for ordering the use of the tractor;
- Adequate O&M of the tractor resulting from the devised self-raising procedures;
- Financial monitoring through easy accounting methods;

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but it contains a central township, known as *sede*, and the outlying rural areas. In 1995, there were 178 *municípios* in the state of Ceará.

- Alternative uses of the tractor during the off-peak seasonal period.

The process of selection of the *municípios* to be visited began in Fortaleza, the state capital, through interviews with high- and mid-level state officials at SEPLAN, both for understanding their concerns with respect to the program and for making the decisions about which *municípios* to select. In the field, I usually began interviewing in each *município* some local public officials, such as mayors and secretaries of agriculture, before going out to the communities to evaluate the points of view of the beneficiaries. During the first stage, I interviewed in total two municipal mayors, two municipal secretaries of agriculture, and eight agricultural extensionists from EMATERCE. In the communities visited, I interviewed eight presidents of rural associations in charge of collective tractors, and also more than 20 small producers, trying always to get impressions, beliefs, and expectations regarding the PAPP program, both from landholders and landless peasants, both from those that used and did not use the tractors. For a better understanding of how tractors work and the problems associated with their functioning, I also interviewed four tractor drivers and operated a tractor. To complete the picture of the tractors' O&M in this region I also met with three private tractor owners and four bank managers. I concluded the field research with the answers to many of the queries that surged during my field visiting, by interviewing still more state officials and state secretaries in Fortaleza. In Brasília, I had the chance to interview a federal Senator, who had previously conducted this program as the former state secretary of Planning in his homestate of Bahia.

I have organized the material in the following way: in the second chapter, I set the stage for my findings by describing the general process of mechanization in Brazil, the previous programs in the Northeast focusing in the tractorization of the region, and the programs and set of institutional actors present in the Ceará context. In the third chapter, I examine the positive communal arrangements set by the associations and cooperatives for the functioning of their tractors, that oppose the negative stereotype of the use of collective tractors. In the fourth chapter, finally, I draw conclusions and provide some policy recommendations, which aim to shed light on what policy-makers should look for

and enforce before approving this kind of project, and what they can do to continue to foster the project after implementation.

CHAPTER 2
PROVISION OF TRACTORS AND RELATED SERVICES IN CEARÁ

In the previous chapter I mentioned some of the differing outcomes in past experiences with the collective use of tractors. Those performances represent many of the common misconceptions and previous failed cases that the literature associated with the provision of tractors in a collective fashion. I introduce this chapter with the mechanization process that Brazil has followed to provide a background for the discussion of the tractorization of the Northeast. But, since when have tractors been used and provided collectively in Ceará? What programs existed previously and are currently in place for this provision? Which actors have been present in this process? The following discussion will shed light on this recent history of the use of collective tractors and illustrate the current context in the Sertão of Ceará.

GENERAL MECHANIZATION IN BRAZIL

In the last few decades, there has been a widespread change in the Brazilian agriculture techniques, with an increasing reliance on mechanization.[10] Today, the use of animal draft power in agriculture,[11] though a widespread practice in Brazil, has had some of its allure taken away. Farmers throughout Brazil have been increasingly shifting to mechanical power, resulting from the federal government efforts to modernize agriculture through industrial policies and subsidized programs.

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[10] Mechanization encompasses not only the introduction of tractors to farms, but also the use of hand tools, animal draft equipment, and mechanical power machinery, in which the main sources of power are respectively human labor, animal and mechanical or electrical engines (Von Hülst, 1975).

[11] The use of draft power for agriculture was introduced in Brazil by the Americans after the American Civil War (Reis, cited in Pinheiro, 1984).

In the early 1960s, the Brazilian government started encouraging the production of nationally manufactured tractors.[12] Most countries, indeed, have only moved rapidly to internalize production of agricultural machinery later in the 1970s. In some instances, as Duff and Kaiser (1984) suggest, this has been a conscious effort on the part of planning agencies to maximize employment and provide backward linkages with the agricultural sector.[13] In other cases, such as Thailand, they add that there seems to have been little government intervention in the establishment of the agricultural machinery manufacturing industry and that it appeared as a consequence of the demand for supplemental farm power.[14] In the Brazilian case, a conjunction of both of these factors took place. On the one hand, the Brazilian government's awareness of the advantages of and the need for the mechanization of its farms motivated the government's constant attempts to improve the situation by encouraging the manufacture and distribution of tractors and implements. On the other hand, an expanding farm area coupled with large farm size may have also induced these developments in the early 1960s (Clements, 1969). At that stage, there were in the country as a whole, a total of 245 workers on the farms and other agricultural and pastoral establishments for every tractor in use. This data, if compared to the United States 1959 ratio of only 1.2 workers engaged in agriculture for each tractor in use, shows the incipient stage of mechanization in Brazil at that time (Clements, 1969). Regionally speaking, the Northeast by that time showed the widest ratio of workers engaged in agropastoral activities per tractor.

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[12] Considering that Brazilian tractor manufacturing started only in 1960 producing 37 units, in 1961 still 80% of the tractors sold in Brazil were imported. However, in 1962, this situation reversed, and 81% of the tractors sold were produced locally. This drastic change in the tractor production has gone hand in hand with the mean power: while in 1962, Brazilian tractor mean power was about 50cv., in 1977 the mean power had increased to 65cv (Barros, cited in Benez and Laperuta Filho, 1992). Though Barros states that the use of tractors in Brazil is not currently measurable since it is done by simple verification of tractor unit numbers, he gives some figures for the fleet of Brazilian tractors which clearly depict this increment, raising from 11,287 units in 1950 to 407,855 units in 1977. In 1991 the tractor fleet was estimated to be around 600,000 units, producing about 14,000 four-wheel traction tractors and 2,000 microtractors (Benez and Laperuta Filho, 1992).

[13] In this sense, see Gotsch (1982) for government policies encouraging mechanization in Pakistan in the late 1960s.

[14] Tiwary (1994) has reviewed a similar experience for the growth of the Indian tractor industry resulting from their increasing demand.

Tractorization of the Northeast and Ceará

Use of tractors in the Northeast and in Ceará sharply increased during the 1970s, as a response to the subsidized investment credits available at the time.[15] As depicted in Table 2.1, while the agricultural establishment size in the period from 1950 to 1980 was following a decreasing trend in the region, so was the number of persons employed by establishment. By contrast, both the number of cattle and tractors were following an upward trend during the same period, which in the case of tractors, even skyrocketed during the 1970s.

Table 2.1
Indicators of Agrarian Structure and Productivity in Northeast Brazil: 1950-80

Indicator/Year	1950	1960	1970	1980	% Chg./Yr
Avg. Agric. Establ. Size (in hectares.)	69.0	44.7	33.7	36.5	-2.1 %
Avg. Area in Crops (has./establishment)	7.2	7.2	6.5	7.8	0.3 %
Avg. Area in Perennial Crops (has./establishment)	0.9	1.1	1.8	2.0	2.7 %
Crop Area/ Total Area (%)	10.4	16.2	19.2	21.4	2.4 %
Area in Perennial Crops/ Total Area in Crops (%)	14.9	16.9	38.5	33.9	2.8 %
Persons Employed/ Establishment	5.1	4.7	3.4	3.8	-1.0 %
Persons Employed/ Crop Area (persons/ha. in crops)	0.71	0.65	0.53	0.49	-1.3 %
Head of Cattle/ Noncrop Area (animals/ha.)	0.18	0.22	0.23	0.30	1.7 %
Tractors/ Cropland Area (tractors/000 has.)	0.07	0.31	0.51	1.76	11.3%

Source: FIBGE, from May (1986).

In the agriculture of Ceará, similar changes took place, with a shift from the more traditional hand labor techniques to an increasing use of animal draft power[16] and mechanization.[17] As one farmer put it, "while the plow share was the technological breakthrough of the 1950s, and the cultivator of the 1960s and 1970s, the breakthrough of

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[15] Investment resources have been considerably curtailed since 1979, so that the substitution of labor by mechanical crop production technology has been slowed somewhat. The mechanized sector remains extremely limited both geographically and by crop (May, 1986).

[16] In 1970, 22,486 land plots used animal force, with an employment rate of 9.2%, figure which increased to 14.1% in 1975. By 1980, the number of land plots using animal force increased to 52,814, more than doubling those that had used it in 1970. Thus, between 1975 and 1980 the number of plots using animal traction in Ceará increased by 49.9%; though a huge increase, it was less than the growth experienced between 1970 and 1975, which was on the order of 57.3%.

[17] For a more detailed description of the mechanization process and the search for cultivation techniques more suitable adapted to the agriculture of the Brazilian Northeast, and in particular to that of Ceará, see Pinheiro, José C. Vieira (1984).

the 1990s is going to be the tractor, which started to be extensively used in the 1980s." While in 1975, 74.5% of the rural establishments used human labor force, 14.5% draft power and only 12% mechanized power, by 1980 these figures had changed drastically, decreasing to 64.6% for human labor force use, and increasing to 21.5% and 13.9% for draft and mechanical power respectively (Pinheiro,1984). In addition to the federal government's policies devoted to the tractorization of the countryside, the state of Ceará was also encouraging the use of tractors, though its approach was more collective than the private oriented approach pursued by the former. In the next section I describe how the state of Ceará initiated that approach and how it has changed through the years.

RURAL DEVELOPMENT PROGRAMS AND COLLECTIVE TRACTORS

This section deals with the approaches followed by both federal and state rural development programs regarding tractors, to identify the different approaches taken throughout time. Although little or any attention was given to the initial federal program, tractors have increasingly become a more sought after project for development programs, all the while tending toward a more decentralized approach with the PAPP. The ultimate result has been the granting of funds to associations of small farmers to purchase their collective tractors.

CODAGRO

In Ceará, the more generalized use of tractors dates back to the 1970s. At that time, CODAGRO (*Companhia de Desenvolvimento Agrícola do Ceará*), a state agency dependent of the state planning agency, started to provide a tractor hiring service to small producers. The agency provided this service satisfactorily up to 1984, when due to the increased political interference the program started to fail. The program worked on a first come, first serve basis, and though at not so subsidized prices, farmers could pay an initial part of the service in cash and the rest with produce from the harvest. By 1986, larger farmers were mostly using the service and the small farmers had been by then neglected, the payment of the service was badly managed, and the maintenance of the tractors badly carried out. Coinciding with administrative upheavals, in 1994 the state

government terminated CODAGRO. The state government delegated its functions to CEDAP (*Companhia de Desenvolvimento Agropecuário*) dependent of the State Agriculture agency, with the same objectives as CODAGRO in regard to mechanization. The mechanization program of this agency, however, has not yet been implemented.

POLONORDESTE

In 1974, the World Bank and the Federal Government of Brazil embarked on the POLONORDESTE (*Programa de Desenvolvimento de Areas Integradas do Nordeste*) rural development program. By directly targeting agricultural production services and subsidies for the poor, and by providing certain regions with a complete array of development investments, the program aimed at reinforcing local economies between 1975 and 1986 by stimulating production in areas with agricultural potential and a high concentration of small farmers. Initially, resources were predominantly allocated on infrastructure improvements, in particular to irrigation, electrification, and feeder roads. In that context, the credit for tractor purchase through POLONORDESTE had been available in conjunction with PROTERRA since 1972 at very highly subsidized rates--7% interest until 1977, and 10% thereafter, with five-year repayment periods. With rates of inflation between 20% and 40% a year during this period, such rates were highly negative in real terms and hence the ups and downs of tractor credit were highly correlated with tractor sales (Tendler, 1978). However, as one of my interviewees put it, "POLONORDESTE only financed tractors for rich *fazendeiros*, and it didn't have matching grants to be used for tractors for the poor." As such, financing those tractors was mainly for private uses rather than for collective ones, which the program did not really target.

PAPP and Collective Tractors

The severe criticisms of POLONORDESTE led to the formulation of PAPP, a program now specifically aimed at small farmers, and meant also to incorporate the entire Northeast region. With planning initiated in 1982, the first phase of PAPP, identified as PPP (*Programação por Projeto*), followed a similar approach to POLONORDESTE in

that it maintained the successful experience of the small community projects component. This component, known as APCR (*Apoio às Pequenas Comunidades Rurais*), relied on community planning and implementation, stressed community organization and contracted out needed technical expertise.[18] In the state of Ceará, such program was launched in 1987, with a wide range of projects implemented in seven municipalities[19] between 1988 and 1990, all in areas with high agricultural development potential. The program also started providing tractors, in an integrated manner--jointly with several other projects-- to rural complexes and cooperatives. In addition, the program also provided technical assistance during this stage, which has been in many cases supportive, as a result of the technicians knowledge of tractors' O&M, for the adequate operation of these machines up to the present day.

Based on the success of this approach, the program was reformulated in 1990 in an attempt to distribute benefits more widely, and with tractors remaining as one of the subprojects eligible for financing. A major characteristic introduced into the program was a wider participation of the beneficiaries, with the decision making process for the subproject left to the group's criteria. Those organizations receiving tractors under the program have to contribute at least ten percent of the tractor value. This contribution, which can be given in kind or in labor, is usually executed by community members through the construction, as mentioned above, of a *galpão* for sheltering the tractor and storing the produce after the harvest.

Under PAPP requirements, these groups have to be legally organized in associations, in full accordance with Brazilian regulations for these kinds of institutions. Having accomplished that,[20] the PAPP will only finance tractors to those associations showing enough credentials of fulfilling the requirements that SEPLAN--in the case of Ceará-- has previously established. Among others, these requirements include the use of

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[18] For a review of APCR Projects and its successes in Pernambuco, see da Cunha (1988).

[19] Those municipalities were Aratuba, Canindé, Capistrano, Itatira, Piquet Carneiro, Quixadá and Senador Pompeu. Of these, I visited the last three during my field work.

[20] Establishing an association with legal status implies high transaction costs to the members of these rural communities. Registering an association is a costly and usually a slow process, both for the time it takes for the community itself to decide the organization it wants and for the time it takes to accomplish the registration. Very poor communities, hence, find it very difficult to meet these requirements and are

the tractor for more than 1000 hours/year within the community to which it will be granted; a guaranteed minimum number of users, which will vary in accordance to the size of the community; the soil appropriateness of the community for that kind of machine; and a detailed and structured plan for the tractor's O&M arranged by the community members. Only after having complied with all these requirements does the organization receive the necessary matching grants for buying the tractor and at the same time becomes legally responsible *vis-à-vis* SEPLAN for its adequate O&M.

In 1993, drawing from lessons from the Mexican *Solidaridad* Program, the PAPP again took a new approach to tackle rural poverty. Under this reformulated PAPP, the array of available projects that could be financed --up to a cost limit of $40,000-- were classified in three major areas: productive (42% of the total subprojects requested in the Northeast), infrastructure (55% of the total subprojects) and social (3% of the projects). Among the productive subprojects, the program continued considering farm machinery and tractors,[21] which continue to be funded for associations, though now with additional requirements in part due to the high demand for this kind of project. Table 2.2 shows some of the major socio-economic benefits of the collective tractors subprojects according to World Bank (1995) measures, which help in explaining their current high demand in the Northeast.

Table 2.2
Socio-Economic Benefits of Collective Tractors Subprojects

Total No. of Subprojects Implemented and/or Completed	198
Total No. of Beneficiaries	15,048
Average Net Income per Association (US$)	6,631
Average Cost of Subproject (US$)	33,300
Average No. of Beneficiaries per Subproject	76
Cost per Beneficiary (US$)	438
Total No. of Jobs Created	9,900

Source: World Bank (1995)

excluded from possible benefits of the PAPP. I found that some *municípios* had financially aided these communities to cover those costs, in order to allow them to apply to a PAPP subproject.

[21] Other projects considered under the productive component include manioc and rice mills, clothes making, small-scale irrigation schemes, storage deposits, livestock, and candy factories.

The High PAPP Demand for Tractors

The high demand for tractors has not only been manifested in the actual number of tractors requested and provided under the program in the state of Ceará --by 1995, 198 tractor subprojects (15.6% of the subprojects submitted in Ceará and 9.7% of those submitted in the whole Northeast) were under implementation or were already completed-- but more crucially in the standardization of subproject documents, technical designs and unit costs that SEPLAN is now performing under the so called *projeto padrão.*[22] This procedure, which has been replicated from the Mexican experience with the Solidaridad program to minimize the possibilities of subproject oversizing, aims to avoid possible money misappropriation. The high costs of the tractor subproject --among all possible PAPP subprojects, the tractor subproject is also the most expensive as seen in Table 2.3-- explain in part why SEPLAN has been so careful in this regard. The other reason had to do precisely with the high demand for the tractors in Ceará. In consequence, according to SEPLAN officials, the number of tractors provided lately has dropped considerably, with demand increasing instead for other kind of subprojects, such as rural electrification and small-scale irrigation.

Table 2.3
Average Costs of Typical PAPP Sub-Projects

Type of Sub-Project	Cost per Sub-Project (US$'000)
Farm Tractor	35.7
Street Paving	33.6
Slaughter House	33.3
Child Day Care	29.0
Brick-Making	27.5
Reservoir	25.4
House Improvement	24.3
Rural Electrification	23.4
Small Scale Irrigation	21.3
Bridges	20.6
Rural Schools	20.1
Clothes-making	18.5

Source: World Bank files, Recife

[22] This approach, which SEPLAN has adopted for the five most demanded productive subprojects, namely, cattle herding (16.6% of all subprojects), tractors (15.6%), agricultural tools warehouse (9.4%), manioc mills (5.1%) and clothes making (3.2%), has made it more difficult for rural associations to comply with the whole set of tractor requirements.

Other reasons accounting for the high demand for tractors under the PAPP have to do with the information disseminated to beneficiaries with respect to the project's implementation, and the influence that tractor dealers are having in this whole process of disseminating the information.

Information

The way the information about the program and a specific project arrives in the communities, be this a tractor or any other kind of project, is another factor that influences the decision making process. Word of mouth is a strong communicator in the Sertão, and as such, information about a recently granted project goes back and forth from one community to another. When a tractor arrives in a community, many things start to circulate: ease of arranging for matching grants for the purchase of a tractor through the PAPP, or that tractors are the sole subprojects being financed by SEPLAN at that moment. Thus, adjacent, and even distant communities--people in this region heavily rely on the radio for communication--[23] feel motivated to choose what they think is a sure bet: a tractor.

Tractor Dealers

Tractor dealers also influence the final outcome in the decision making process of the associations. The kind of information they introduce into the communities about their products, and the technical assistance they provide for their products are two issues which also influence the final decision of an association. Sometimes, by overstating the benefits of tractors in the agricultural process and its related uses, disregarding particular geographical conditions of the communities, the tractor dealers have been successful in promoting their sales to community associations. For example, I was told that tractor dealers had in one case encouraged an association to buy a larger machine and equipment

[23] People get informed about major events going on in the urban seat of the municipality, and also throughout the municipality and the state, by listening to radio stations. With respect to the tractor, when small producers listen that SEPLAN has approved tractor projects for particular associations in the state, and that the matching grants for those tractors have been liberated, they feel inclined to that particular kind of project, as one rural extensionist from EMATERCE told me.

than what their actual requirements actually were.[24] As a result, the oversized tractor demanded larger O&M costs which the community members had not expected. To cover operating costs, they either sold some of the tractor's parts or did not maintain the tractor adequately. Through disruptions like this one, community members have become sensitive of relying too much on tractor dealers, and associations are now increasingly cooperating one with another on issues that range from the initial exchange of information about the differing tractor characteristics in order to opt for a particular brand and model, to skills about how to better manipulate the tractor. I will come back with this learning process of the communities in the next chapter.

Technical Assistance

Tractor dealers were also able to influence the association's decision making process by providing technical assistance to the tractors they had sold. Usually, since the tractor driver or the person in charge of the tractor's maintenance has a basic knowledge of mechanics, he will only be able to provide some routine service to the tractor. Sometimes, though, the machine will need an emergency repair requiring more advanced knowledge that only specially trained people posses. With this in mind, then it is not coincidental that most of the tractors sold in the Sertão of Ceará came from one dealer. This dealer provides free technical assistance during the first year, as part of the guarantee. During that period, the dealer's mechanics come to the communities to evaluate the physical state and make suggestions on the correct manipulation of the machine. After that, the service is paid, but the dealer continues providing the service in the same fashion, that is, sending a representative to the community requesting the service, rather than the associations having to spend even more in taking the tractor up to the dealer's workshop, which is for all dealers located in Fortaleza. In this regard, this particular dealer offered an additional service which consists in having another workshop in Iguatu, a city of the interior, and as such more closely located to a larger number of communities. Whenever a technical representative had to be called, he would show up

[24] The private design firm, in charge of the association's project design in applying to the program, was also responsible of this, with their technicians approving larger requirements than those actually needed by the community.

more rapidly than he would have done in the case of the other dealers, who had to travel from Fortaleza. This was in the end a very important concern for the community, because with nearby service the tractor was useless for a shorter period of time.

The Beneficiaries Contribution

Under the new regulations for PAPP subprojects in Ceará,[25] the elaboration of the tractor subproject is the responsibility of EMATERCE agents and is no longer under the auspices of private design firms, which were many times inclined to overestimate the costs of the subprojects.[26] In a typical tractor subproject, EMATERCE agents tend to break up the total costs as shown in Table 2.4 below.

Table 2.4
Typical Components Costs of a Tractor Subproject

Component	Cost of Component (R$)	Cost of Component (US$)
Galpão (Warehouse)	3.088,00	3,396.80
Farm Tractor MOD. MF275 with 75hp and hydraulic cultivator 28"x18"	29.865,00	32,851.50
Hitch (4 tons capacity) and Maize Processor	3.783,00	4,161.30
Tow Mechanism (800 kg.)	201,00	221.10
Fuel (initial contribution)	179,45	197,40
Total Cost	37.116,45	40,828.10

Source: EMATERCE, Mombaça, CE

As mentioned above, the association makes a commitment with SEPLAN to cover at least ten per cent of the total costs of the tractor subproject. While in Table 2.4 this contribution is represented in the first row by the construction of the *galpão*, in Table 2.5 the items usually considered in that community contribution are shown. Table 2.5, as

[25] Beginning in late 1995, the state government of Ceará has given a new approach to the program by decentralizing the subprojects' approval and implementation to different state agencies. Under this new approach, which has become known as Projeto Sao José, SEPLAN has been left only with a coordinating task among all the implementing agencies.

[26] These private design firms earned 2% of the subproject's cost if and when the project was finally approved.

such, shows the itemized components of a *galpão* of $72m^2$ of area for the shelter of the tractor and related equipment, such as maize, rice, and beans processors. Additional implements that rural communities usually shelter in the *galpão* are their hitches, water pipes, towing mechanisms and shovels, if they happen to have one. Moreover, after harvest period, many associations also use the *galpão* for storing beans and maize that the associations collect as paid revenues for the services performed by the tractors in the plowing season earlier in the year. I refer to this issue of produce given in payment in greater detail in the next chapter when dealing with the user fees charged by the associations for the tractor services.

Table 2.5
10% Financial Contribution of Beneficiaries in a Tractor Subproject

Itemized Components for a $72m^2$ *Galpão*	Quantities	Cost of Item (R$)	Cost of Item (US$)
Bricks	7,000	266,00	292.60
Tiles	36,000	432,00	475.20
Cement	16 sacks	128,00	140.80
Sand	$18m^3$	108,00	118.80
Wooden Ceiling Pitch	24 lineal m.	768,00	844.80
Maize Processing	1	1750,00	1925.00
Mason	35 days x R$7,50	262,50	288.75
Total Cost		37.116,45	40,828.10

Source: EMATERCE, Mombaça, CE

In the application of the subproject, the EMATERCE agents discount the tractor on a 10 % basis, and also consider a 10 % allowance for maintenance. For the *galpão,* in turn, they discount at a 4 % basis for depreciation and also a 4 % allowance for maintenance. This notwithstanding, when charging for the tractor services, though all these groups were recovering their costs for O&M, they were not considering extra charges in order to build up for a depreciation fund. Planners and bank managers[27] in

[27] In the case of tractors bought with bank credit, the issue of depreciation is very evident. While the tractor itself only guarantees 70% of the credit taken for buying it--due to the depreciation to which the machine is subject in the accounting methods--creditors need a guarantor to cover for the rest of the tractor value.

Ceará have insisted on the necessity of charging for depreciation in order to replace the machines at the end of their useful life. Not that they did not know the importance of this accounting practice, but instead, as many of my informants told me, they could not afford to charge an extra cost for establishing such an account. In Morada Nova, for example, they are aware of this, and are even thinking of charging for it beginning next year, by increasing the price charged for deployment of material--the current price is R$1,50/km.(US$ 1.65) for members and R$2,00/km (US$2.20) for non-members, based on the price that private pick-ups charge for the same service in the region.

Leaders of the organizations surveyed, when asked why they do not charge increasingly for the tractor services so as to include in their price a portion for the depreciation fund, also argued that most of their members were too poor to pay for those additional costs. Medium-sized members replied negatively to the same proposal, as they were not expecting to receive immediate benefits from the additional measure. Even among private tractor owners, who charge the most expensive fees, and act as price-givers of the service in the region, this was not a practice. They gave as explanation that it would render the service too expensive for small producers. Some of them even suggested that the tractor would never need a replacement, provided all their parts were kept in order and that spare parts were not replaced for adapted ones. As a result of that, associations and cooperatives, as price-takers of the service in the region, do not charge for it either.

THE SUCCESSFUL CASES

All of the tractors under review in this study, though having been in use for differing lengths of time, were provided by the PAPP to the following groups:

i) The District Association of the Small Producers of Cipó dos Anjos (*Associação Distrital dos Pequenos Produtores dos Cipó dos Anjos*), located in the *município* of Quixadá.

ii) The Association of the Free Workers of Califórnia (*Associação dos Trabalhadores Livres da Califórnia*), also located in the *município* of Quixadá.

iii) The Community Association of Oiticica (*Associação Comunitária de Oiticica*), located in the neighboring *munícipio* of Quixeramobim.

iv) The Community Association of Morada Nova (*Associação Comunitária de Morada Nova*), located in the munícipio of Mombaça.

v) The Association of the Small Producers of Massapê (*Associação dos Pequenos Produtores dos Massapê*), also located in the *munícipio* of Mombaça.

vi) The Agricultural Cooperative of Senador Pompeu (*Cooperativa Agropecuária de Senador Pompeu*, COSENA), located in the *município* of Senador Pompeu.

vii) The Agricultural Cooperative of Piquet Carneiro (*Cooperativa Agrícola de Piquet Carneiro*, COAPEC), located in the nearby *município* of Piquet Carneiro.

All these groups share some similarities and differences, which is oftentimes reflected in the way each one administers its own tractor. The main similarities that run across these cases, and which are also summarized in Table 2.6, consist in the following:

First, though they are all located in different *municipios* of Ceará, they are all in the Sertão and therefore their main economic activity is related to rainfed agriculture: the agricultural production all consists of the same subsistence crops, namely beans, cassava, corn, and rice, with only one yield per crop per year. Tractors are all used for land preparation and as a complementary source of power in the harvest period, for the grains and beans processor.

Second, they have all received not only their tractors but also large amounts of state support through grants, subsidized credit, and technical assistance. The tractors were in all the cases provided by the PAPP program and they are basically the same model: Valmet 785, chosen by the groups due to its technical simplicity, economic advantage and 'appropriateness' for the agricultural activities (Biggs et al., 1993).

Third, they all are covering the costs of their tractor's O&M by charging user fees in the agricultural process and having the tractor perform--more than preparing the land and as a complementary source of power in the harvest--other uses in the off-season period. They also carry some sort of financial record of the expenses and revenues generated by their tractors.

Table 2.6
Main Characteristics of Reviewed Groups in Ceará and their Collective Tractors

	Cipó dos Anjos	Califórnia	Oiticica	Massape	Morada Nova	COSENA	COAPEC
Creation	1989	1983	1988	1988	1981	1977	1970
Nature of organization	Association of small farmers comprising 12 communities	Individual association of agrarian reform settlement	Individual association of small farmers	Individual association of agrarian reform settlement	Individual association of small farmers	Cooperative of small farmers, comprising 24 communities	Cooperative of small farmers, comprising 25 communities
Members	180	50	55	53	57	550	563
Main Crops	Beans, manioc, maize	Beans, manioc, maize, rice, cotton	Beans, manioc, maize, lima beans, rice	Beans, manioc, maize, sugar cane, rice	Beans, manioc, maize, rice	Beans, manioc, maize, cotton	Beans, manioc, maize, cotton
Other PAPP Investments or subsidized from other state programs	3 communal shops 4 agricultural tools storage 5 cisterns 5 water systems 4 manioc mills 3 reservoirs	Irrigation systems 1 manioc mill	1 Agricultural tools storage 2 water systems 1 community center	Water reservoirs Children Day care 1 Manioc mill 1 Sugar cane processing facility	1 Cistern 1 Children Day care 1 clothes making facility	2 Trucks Extension Services (2) 4 manioc mills 1 community center 12 communal shops 11 agricultural tools storage	2 Trucks Extension Services (2) 4 manioc mills 1 community center 4 communal shops 10 agricultural tools storage
Operating Tractors	2 Valmet 785 received from PPP (1) in 1989	1 Ford 660 received from PPP in 1989	1 Valmet 885 received from PAPP in 1992	1 Valmet 685 received from PPP in 1988 1 Ford 660 from credit in 1993	1 Valmet 785 from PAPP received in 1994	3 Valmet 785 received from PPP in 1988 1 tractor on loan from state in 1992	2 Valmet 785 received from PPP in 1988 1 Valmet 685 bought in 1989
Tractor's Operation and Use	2 hours per member Lottery within communities for deciding order	Preference for communal plots Individual plots based on the affordability of each	No area limits Restriction on the time used Follows natural path of deployment	First come, first serve basis Old tractor in communal lands New tractor for individual plots	First come, first serve basis, no limits for the use Follows natural path of deployment	Lottery for deciding order within the regions of cooperative Within communities follows natural path of deployment	Lottery for deciding order within the regions of cooperative Within communities follows natural path of deployment

Source: Field interviews, Summer 1995

(1) PPP = Programacao por Projeto, initial phase of PAPP

(2) All these investments were implemented in different communities within the scope of the cooperatives

Table 2.6 (continued)
Main Characteristics of Reviewed Groups in Ceará and their Collective Tractors

	Cipó dos Anjos	Califórnia	Oiticica	Massape	Morada Nova	COSENA	COAPEC
Tractor Service Payment	30% rebate from market price for members Members can pay with produce in harvest	30% rebate from market price for members Members can pay with produce in harvest	30% rebate from market price for members Members can pay with maize at the market price	30% rebate from market price for members Member can pay 15 or 30 days after service	30% rebate from market price for members Member can pay 15, 30 days after or even in harvest	30% rebate from market price for members Members pay 50% in the moment and 50% in harvest w/ produce	30% rebate from market price for members Members pay 50% in the moment and 50% in harvest w/ produce
Financial Monitoring	6 bank accounts 2 accounts for tractors and 1 for the tractor's working capital	No bank accounts, all accounts taken together in a notebook	2 bank accounts 1 checking and 1 savings	3 bank accounts 1 checking and 1 savings 1 account for new tractor	5 bank accounts, 1 account for tractor	2 bank accounts Separate control of each tractor in a notebook	2 bank accounts Computerized control of each tractor
Tractor Supervision	Tractor drivers and directive committee	President of association	President of association and designated member	President, Treasurer, and 4 members of a commission	Tractor driver and designated member	Tractor drivers and technician	Tractor drivers and technician
Other tractor Uses	Transport of water, material and produce Supplementary power for maize and beans processors	Supplementary power for maize and beans processors	Transport of water, material and produce Supplementary power for beans maize processor Dam Construct.	Transport of material and produce Supplementary power for maize and beans processors	Transport of water, material and produce Supplementary power for maize and beans processors	Transport of material and produce Supplementary power for maize and beans processors	Transport of material and produce Supplementary power for maize and beans processors
Tractor Drivers	2, took tractor dealer's course in Fortaleza Earn 15% value of tractor worked hour	1, hired from outside Fixed payment per day	1, member of community Fixed payment per day	2, members of community Earn 1 salary and 10% value of tractor worked hour	1, prior tractor driver Earns 10% value of tractor worked hour	4 , trained by state technical agency Earn 1 salary and 10% value of tractor worked hour in extra hours	2, took tractor dealer's course in Fortaleza Earn 1 salary and 10% value of tractor worked hours extra

Source: Field interviews, Summer 1995

There are also key differences among all the groups under review, which are also important to bring up to the fore:

First, they are different kind of groups in terms of their legal status and size. While two of them are cooperatives and one is an association comprised of several communities (Cipó dos Anjos), all the others are individual associations in charge of their own tractors. This implies a different number of members in each of the groups, and area that the tractors cover.

Second, they differ in terms of their previous background and ownership structure of lands, though all of them are composed of small producers. In some cases they were inherited lands, while in others acquired through agrarian reform processes. In the case of the agrarian reform settlements (Califórnia and Massapê), the tractors also operated in areas that were collectively cultivated by the settlers.

Third, they differed in terms of the way they administer the tractor. All the groups had adapted the administration to their regions, which is reflected in the way the order of use of the tractors is decided--either by individual plots in the case of the association's tractors or by communities in the case of the cooperative tractors.

In addition to the collective tractors dispersed in the Sertão, two other systems of tractor hiring services are currently found in this region. One is a tractor pool system organized by the local governments in some of these *municípios* of the interior, while the other involves local inhabitants who own tractors and provide the service through a hiring system, though on a completely different basis. The following sections will deal with both of these systems and how they have influenced the arrangements and uses of the communal tractors.

MUNICIPAL TRACTORS

Some *municípios* in the Sertão are either using their own tractors to provide the service of land plowing to small producers in their jurisdiction, or are hiring it from third parties, and in some cases, they are even contracting the communal tractor. In all cases, however, the municipal government subsidizes the service provided. In the last few

years, these mayors have provided such incentives to their rural population for several reasons. *First*, they already had this machinery as part of their municipal assets, but it was devoted to other uses. These could include trash collection in the urban seat of the municipality, or for civil engineering purposes, like the building of small artificial reservoir dams to create sources of water for their populations during the summer or dry season, or for repairing roads within the *município*. In some of the *municípios* recorded as *coronelistas*,[28] some of the previous mayors had these tractors operating in the lands of the large landowners, supplying free power for their agricultural activities as a reward for the close political alliances they used to maintain.

Second, the greater efforts toward decentralization in Brazil after the 1988 Constitution provide a good explanation for this program. With larger resources resulting of increased intergovernmental transfers, mayors are looking towards extending their aid to the poorest of their constituencies.

Third, many of the *municípios* in which this service is being provided have as a principal actor behind it an individual devoted to social causes. In the case of Quixadá, for example, the mayor himself and his secretary of Agriculture are both politically aligned with the PT and have given a great impetus to their program "Hora de Plantar"; in Quixeramobim, the secretary of Agriculture is also aligned with the PT, and though he is not from the same party as the mayor is, he has succeeded in implementing and keeping the program working satisfactorily[29]; in Jucás, the mayor is a former health state secretary, and is widely known in Ceará for being socially committed to his people.[30]

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[28] Relations of clientelism were typical of the Sertao, where the estate owners known as *coronéis* were desirous of sociopolitical preeminence and wealth, needed to develop patron-client relations at the local level. Removed from the center of power, the Sertao was long the scene of violent confrontations between individuals and political networks competing for increased control over land and water rights, and hence for power. According to Roniger (1990), these confrontations led to the formation of regional and local allegiances. Competing estate owners used their access to land, water, and mills to win the complete loyalty of their workers, who were willing to defend their employees--even to the death.

[29] The secretary of Agriculture of Quixeramobim is an elected *vereador* (municipal council representative) who in accordance with legal restrictions had to leave his elected position to assume this current nominally appointed one. He conducts a weekly radio program in the *município* in which he addresses all the concerns of the farmers.

[30] Carlyle Lavor, the current mayor of Jucás, was the state Health Secretary during the first government of Tasso Jereisatti. He was a key actor in implementing the successful Programa de Agentes de Saúde throughout the state (See Freedheim, 1993).

By providing the local governments this service, the mayors have decided to give their rural populations indirect financial help--mayors argued precisely as one of the main reasons for supplying this service at subsidized prices, the pursuit of an educational purpose.[31] In this way, the mayors are taking initiative and reviving at least to some extent, the old state program of tractor hiring which existed once under CODAGRO--and which should have continued to be supplied by CEDAP--though this time at a lower level of the Brazilian subnational governments.

PRIVATELY OWNED TRACTORS

The other source that provides for tractor hiring are private tractor owners. Usually these private owners are large and medium sized landholders in the *município*, who in principle have more than one economic activity supporting them. After using the tractor on his own lands initially and having finished the work on them, he then rents it out on a first come, first serve basis, to those farmers requesting the service. This keeps the machinery operative during a period in which there is still a demand for it, and consequently this landowner can obtain some extra revenue from its rental. Another type of private tractor owners are private contractors, who usually tend to be local inhabitants from the urban seat of the *município,* and who mostly use their tractor for civil engineering purposes, such as the construction of small dams in landholdings within the *município*, or for the removal of land and rocks in the urban seat.

With the increasing presence of communal tractors in the region, and the provision of the tractor rental service by municipal governments, communities are becoming less dependent on privately owned tractors. From my interviews in the field I realized that if these tractor owners were already complaining of the non profitability of the tractor rental service, certainly they have not welcomed the arrival of all these substitute services. A symptom of the reduced demand for the services of these tractors is reflected in the fact that they have begun to sell their machines for obtaining capital for

[31] Mayors are aiming that farmers learn to reimburse for the services they receive. In this way, they argue, they want to break with the clientelistic approach to which the rural populations in the Sertao have been accostumed, by always expecting the government to come in free of charge.

other purposes. In many cases, they even ended up exchanging the tractor for another sort of machinery, such as cars and trucks, which as they argued, provides better revenues.

Tractor owners, however, commonly blame this situation on the Brazilian macroeconomic situation, rather than on the presence of the other forms of tractor rental. With the very high levels of inflation the Brazilian economy formerly had, all prices were distorted, making it more difficult for the tractor owners to cover their O&M costs, and less affordable for small producers to pay for the hiring services. On the one hand, while inflation did not allow these farmers to save, on the other hand, inflation also eroded any depreciation fund that could have been considered for these machines.[32] According to the accounting procedures these private tractor owners were following, the competing presence initiated in the Sertão by these two other rental systems--both from the collective and from the municipal rental service--were disregarded. Although a perfect competitive market has not been introduced, at least small producers have nowadays a greater range of options for tractor rental.

[32] Since the depreciation is calculated based on the original value of the tractor, with high inflationary rates the depreciation fund decreases in value. Thus, diminished by inflation, the depreciation fund ends up being too small to cover O&M, even though there used to be price indexing in the Brazilian economy.

CHAPTER 3
AGAINST ALL ODDS:
POSITIVE COMMUNAL ARRANGEMENTS

Many of the problems already described for using the collective tractor were also commonplace in the countryside of Ceará. In some communities, I observed a lack of community participation, in others disregard for tractor maintenance. Despite that, I also found positive arrangements that brought additional considerations in relation to the use of collective tractors. In some places, moreover, I was able to find arrangements that actually contradicted that depicted negative stereotype of tractor use. Why and how was this possible? In this section I describe these findings and explain how the groups under review managed to achieve good results with their collective tractors.

MINIMIZING THE CONFLICTS

In many of the rural communities I visited in Ceará, the kind of conflicts for the use of the tractor and the violent polarizations mentioned above were minimized. How is it that these rural communities, with characteristics similar to those often described in the literature, managed to reduce the number of conflicts in their use of tractors? Key to this success story was the efficient management in the use of the tractor and the institutional arrangements set up by the communities. These facts were the result of a clear set of rules established for the use of the tractor--set up either formally, in a written *regulamento de uso* (user regulation document), or informally, by word of mouth--and innovative schemes in its assignment, as compared to the usual ones in the region. Moreover, each community's history of organization and their inclusive leadership created conditions which helped the communities to devise and enforce these arrangements. In this section I describe these conditions and arrangements.

Equitable Assignments

One major approach that the associations and cooperatives owning collective tractors have adopted in order to diminish conflicts in their use has been to set more equitable arrangements. This has meant limiting the amount of time of use available for each member of the association or cooperative. Rather than allowing each producer to use the tractor as long as he may want and can afford to, some organizations have devised a system of allowing a maximum number of hours for each person. Usually this has been set at two hours of mechanized plowing for each, which from my conversations with farmers, allows them to prepare on average, from two to six hectares of land, with variations accounting for differing soil conditions.

The use of collectively owned tractors has not only allowed some farmers to increase their cultivated areas--before, when using animal draft power and/or hiring private tractor services, these same farmers tended to plow roughly only two has.--but has led to a more equitable assignment in tractor use. Previously better-off farmers had more access to using the tractors as a result of their affordability, which left the poorer members as tail-end hirers. Under the current system, anyone willing to have extra hours of tractor service has to wait until all interested association members have had access to their two hours of the communal tractor. In addition, association and cooperative members have an advantage as they are given priority in the order of tractor use. Only when all members have been served will outside and non-member producers be given a chance to use the tractor.

This system allows for a fairer distribution of the time available for tractor use during the peak plowing period, which in an agriculture relying solely on rainfed cultivation, achieving timeliness is crucial. In this way, this arrangement ends up satisfying a larger number of small farmers in a community. The communities realized the advantages of working in this way after the municipal tractor hiring service began working in the region. Poorer members questioned the way the association was providing the service in comparison to the municipal, calling for a similar procedure. In an effort to remain legitimate and to keep more farmers as members of their associations--members

who were not given the service on time started to question the advantages of being a member of that particular association--their leaders had to replicate the municipal system.

Leaving it to Chance

Associations have also been able to reduce conflicts in the use of tractors by entering in a lottery. The previous system with order of use being on a first come, first serve basis,[33] turned out not only to be conflictive--every member was willing to be the first user of the tractor in the season--but also proved to be an inefficient way of running the machine. In order to increase efficiency, these organizations opted for a defined set of rules to minimize conflicts by organizing the lottery prior to the planting season, that is, before January when rains commence.

Apart from this common characteristic, the agreements vary slightly depending on the type of administration the tractors are subject to. In individual community associations, a designated member or occasionally a committee, customarily decides the first user of the tractor based on the lottery. Starting from that randomly chosen field, the tractor will then continue operating in an orderly pattern, plowing out next the adjacent fields. Cooperative tractors, which are subject to a more centralized administration from cooperative headquarters, decide on order of use based on the lottery also. However, in this case, it is the initial community to be served by each of the tractors that is chosen randomly, and not the plot as in the association's case. Considering that each tractor serves a determined region of the area under the scope of the cooperatives, it is within each of these regions that the lottery defines their order of use.[34] As soon as the tractors in each region arrive in a new community, each representative decides together with the

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[33] Even in places where they still decide the order on a first come, first serve basis, those groups have devised some agreements to reduce conflicts. Everyone in the association must sign up the *Regulamento de Uso* (user regulation document), where it states that the order of use is going to be on that basis. In signing, each one gives his approval of the order in which he will end up coming. In the case of Morada Nova, the community devised this arrangement after their first two years dealing with that policy: "everyone wanted to be the first, the order was not respected, and members left the association", told me one interviewee.

[34] Cooperatives administratively divide the area under their scope of action in regions. It is among all the communities comprised under the range of influence of a region that the lottery decides the first community to be served.

tractor driver, the order of use among cooperative members and the path the tractor will follow within that community.

By leaving to chance the order of use, these organizations have reduced conflicts by eliminating the possibilities of giving preferential treatment to the better-off members--a complaint of the poorer farmers in the previous system, charging that the association preferred to provide the service initially to the larger farmers because they would pay sooner than the smaller producers. This system has also given a sense of predictability to the communities' planting season. In knowing the scheme of tractor use in advance, people are better able to plan their power requirements. For example, if a producer knows he is going to be a tail-end user in the next plowing season, he gauges the possibility of using draft power sooner to take full advantage of the rains instead of having to wait for the tractor to arrive later at his plot. Before the adoption of this method, it was common to find farmers waiting for the tractor until a time in the season when the tractor was no longer useful. As a result, these very small producers ended up reducing the amount of land they had initially planned to plow that year. In the worst cases, some small producers were unable to plant any amount of land because it was too late to grow and seed any crop.

Flexible Arrangements

Considering the scheme of use as described in the previous section, it is also important that the communities allow some flexibility to the order decided by chance. In the Sertão of Ceará, optimal land preparation time is limited by the timing and duration of the region's rainy and dry seasons and the unfavorable geological conditions, which limit the soil capacity of moisture retention and of water sources. Irregular and dispersed rainfall in the region make it inefficient for the tractor order of use to be too strictly enforced.[35] For example, if it does not rain initially on the fields which were previously chosen as the starting point for the tractor's operation and rains instead on fields to which the tractor had not been assigned, it is unproductive to stick with the initial order.

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[35] It can rain, for example within one community, only in some fields while fifteen kilometers away it will not rain at the same time and might even get delayed for a week or so.

The quality of the land makes the need for flexibility even more important. Generally, the soils, mainly of crystalline formations, facilitate the rapid drainage of superficial water, and make difficult the permeation of rainfalls which would otherwise form the groundwater reserves. Moreover, the clearing of natural vegetation withdraws from the soil the spongy layer that would result from the roots of the plants, and which would function as an absorbent of moisture. These features cause torrential rain to result in soil erosion, at the same time that they make it more difficult for groundwater accumulation (Lemos et al., 1995).

As a result of these realities, community members have devised a preestablished flexible agreement which works to the advantage of all. Both the association and cooperative tractor arrangements take advantage of the rainfalls and tractors by allowing them to head first where they are more urgently needed, that is, where it has already rained, despite the previously set lottery arrangement described above. While in the associative system this means that the tractor will only plow plots containing enough moisture, in the cooperative (and in the municipal) system this implies that all tractors may be geared towards the specific region where it has already rained. Any possible conflict that may arise due to this flexible arrangement is reduced by having the tractors go back to their originally assigned track once rainfalls commence in those previously designated areas.

Communal Work Experience

> *"Tem que se organizar primeiro para poder recever o projeto, o grupo não estando organizado não sabe lutar com o projeto".* [36]
>
> (Association president talking about previous group requirements for dealing well with a tractor)

The recent literature on common property resources shows the successes of dealing collectively with natural constraints (Ostrom, 1990; Bromley et al., 1992). This literature stresses that neither the state nor the market has been successful in enabling individuals to sustain long-term, productive use of natural resource systems. Institutions

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[36] "You have to be organized prior to receiving the project, if the group is not previously organized it will not know how to run with the project", my own translation from the above quotation.

specially set by user groups over long periods of time have fared better. Dealing successfully with a collectively owned capital good such as a tractor also implies special arrangements within the groups in charge of them.[37] In this sense, it was not coincidental that the associations that managed to reduce their conflicts in using their tractor did so because they had a history of organized communal work dating back several years. This previous experience with other kinds of communal jobs allowed the community members to 'cut their teeth' with simpler activities and easier-to-run projects--such as the distribution of water from collective cisterns[38] or the operation of manioc mills--than those entailed by the administration of a tractor.

As a result of PAPP subprojects, many rural communities in Ceará have in the last few years legally established associations to allow them to be eligible for the program subprojects.[39] However, as previous evaluations suggest (Kottak, 1994), I also found greatest success for the PAPP tractor subprojects in places where "good things" already existed organizationally and where there was a favorable political climate for participatory development. In fact, according to SEPLAN officers, many of the rapidly failing tractor subprojects were in rural associations that had been created just for the purpose of receiving the machine.[40] SEPLAN officers, in addition, had also observed that in general, communities with some organizational base in the community and with stronger ties of communal work together--measured by the amount of previous successful projects in these communities and the length of time of the establishment of the association--were more prepared to deal with the administrative and operative constraints imposed by tractors, and more likely to succeed with a subproject.

The fact of having community members more acquainted with communal work was also determinant in the reduction of conflicts, since they tended to be more patient about the benefits they could get from membership in the association. Rather than seeing the association's benefit as limited to the preferential use of a tractor and cheaper fares for

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37 For a theoretical framework on collectively owned pool resources, see Ostrom (1990), and for a "public good" description see Olson's (1977) theory on collective action.

38 See, for example Quirós, Rosa M. (1996) for a further description of these arrangements.

39 In his report on the PAPP, Kottak et al. (1994) suggest that new associations may emerge in an illegitimate way, through political manipulation, precisely as a result of the program.

40 Indeed Kottak et al. (1994) state that communities that were better organized at the outset reacted faster to news about the program and presented their requests more quickly.

its hire, these producers were aiming for longer-term results of their associationalism. Their history of cooperation had created the conditions for this effect. Resulting from previous pastoral work dating back to the 1960s, the Catholic Church had promoted the creation of grassroots groups in Ceará, known as *Comunidades Eclesiais de Base* (CEBs or Christian Base Communities). In all these communities, local priests introduced collective work programs known as *mutirão*, by which small groups of peasants would exchange workdays for carrying on collectively agricultural activities in all their plots (Damiani, 1993). Values such as solidarity were emphasized and peasants had the opportunity to discuss problems jointly, propose solutions, and undertake concrete and successful actions together, such as they had previously done in Massapê and in some of the reform settlements of Cipó dos Anjos in building their houses collectively. In later years, these producers applied this acquired technique by collectively contributing to labor in the construction of the building for the *galpão* for the PAPP tractor subprojects.

Inclusive Leadership

> *"A comunidade como toda não é muito organizada, mas o grupo que trabalha é".*[41]
>
> (SEPLAN officer referring to the successes of the community of Oiticica with its projects).

Strong and motivated leadership in these associations, rather than a strong authority,[42] was directly linked to the just described communal experience of working together. The leaders in these groups played a prominent and coordinating role by mobilizing members and motivating and organizing the community to achieve goals by themselves, rather than continuing to expect the state to do it for them. In the Sertão of Ceará, this fact is associated with the work derived from the CEBs, as described in the previous section. But, the perception communities had of their leaders (as being extremely competent, honest and hard workers), and the way they related to them (in a

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[41] "The community as a whole is not that organized, but instead the group that works there is", my translation from a direct quote made by a SEPLAN officer in Quixadá about the community of Oiticica.

[42] Heifetz (1995) discusses the definition of leadership against that of authority, and suggests that it is more useful to define leadership as an activity, rather than defining it as either a position of authority in a social structure or as a personal set of characteristics. In this section, I am adopting his definition of leadership.

very familiar spirit rather than with a hierarchical attitude) was also extremely important for accomplishing an inclusive environment, where the input of the majority of members was heard rather than only a few. This in itself, is striking because the Sertão has long been known for a tradition of local-level alienation, passivity, and very weak horizontal social networks and community mobilization.

From my conversations with the poorer members, the "bottom-up" approach institutionalized in all these communities--all of the groups had communal meetings at least once a month to discuss current events in their associations--motivated the people to work for the common interest.[43] Having the participation of the majority of members in these communal meetings allows them to release their grievances and to promote a growing exchange of opinions. As a case in point, many times the main issue discussed in these meetings had to do with the way the tractor service was being provided. A controversial theme in all those meetings had been the charging of user fees, which I explain below, and which many of the community members initially considered unfair. In discussing the issue, these meetings turned out to be crucial in making the people understand the need for charging user fees for the tractor service.

The leaders of many of these groups, in addition, also participated in other voluntary work or in other outside civic organizations. Currently, for example, some of these leaders are also *agentes de saúde* (rural health agents) in their same communities or in nearby ones,[44] or are active Catholic Church members--they give mass each Sunday in the community's church due to the absence of a permanent priest.[45] Likewise, in the past, some of these leaders had been active participants in the Rural Workers' Union of their *município,* and another portion had been engaged in political activities, either as *vereadores* (municipal council members) or as sympathizers of the Workers' Party of

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[43] Olson (1977) identifies the important role that small groups in organizations play, namely committees, subcommittees, and small leadership groups. He identifies that the decisions of the meetings are public goods to the participants, and that the contribution that each participant will make toward achieving or improving these public goods will become smaller as the meeting becomes larger. It is for these reasons, among others, that organizations so often turn to these small groups. Once they are created, he adds, they tend to play a crucial role.

[44] For a larger discussion of the role these agents are playing in the rural communities of the state, see Freedheim (1993). For an analysis of the program, see Tendler and Freedheim (1994).

[45] Priests visit the communities roughly only once in a month.

Brazil (*Partido dos Trabalhadores-PT*). These activities had already given these leaders experience in dealing with touchy issues, such as the struggle for land and for better wages for their class. It had also given them contact with a larger outside world beyond their municipalities' borders.

With all this background, community leaders had acquired experience in organizational tasks, which had also prepared them to deal with more burdensome issues like the administration of a tractor. With previous implementation of federally and internationally funded projects in their communities, from the initial stage of PAPP, these leaders had had practice in negotiating with state agencies and bureaucrats. This had not only made them knowledgeable about procedures for developing projects, but had also created a good rapport with officials from SEPLAN, EMATERCE, and other state agencies, legitimizing further their roles as leaders in the eyes of their respective groups.

One other differing characteristic of the leadership in all these effective organizations was the number of people with qualified backgrounds. Rather than having only one or two entrenched leaders, as is commonly seen in the rural Northeast, all these groups were comprised of a number of leaders--on average five or six--who alternated the association's command, together with poorer members in the directive positions.[46] These leaders also used their oratorial abilities for public speaking during group meetings and their managerial skills for supervising work teams and marketing the communities' produce in the nearby *sedes,* or urban seat of the *município.*

Having given this description of the inclusive leadership noticed in all these groups, I am not crediting the success of the groups to its idiosyncratic appearance. After all, strong leaders represent the ultimate in intentionality (Tendler,1996) and stressing outstanding leadership as an explanation of the good tractor performance of these groups, would emphasize by its very focus on individuals, the singularity of the cases. Instead, I wanted to emphasize the coordinating role the leadership had in groups which already had a history of collectively acting together.

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[46] Kottak et al.(1994) illustrate a more common picture of these groups in the Brazilian Northeast. They state that one of the common problems of community associations in this region is the lack of renewal of the leadership structure, which, according to them, saps the energy of association presidents. They associate that problem with the low participation rate and members' underdeveloped awareness of the association's nature and objectives.

RECOVERING OPERATION AND MAINTENANCE COSTS

Financial aspects are a key issue in the success of the provision of the collective tractors in the Sertão. Considering that under PAPP guidelines, organizations in charge of these tractors have to operate and maintain them using their own resources--without aid from local or state governments, as often happened in the past-- these associations and cooperatives have developed several arrangements to cover O&M costs. Despite their accounting differences, all of the groups were able to cover their O&M costs. Given the high inflation the Brazilian economy underwent up to 1994, this is a surprising outcome. What enabled the associations to succeed?

Maximizing Revenues and Rationalizing Costs

In order to cover the tractors' operating costs, the first measure undertaken by the associations and cooperatives was to maximize revenues collected from tractor use, and to rationalize expenses. These groups charge user fees for all the services that their tractors render. Though this seems an obvious response to dealing with operating costs, many collective tractors in Ceará have incurred heavy losses in the past and were unable to maintain their machines adequately. As a result, the tractors often broke down, sometimes after less than a year of use according to SEPLAN officials.

Charging User Fees

The public finance literature has emphasized the importance of the efficient provision of services through user charges (Bahl and Linn, 1992).[47] From my interviews with users in Ceará, and for that matter even non-users of the service, the majority of farmers tend to consider the association's user charge for the tractor fair--in the sense that they are willing to pay the price. What they emphasize however, are the advantageous terms of agreement for payment of the service, which can be postponed until the harvest, or even paid sometimes in kind, i.e. with an equivalent amount of produce.

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[47] Under the efficient pricing rule, the price of the service should be set equal to the marginal cost of producing the service. According to this rule, welfare is maximized when the benefit of an additional unit of the service to the consumer--reflected by his willingness to pay the price--is equal to the cost of producing this additional unit, that is, its marginal cost.

For collective tractors the user fee varies according to whether he is a member of the association or cooperative. Private tractor owners in the region fix the price of the service based on cost recovery accounts--which include the cost of oil, fuel, the tractor driver's wage, and additional charges for replacement of parts, particularly plowing discs, which often break easily, and tires--and the organizations in charge of the collective tractors use that same price as a reference.[48] Members of associations and cooperatives get a 20% rebate over the original cost. In Ceará, for example, while the private tractor owner was charging on average R$22,00 (US$ 24.20), association and cooperative members were charged R$17,00 (US$ 18.70) per hour of tractor use. Non-members were charged the regular R$22,00 (US$24.20) per hour of use. Despite this rebate, total revenues collected still allowed these groups to recover their maintenance costs.

Another advantage provided by the collective tractors to their association members was the possibility of delaying the payment for the service until the harvest. This, combined with the system of *equivalência em produto*, or paying in kind with an equivalent amount of produce (usually through beans or maize), gave members an added incentive to cooperate in the collective use of tractors. Non-members, though charged the same price as the privately owned tractor, also have an incentive for using this tractor because they are also allowed to delay payments some time after the plowing has been done, rather than just immediately after. Finally, for some associations this system has also 'paid' in other ways. They are able to store the considerable volumes of produce they collect--during the harvest period when produce prices are low--and sell them at a later part of the year, when prices are better. Associations can, thus, collect significant revenues from this sale. It was not uncommon for tractors to be the most important source of revenues for the association (as most of my interviewees responded). Although we may have been tempted to think that cooperative groups would charge little or nothing

[48] In Morada Nova they had devised another method of fixing prices for the plowing of land. It consisted on equating the price of plowing one *tarefa* of land (1 hectare = 4 *tarefas* aprox.) on the price of a plowing disc, which in 1995 was R$9,00 (US$9.90). While this was the price charged to non-members of the local association, members had a 20% rebate on that price, and ended paying around R$7,00 (US$7.70) per *tarefa*.

to their members for the service,[49] most producers in Ceará have understood that they cannot use the tractor and related agricultural processing services for free any longer.

Efficient Deployment of Tractors

Having the tractor deployed in a continuous direction when operating within a community--as described in the section regarding the lottery for the order of tractor use--minimizes conflicts because beneficiaries know the order of use in advance. Equally important, this system also allows the communities to rationalize their tractor costs, because (i) it leads to a more efficient use of time, (ii) it reduces the operating expenses of the machine, and (iii) it extends the depreciation of the tractor over a longer frame of time.

(i) With the tractor moving in a continuous direction, the amount of time lost in displacing the machine from one small landholding to another possibly much farther away--without any productive use in the meantime--is reduced. Thus, more time can be devoted to productive activities like tillage of the soil. Particularly in periods of heavy usage, when time is of the essence in this region--farmers only rely on subsistence crops, and these crops will only be watered with the scarce rainfalls of the rainy season--the system works to the advantage of the whole community as it increases the availability of the machines. Even though this system allows for variation in the order of tractor use due to rainfall--as described in the section referring to flexibility in the order of use-- most community members emphasize in interviews that the time saved with this arrangement is nevertheless greatly valued.

(ii) In the past, an additional cost to the associations was the cost of fuel to take the tractor from one plot to another since users are only charged for the costs incurred for tractor use on their plots--the cost was included in the user charge. By reducing the

[49] Tendler (1988) has previously pointed out that according to coop rhetoric, prevailing prices reflect the machinations of "exploitative" middlemen, the reason why these groups frequently charge prices for their services that are too low to cover costs. In the case of the groups in this study, the previoulsy investing of their prices with this strong social symbolism made it difficult to charge prices that covered costs. In fact, among many of the producers who have not yet joined these associations, this continues to be the rhetoric. They argue that the association's purpose is to provide services to their members for free. As such, they criticize these charges made on behalf of the use of the machines, and claim that they are only for the benefit of the directive board.

distances traveled between plots, the associations reduce the tractor operating expenses in that there is no unnecessary consumption of fuel, oil or even wear out of the tires. Cooperatives, instead, have managed to charge their users this cost. In this case, the cost is shared by those community members requesting the services of the cooperative tractor. The cooperative administration calculates the total cost of the amount of fuel spent in moving the tractor from its garage--located in the urban seat of the *município*--to the community, and then divides it by the number of users in that particular community. The end result is a fairer charge system, as the final cost of the tractor's transport is equally shared by each individual in the community to where the tractor deploys. Moreover, as one cooperative tractor administrator put it, charging for the deployment of the machine reduces indiscriminate tractor use.

(iii) In having adopted this efficient deployment system, communities also reduce the natural obsolescence of the machine that results from continuous use. The tractor ends up having a longer useful life, and the rate of depreciation is slowed down as the machine is no longer subject to unnecessary long distance moves from one place to another. Collective groups have devised other alternatives to further reduce depreciation of tractor. The local association of Oiticica bought a motorcycle (with the revenues collected from the tractor service) to transport, among other things, the driver and the extra fuel required by the tractor. The tractor was to remain overnight in the plot where it had been working, to continue the next day from that point onwards.[50]

Monitoring Costs and Accounts Easily

The way these organizations keep track of their financial accounts for the tractor hiring service varies widely. The spectrum of possibilities ranges from the most rudimentary accounting system, like handling only some of the expenses and revenues in a small notebook, with all the hazards that the lack of simple arithmetical skills imply, to more modern and advanced accounting methods, like keeping a detailed financial

[50] Another example which I found interesting, on these same lines, consisted in leaving the cooperative tractors overnight in the community where they had been working, instead of deploying them back to the headquarters in the urban seat. In those cases, only the driver returns back, either biking or hitch-hiking.

description and bookkeeping on a computer, as was the case in COAPEC. Despite the differences, all the groups surveyed used some method of financial accounting. This allowed them to self monitor their accounts and to easily identify whether fares and charges needed to be raised in order to balance their budget.

An interesting case I saw was in the Cipó dos Anjos association. This association has devised a system that allows easy identification of accounting procedures to all its members. The association has opened six different bank accounts, assigning each one to a different purpose--two for tractors, one for the tractors' *fundo rotativo* (working capital), one for the communal shop, one for the association's working capital and one for the financial remainings of a communal shop.[51] This procedure allows them to differentiate their earnings and keep better track of each account, without needing to cross-subsidize to keep them in the black. In developing countries, and specially in a rural setting like this, where the level of education is usually very low and where it is commonplace to keep no accounts or use very simplistic accounting methods, such a finding is quite remarkable.

The two tractor accounts, one for each tractor the association owns, work in conjunction with the *fundo rotativo* account. During the peak plowing period, both tractors finance their operating expenses with their own accounts, and only after the harvest--when association members have to pay back for the plowing service provided months before--the payments received are credited, once the produce is sold, to the *fundo rotativo* account. All expenses that both tractors incur for the rest of the year are defrayed from this account, and it is only when the peak plowing period starts again, that they transfer money back to each of the tractors' accounts. While the two separate tractor accounts allow the association to monitor costs for each tractor, the *fundo rotativo* account allows to have as widely accepted the *equivalência em produto* system. The fact that separate accounts have been created for each tractor is further indication of the association's desire and ability to monitor their accounts, while having the *fundo rotativo*

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[51] This communal shop was very well administered up to 1992, when in the midst of the severe drought was sacked. The administrator decided to open this bank account to save the past earnings and what could be collected from the remains. As one interviewee said referring to that shop, "it was a grocery store, the envy of the whole Ceará".

allows to pay delayed and in kind, at a period when farmers have more cash. The system, which demands an initial contribution of extra capital to create the fund, has been now working for three planting seasons in a row.

Another way that the accounting system used by these groups allows their members easy monitoring is the legal provision for associations of having at least two people sign corporative checks (generally, the president and the treasurer of the association). Using the formal banking system and allowing only certain people access to the accounts reduces the possibility of money being misappropriated. Transparency in financial matters of the association is further ensured by a routine operation called *prestação de contas,* which requires the association treasurer to present statements of expenditure to all members during every monthly meeting.

Selecting the Tractor Drivers and Operators

Communities are in charge of choosing their tractor drivers, and to do so they usually rely on a member of the community who has had some experience with tractors, or who has driven any other kind of machine before. For example, in Morada Nova, the tractor driver had previous experience in driving tractors from his former job as tractor driver in a nearby *fazenda*; in Massapê one of the tractor drivers had been in the past a truck driver in São Paulo. For tractor maintenance, these groups follow a similar approach, as was the case in Cipó dos Anjos, where the person in charge of the tractor maintenance had previously been a bus driver in the region.

This rudimentary knowledge, however, does not imply that they will have the most appropriate knowledge for economically operating the tractor.[52] In many cases I found that the tractor drivers had learned many of the operations the machine could perform, such as operating the shovel for removing soil, just by reading the tractor manuals, or by trial and error after operating the machine for a period of time. In other cases, there had been cooperation among communities, as was the case when Califórnia received its tractor. At that time, the tractor drivers from Cipó dos Anjos came to the

[52] Tembo (1994) states the lack of farming experience of the tractor operators as one of the main problems in operating as a business enterprise the tractor hiring services in the North East arid zone development programme (NEAZDP) in Nigeria.

settlement to teach them how to better operate the tractors and how to rationalize their costs, such as by running the machine in the smoothest possible way to save fuel or by replacing oil at the right time to maximize its use.[53]

The preference of these groups in having a member of their community drive the tractor is related with the concern they would show for the machine. Handing in the machine to only one person is preferable than to several, as it makes easier accountability over the machine. In Morada Nova, they decided to rely on one driver rather than two, because of this reason. However, to have the machine running efficiently, without a low utilization of the equipment, an incentive based system of payment to the drivers' had to be implemented. For this reason, many community associations have devised the driver's payment based on a percentage of the amount produced.[54]

Limiting the Use to Compliers: Who Pays Gets the Tractor

There is a strict criterion for prohibiting association defaulters from using the tractor in the next planting season if they are not up to date with their payments. In most of the communities, for example, those who did not pay for the tractor use after the harvest period would not be allowed to request its service in the next planting season. Groups which did not follow this practice and were more lenient with the debts their members owed, ended up with severe accounting problems and financial 'holes' in their accounts. In fact, Olson (1977) points out the necessity of some form of coercion or some other special device to make individuals act in their common interest. The Ceará groups under review, by allowing payments in the harvest period with produce, have succeeded in providing the right incentives. As people informed me, nowadays only three or four

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[53] However, leaving this entire learning process to the associations could neglect the concern that communities should show towards soil conservation. In fact, top technicians from EMATERCE are in favor of having included in the PAPP a component for training the community tractor drivers prior to the arrival of the machine. They believe this would not only teach them to operate the tractor better, but also to instill in them conservationist practices, more suited to the soil in their regions. Though the tractor dealers also provide the drivers with courses, they basically deal with the better operation of the machine rather than with these last concerns.

[54] Binswanger (1987) asserts that many tractor schemes failed because tractor drivers typically do not or cannot be made to benefit financially for working long hours during peak seasons to maximize the number of hectares tilled or to keep tractors in good condition.

farmers in each community, of usually fifty or more members, tend to default on their commitment to the association.

Beyond their Productive Scope: Other Uses for Tractors

> "*... mas o trator é muito bom, serve para trazer água, o produto da roça e para tratar do milho e feijão*".[55]
>
> (Tractor Operator in Morada Nova)

I found in my cases a number of additional considerations that made a tractor a desirable investment. The typical portrayal of the tractor relating it just to agricultural productivity is not an accurate one, as expressed in the above quotation. Moreover, the literature on tractor use has indicated that tractor ownership can be strongly associated with the operation of multiple economic enterprises, among which farming has not been the primary generator of income (Biggs et al., 1993; Farrington et al.,1984). In the Sertão, this is the case for the privately owned tractors, whereas the communal and cooperative tractors relied on nonagricultural services only as generators of extra revenues.

The high demand for tractors during the plowing and harvest seasons leaves the tractor underutilized for the rest of the year. Instead of having the tractor idle, all these groups have devised alternative uses which allow them to take even more economic advantage of the tractor. Binswanger (1987) agrees that in subsistence farming systems under shifting cultivation, transport requirements are confined to transporting harvests, firewood, and water to the homestead. The intensification of farming systems and the opening of market opportunities, he adds, greatly increase transport demands: plots, firewoods, and water can be at a greater distance from homes; fodder is often collected, brought to the homestead, and fed to animals in stalls; manure is transported in the fields; surpluses are transported to the market; and purchased inputs move in the reverse direction. In Ceará, tractors perform such alternative uses as transport of construction materials, firewood from adjacent lands, and drinking water from nearby *açudes*

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[55] "The tractor is very good, it allows us to bring water, the produce from the fields and for processing maize and beans", my translation from a direct quotation made by an interviewee in Morada Nova.

(reservoirs)--this was one of the reasons why women, contradicting conventional wisdom,[56] showed interest in selecting the tractor as a viable project for the community, as it liberated them and their children from the tedious job of bringing buckets of water from adjacent reservoirs.[57] The tractor also helped them in that the supplemental power it provided was used for the grain processing machines, which was formerly done manually in the middle of their homes.

These extra activities guarantee increased revenues to their owners, who reinvest it on the tractor's maintenance. The associations and cooperatives have strict rules and prices for these additional uses. For example, the transport of material is charged at R$1,00 (US$1.10) per kilometer and the transport of water (3500 cm^3 water pipe) at R$6,00 (US$6.60). Other uses, such as for construction purposes are possible, if other implements for the tractor are bought, as in Oiticica, where the association bought a shovel which they are planning to use for the construction of an artificial *açude*.

Tractors can also be devoted to other social purposes, such as helping the poorer members of the communities. With the water pipe, the tractor can provide cheap drinking water to people who live far from the *açude*--in Morada Nova, for example, the association charges five cents (US$0.055) for an 18 liter can. My interviewees also mentioned that transport of construction materials by the tractors was a major help to the poorer farmers, who could not afford to contract private pick-ups or move materials with mules. I observed other indirect benefits of tractor use in Oiticica-- these included the free provision of water to cisterns in the communal school, and road repairs (done once every year in the off season when the tractor is used to level roads with land fillings). All these activities, even if they do not result in an increase in revenue for the associations, at the very least they alleviate other expenses that members would have incurred without a tractor.

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[56] Usually it is said that women place their interest in other kind of productive suprojects in which they tend to participate more and thus 'creates' a job for them, eg. clothes-making.

[57] Biggs et al. (1993) suggest, instead, that women are particularly vulnerable in Sri Lanka to the spread of mechanical technology, because men, with the help of machines, tend to take over the activities performed previously by women.

Learning Process

Associations and cooperatives are developing better administrative terms for their tractors by adapting them to their specific contexts. The adoption of these more efficient measures are made possible through a learning process, specifically routine experience has led to better performance. Skeptics of the success of these organizations criticize all aspects of the projects from the way the schedule of use is organized to the actual use of the machine. Officials from EMATERCE, for example, want to see a more organized system. This includes, in addition to training the tractor driver, requiring members to fill out standard forms with information on the crop and area to be tilled, the amount of hours that each farmer would require the service, the price to be paid, etc. SEPLAN technicians argue against the low user charges these machines are subject to. Bureaucrats have sometimes been unable to see the kinds of progress the communities have made in their understanding of running the tractor adequately, namely by trial and error, and by the institutional cooperation among communities. These are discussed below.

Trial and Error Learning

The level of education and technical know-how were not the main issue in the learning process. Members were able to overcome educational limitations with the aid of other family members. Even though the person designated to take care of the tractor's administration in Oiticica was illiterate, he relied on his younger child to write down the names of people requesting the tractor service, and the amount of money they owed. Everyone recognized that he did his job exceptionally well, and I even heard compliments about his performance from neighboring communities.

Learning by trial and error can best be described through the following example. In Oiticica, the tractor stopped working several times in 1993 right after it had been bought. The problem in this case was not mechanical but administrative--the person in charge of the tractor did not know how much fuel was needed to keep the machine working. Because he was also the president of the association he did not have time to go and buy fuel every day. As a result of that failed experience, the association members decided to decentralize the administration of the tractor to another person on the directive

committee.[58] This individual has devised an innovative arrangement--for a monthly fee (which is much less than what the former president spent in going out to the *sede* only to buy fuel), he has arranged with the local bus driver to pick up, refill and return the fuel container daily. Examples such as this show that, in running a tractor adequately, some time will usually pass before management inadequacies are overcome and translate into higher returns for the new organization (Tendler, 1988).

Cooperation among Communities : Information *Troca-Troca*[59]

Cooperation among different communities for the operation of the tractor has also gone through a learning process. This process covers a range of issues, from selecting the type of tractor, to the actual running of the tractor in the field.[60] This is very clear in the case of the more recent associations receiving tractors under the PAPP. Leaders of these communities visit communities that have owned tractors for a longer period in order to get more acquainted with the administration of the machine. Issues such as the amount of fuel and oil needed, for example, are completely new for these people. Sometimes, as happened in Quixeramobim, leaders of several communities gather to share information on tractors prior to purchasing them in order to get the best deal. At other times this cooperation extends to learning about the operation of the tractor. I learned of an experience of this kind, where the tractor drivers of Cipó dos Anjos, initially trained by the dealer in its Fortaleza headquarters, traveled to Califórnia to teach the new tractor drivers there how to drive and operate the machine effectively.

Communities also get together to discuss issues of tractor use. In Morada Nova, for example, a group of leaders from nine surrounding rural associations gather to discuss

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[58] Kottak et al. (1994) also mention as one of the common problems in community associations in the Brazilian Northeast, the centralization of decision-making and the existence of anti-democratic pratices within the associations.

[59] This is a colloquial Portuguese expression meaning exchange,which is commonly used in this region for the exchange of products and services.

[60] This learning process among communities can be extended to other issues beyond tractor operation. For example, a recently formed group of settlers from the *município* of Tauá went to the agrarian reform settlement of Massape, to get informed on the process and learn of their communal arrangements. Others think that this kind of cooperation can even be induced from above, as it is the case of the mayor of Quixadá. While he has in mind implementing in the short run an agrarian reform "without tears", he is considering to use the accumulated experience within his *município* to inform the process, and thus have Califórnia settlers advising and informing the new settlers.

the collective arrangements and to normalize fares for their tractor services. These meetings have been going on on a monthly basis for the last three years. Municipalities sometimes also play a coordinating role. In Quixeramobim, for example, the municipality organizes occasional meetings of all the communities running their own tractors to allow them to exchange information about the machines. In these meetings, past problems with the machine and how they were resolved are also discussed. This information *troca-troca* among communities is key to diffusing best practices and innovative solutions.

CHAPTER 4
CONCLUSIONS AND POLICY RECOMMENDATIONS

Amidst the many examples of collective tractors that failed due to the conflicts arising for their use and the inadequate maintenance to which they had been subject in the past, the groups in this study managed to come up with successful outcomes. The results were unexpected because, contrary to the opinion of public officials and rural extensionists in Ceará, they managed to maintain their machines adequately. In principle, they were able to do so because they had defined, and enforced, a clear set of rules which had been set up specifically--either formally or informally--for that purpose. The performance of all these tractors was successful in that conflicts concerning the order of use of the machines were minimized, while at the same time the collectives were recovering their O&M costs from users.

Past rural development programs targeting the Northeast neglected the provision of collective tractors to rural communities. Under the PAPP program, these tractors have increasingly become a more demanded subproject for a number of reasons. The most important of these are the way information about the program has spread throughout the countryside of Ceará, the influence of the tractor dealers, and the benefits that a machine like this provides, particularly in achieving timeliness in the agricultural process.

An additional tractor service that has appeared in the past few years in some *municípios* is the municipal hiring service, at highly subsidized rates. As such, this service can turn into a highly political weapon for local government authorities which could reinforce the clientelistic tradition of the region. Under the PAPP program, instead, communities have to contribute at least ten percent of the total cost of the project. In the case of tractor subprojects, this usually consists of an in kind contribution, through the construction of the *galpão* for sheltering the tractor and for storing the grains received as payment for the tractor services after the harvest. With the community input since the

very beginning of the project, that is, even in the selection of the project, the program has enhanced community participation in the case of these groups.

This perception of the project as owned communally has in fact, contributed to the reduction of conflicts among community members. Conflicts were also minimized in that the communities set up more equitable arrangements. Limiting the time of use available for each member of the association led to a fairer distribution of the time of tractor use during the peak plowing period. Another way they reduced conflicts was by setting the schedule of use in a lottery rather than by continuing work on a first come, first serve basis. This has not only eliminated the possibility of giving preferential treatment to better-off members but has also added a component of predictability to the communities' planting season. Organizing the times that members can use the tractors is crucial as tractor use for land preparation is only advantageous if it ensures that land preparation will be completed by optimal planting dates. This is even more so where rainfed agricultural production is practiced. Bearing in mind that this timely land preparation can be a critical yield determinant in the Sertão because the amount of land a household can farm depends on how much it can till by the optimum planting dates, community members have accommodated the rain pattern by allowing a flexible scheme in the use of the tractor. This flexible pre-established agreement reduces conflicts by making things work to the advantage of all community members.

Two other reasons accounted for this reduction of conflicts; though they may not serve as policy lessons for similar cases, they should be considered in explaining the success of the Ceará cases. The fact that all these groups had previous communal work experience and a committed leadership prepared them to take on more difficult collective endeavors, such as the maintenance of a tractor. First, this history of community organization and previous work on simpler projects 'cut their teeth' for designing and figuring out the best, least conflictive arrangements for the use of the tractor. Second, their leadership was a motivator which coordinated the input of all members rather than a strict, inaccessible authority mandating the arrangements.

Financial aspects were basic determinants of success in all these stories. Considering the harshness of their geographic context and the impoverished economic

environment surrounding them, it was a remarkable achievement that the groups managed to raise enough money to keep their machines operative. They achieved this by maximizing their revenues and rationalizing their tractor costs. Additional revenues were collected by using the tractor for non-agricultural and off-season activities and by a learning on-the-job process of dealing with the tractor's maintenance.

The most common practice in Ceará with regard to the communal tractor hiring service is to charge user fees. Users tend to consider prices based on those of the private tractors in their neighboring areas as fair charges. The advantage that the association was giving to its members was a reduction in those charges. Even with this reduction, they were able to cover all their O&M costs, as a result of the efficient deployment of the machines. Having the machines moving in a continuous path led not only to a reduction of its operating expenses, but to a more efficient use of the time and to an extendsion of the depreciation period of the machine. These groups devised simple ways for monitoring their costs, which consisted of differentiating their bank accounts. As a major source of revenue for the association, the tractor accounts were severely monitored; thus, they had an easy system of depicting their revenues. Revenues were maximized also by the selection process associations and cooperatives underwent for their tractor drivers. They looked for people within the community with previous experience with these machines and rewarded them with an incentive-based pay system. Finally, and crucial to the effective functioning of the whole system, the agreements were enforced by limiting the use of the tractor to those who were up-to-date with their payments.

Devoting the machine to alternative and non-agricultural uses allowed the associations and cooperatives to collect extra revenues. Rather than having the machine underutilized after the bottleneck plowing and harvesting periods, the tractor is subject to other economic uses such as the transport of construction materials, firewood and water to the homesteads. In arriving at a better administrative process these groups underwent a learning process based on trial and error, from their daily operating with the tractor, and by sharing among communities their knowledge acquired on-the-job with the tractor use and with problems arising from its use.

RECOMMENDATIONS

Considering the high cost of tractors and the more difficult arrangements to administer it efficiently, tractors should continue to be provided to long-standing associations, with demonstrated capability of haven successfully undertaken other subprojects. Without some organizational base in the community, projects are unlikely to succeed, and tractors should be given tractors where 'good things' are already working.

Having in mind that tractors are only used for land preparation and harvesting, leaving the rest of activities to draft power or hand labor techniques, tractors should be given to those communities already relying on the machines for their agriculture, rather than to those not acquainted with the use of a tractor. Alternate policies should also encourage mixing and keeping together in use both systems.

Standardization of engineering designs, technical and financial parameters, and cost indicators for the tractor subproject--one of the most frequently requested subproject--should be encouraged to achieve efficiency in subproject preparation, evaluation and supervision, and minimize design deficiencies. Environmental criteria should receive greater attention from public officials and simplified documentation requirements should decrease bureaucratic requirements for farmers and motivate the participation in the program of poorer communities.

Tractor subprojects should be funded with an additional capital to provide for an initial working capital of the project, and with additional implements for non-agricultural purposes. Considering a *fundo rotativo* can alleviate the burden of the poorer members in that it would allow to run the machine in the peak period, with payment only after the harvest. The system seems to work best to maintain, extend, and diversify the activities of a community association. After an association receives a grant and implements a project, members pay into a fund , which is used to sustain that project, or invested in something else that benefits the association.

Against all odds, the groups reviewed in this paper achieved something essential for the adequate functioning of the machine and which many would have doubted to be possible. The merit of these groups was achieved by establishing a clear set of rules and truly enforcing them.

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